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ЗНАНЬ У ХХІ СТОЛІТТІ»
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THE PETROLEUM INDUSTRY IN OUR LIFE

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Language supervisor: Kovinko K.V.

Summary: The article deals with petrochemical. Petroleum or crude oil is a naturally occurring, flammable liquid consisting of a complex mixture of hydrocarbons of various molecular weights and other liquid organic compounds. The petroleum industry is largely used nowadays. In recent years the petrochemical industry has been developed. We also mentioned some environmental problems.

Key words: Chemical product, oil, petrochemical industry, petroleum, pollution.

Анотація: Стаття пов'язана з нафтохімічною промисловістю. Нафта або сира нафта – природна масляниста горюча рідина, що складається зі складної суміші вуглеводнів різної молекулярної маси і деяких інших органічних сполук. Нафтова промисловість в значній мірі використовується на даний час. В останні роки нафтохімічна промисловість була розвинена. Ми також згадали про деякі екологічні проблеми.

Ключові слова: хімічна речовина, нафта, нафтохімічна продукція, бензин, забруднення.

Аннотация: Статья связана с нефтехимической промышленностью. Нефть или сырая нефть – природная маслянистая горючая жидкость, состоящая из сложной смеси углеводородов различной молекулярной массы и некоторых других органических соединений. Нефтяная промышленность в значительной степени используется в настоящее время. В последние годы нефтехимическая промышленность успешно развивалась. Мы также упомянули о некоторых экологических проблемах.

Ключевые слова: химическое вещество, нефть, нефтехимическая продукция, бензин, загрязнения.

Petroleum or crude oil is a naturally occurring, flammable liquid consisting of a complex mixture of hydrocarbons of various molecular weights and other liquid organic compounds that are found in geologic formations beneath the Earth's surface. Petroleum is used in manufacturing a wide variety of materials [3].

The term petroleum was found (in the spelling "petraoleum") in the 10th-century Old English sources. It was used in the treatise *De Natura Fossilium*, published in 1546 by the German mineralogist Georg Bauer, also known as Georgius Agricola. In the 19th century, the term petroleum was frequently used to refer to mineral oils produced by distillation from mined organic solids such as cannel coal (and later oil shale), and refined oils produced from them. In the United Kingdom, storage (and later transport) of these oils were regulated by a series of Petroleum Acts.

The petroleum industry is involved in the global processes of exploration, extraction, refining, transporting (often with oil tankers and pipelines), and marketing petroleum products. The largest volume products of the industry are fuel oil and petrol. Petroleum is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilizers, pesticides, and plastics. The industry is usually divided into three major components: upstream, midstream and downstream. Midstream operations are usually included in the downstream category.

Petroleum is vital to many industries, and is of importance to the maintenance of industrialized civilization itself, and thus is critical concern to many nations. Oil

accounts for a large percentage of the world's energy consumption, ranging from a low of 32% for Europe and Asia, up to a high of 53% for the Middle East. Other geographic regions' consumption patterns are as follows: South and Central America (44%), Africa (41%), and North America (40%). The world at large consumes 30 billion barrels (4.8 km³) of oil per year, and the top oil consumers largely consist of developed nations. In fact, 24% of the oil consumed in 2004 went to the United States alone, though by 2007 this had dropped to 21% of the world oil consumed [4].

In the US, in the states of Arizona, California, Hawaii, Nevada, Oregon and Washington, the Western States Petroleum Association (WSPA) represents companies responsible for producing, distributing, refining, transporting and marketing petroleum. This non-profit trade association was founded in 1907, and is the oldest petroleum trade association in the United States [5].

In recent years the petrochemical industry has been faced with many environmental problems; a solution must be found to these problems in the future. This solution concerns mainly two types of problems: the first is a socio-economic one and involves the planning of industry and its future investments, the other is a technical one and concerns the means for improving the quality of the environment.

Typical pollutants of petrochemical industry neglecting some parameters such as pH, temperature, suspended solids, salinity, mineral oils and BOD (biochemical oxygen demand), are common to other industries in which they play a more relevant role or can be treated by currently practised technologies. We think that aqueous effluents originating from the petrochemical industry are essentially characterized by the presence of the following substances:

- organic substances that are not biodegradable enough
- nitrogen compounds
- heavy metals.

The first class of substances cannot be systematically described, an exception being the organic halogen derivatives containing mainly one or two carbon atoms. We are usually deal with a multitude of polymerization, addition, and condensation products derived from secondary reactions taking place in several production processes. Such products show certain solubility in water due to the presence of liophiic groups in addition to being very slow towards biological oxidation [1, p. 147]. The second class may include ammonium salts (typical by-products of some productions such as caprolactam, acrylonitrile, acrylates etc.) and organic substances containing nitrogen such as nitriles, cyanohyd rins, amines and aromatic nitroderivatives. These products when biodegradable usually give rise, in the final effluents, to noticeable quantities of ammonium ions or eventually to nitrate ions. The third class of pollutants is usually due to accidental losses of catalysts, to the production of chlorine by the mercury cell and partly to the corrosion of equipment; in addition to mercury, the metals which may be most frequently present in waste waters are copper, nickel, cobalt, molybdenum, chromium, zinc, bismuth and vanadium. [1, p. 148]

It might seem incongruous that a research focused organization such as the International Union for Pure and Applied Chemistry would pay attention to an issue as pragmatic as oil spills. After all, an oil spill tends to be viewed as a very practical matter, its issues characterized by loss of a valuable commercial product, damage to

the environment, high costs of clean up, high liabilities, and very much media attention. Oil spills are not generally considered a pure or even applied chemistry issue. However, this would be a very short-sighted interpretation. Effectively every element of an oil spill, whether environmental, physical, operational or legal, is related to the complex chemistry of the oil and its breakdown products released to the environment. Indeed, it would be safe to say that if petroleum were a simple chemical product, the difficulties inherent in clean up of an oil spill would be much reduced, no matter what the origin or cause of the spill. The chemical nature of oil is directly related to the fate and environmental impacts of spilled oil, whether on water or on land, and to the effectiveness of the diversity of counter measures which might be deployed. While evaluation of the effects of spilled oil on the environment receives much attention in forums with a biological or toxicological focus, which often do take into consideration chemical factors, the complex topic of the chemistry of oil spills in direct relation to countermeasures is examined more rarely. While oil spills occur in fresh and salt waters, and on land, marine oil spills remain the larger issue — there tends to be more oil spilled, environmental problems are more complex, and counter measures are more difficult to implement [2, p. 1].

One area which recently has seen great expansion is that of the essential linkage between detailed understanding of spilled oil physical/chemical properties and the effectiveness of response counter-measures. Crude oil and oil products are known to differ greatly in physical and chemical properties and these tend to change significantly over the time course of spilled oil recovery operations. Such changes have long been recognized to have a major influence on the effectiveness of response methods and equipment, which increases the time and cost of operations and risk of resource damage. The concept of ‘Windows of Opportunity’ for oil spill response measures has been derived from multiple investigations in industry and government research organisations. Recent advances in chemical dispersant development, formulation of low toxicity dispersants with broader application, and better understanding of dispersant fate and effects have combined to a more ready acceptance of this countermeasure by many, although not all, regulatory authorities throughout the world.

The acceptance of in situ burning of spilled oil has been limited by valid operational concerns about the integrity of fireproof booms, the limited weather window for burning due to the rapid emulsification of oils, the need to develop methods for the ignition of emulsified and weathered oils, and public concerns about the toxicity of the smoke generated during burning. However, burning provides an option, another tool in the tool-box, for the responder called in to combat an oil spill. Burning decreases the amount of oil that must be collected mechanically, thus reducing cleanup costs, storage transportation, and oily waste disposal requirements. It also would decrease contact with sensitive marine and coastal environments and consequently reduce the potential for associated damage costs [2, p. 2–3].

Laboratory and field studies over the last 10 years have addressed essential information requirements for feasibility, techniques, and effectiveness, as well as health and safety. The promising results of research in situ burning have led to its acceptance in a number of coastal jurisdictions throughout the world, prompting the

response industry to purchase and position in situ burning equipment and train its operators to use this alternative technology in approved regions [2, p. 3].

Although not a direct recovery measure in itself, the application of remote sensing to oil spill response assists in slick identification, tracking, and prediction, which in many instances is an early requirement for effective response. An inadequate ability to see spilled oil seriously reduces effectiveness of oil spill response operations. Conversely, good capability to detect spilled oil, especially areas of thick oil, at night and other conditions of reduced visibility could more than double response effectiveness and greatly enhance control of the spill to minimise damage, especially to sensitive shorelines. Advances have been made in both airborne and satellite remote sensing. It has become possible to move from large and expensive to operate airborne systems to small aircraft, more widely available and practical for spill response operators. Also, the limitations in delayed data processing and information communication are being overcome by development of systems operating in functional real-time, which is essential for enhanced response capacity. Spill detection using satellites has also advanced markedly since 1989, with the ongoing intention to provide coverage of oil spill areas as early warning, or when flying by aircraft is not possible. An early useful application was an ERS-1 satellite program for detection of oil slicks, launched in 1992. More recently, spill detection capability has been developed for the Canadian Radarsat satellites, ERS-2 and a few other satellite programs [2, p. 3].

In conclusion, we can say that a great number of technologies are presently available to the petrochemical industry for a correct approach to the solution of the environmental problems. Further developments will also help industry to meet future needs. The economic impact of the use of the present technologies is, however, in many cases the main constraint on their utilization. And this, considering the increasing difficulties in competition, constitutes a real headache. It is probably not coincidental that the amount of funding available for oil spill research and development, from both government and private industry sources, has declined similarly. The articles serve to capture the applied chemistry knowledge and experience of practitioners in a complex field, application of which remains essential for the development of improved oil spill countermeasures, and their effective use in real spill situations.

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CHEMICAL CLASSIFICATION OF FUNGAL TOXINS BASED ON INFORMATION CONCERNING STRUCTURE AND PROPERTIES THEREOF

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Language supervisor: Matviychuk O. M.

Summary: The paper is devoted to systematization data on chemical structure of poisons of macromycetes. This problem is essential both because of the need for searching substances neutralizing their effect with the purpose of poisoning treatment, and for exercising control of mushrooms supplied for sale. A classification of fungal toxins based on its structure and accordingly its chemical properties has been suggested.

Key words: chemical classification, chemical structure, fungal toxins, mushrooms, poisons of macromycetes.

Анотація: Стаття присвячена систематизації даних про хімічну будову отрут макроміцетів. Це питання є актуальним у зв'язку з необхідністю пошуку речовин, які знешкоджують їх дію для лікування отруєнь, а також для контролю грибів, які надходять у продаж. Запропонована класифікація грибних токсинів на основі їх будови та, відповідно, хімічних властивостей.

Ключові слова: гриби, грибні токсини, отрути макроміцетів, хімічна класифікація, хімічна структура.

Аннотация: Статья посвящена систематизации данных о химическом строении ядов макромицетов. Этот вопрос актуален в связи как с необходимостью поиска веществ, обезвреживающих их действие для лечения отравлений, так и для контроля грибов, поступающих в продажу. Предложена классификация грибных токсинов на основе их структуры и, соответственно, химических свойств.

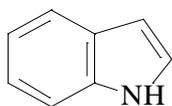
Ключевые слова: грибные токсины, грибы, химическая классификация, химическая структура, яды макромицетов.

The first fungal toxin obtained in crystalline form by S. Kobert in 1866, was muscarine from *Amanita muscaria* [1, 2]. For almost 150 years academic sources provide for description of nearly 100 fungal toxins. The literature studied comprised syndrome-based classification of fungal toxins (by their effect on the human body) [1, 2, 4, 7, 9, 10]. Obviously, comprehending properties of fungal toxins [3] requires chemical classification thereof. Since the literature studied comprised no such classification, the authors have developed one independently.

As regards structure and chemical properties, most fungal toxins can be divided into the following groups: cyclopeptides, alkaloids, amines and hydrazine derivatives.

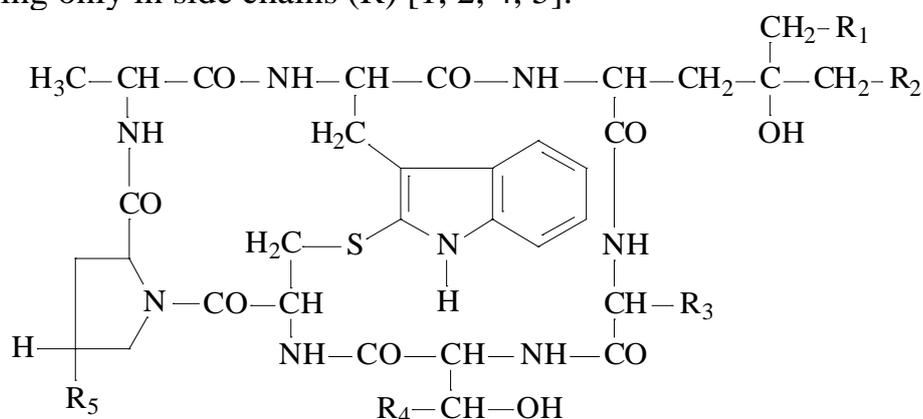
Fungal toxins													
Cyclopeptides			Alkaloids									Amines	Hydrazine derivatives
			Trime thylammonium derivatives	Indole alkaloids	Tropane alkaloids	Bipyridine derivatives	Cyclopropa nol derivatives	Amino acids			Pyrones		
Isoxazoles	Isoxazolidines	Oxazolines											
01-08	09-18	19-24	25-29	30-35	35-36	37	38	39-40	41	42	43-44	45-47	48-49

Amanita species poisonous mushrooms contain certain of the most dangerous fungal toxins: **cyclopeptides** [1, 2, 5, 7] which have indole base nucleus:



Subject to structure peculiarities they are divided into three classes: phalatoxines; amatoxines; virotoxines.

Phalatoxines are bicyclic heptapeptides having a thioether bridge between cysteine and tryptophan. All the phalatoxines have a similar composition and structure, differing only in side chains (R) [1, 2, 4, 5].

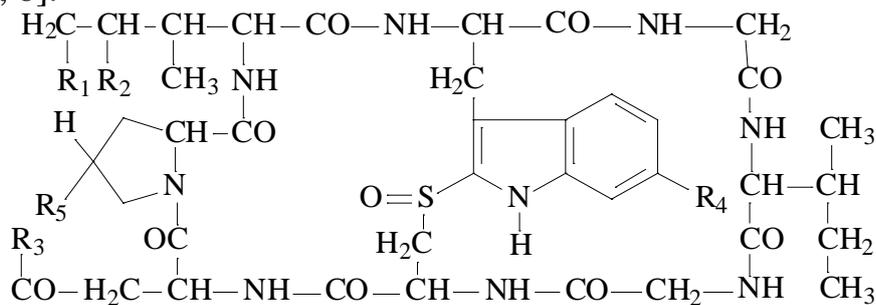


	R ₁	R ₂	R ₃	R ₄	R ₅
Phalloidine ⁰¹	OH	H	CH ₃	CH ₃	OH
Phalloine ⁰²	H	H	CH ₃	CH ₃	OH
Prophalloine ⁰³	OH	H	CH ₃	CH ₃	H
Phallicine ⁰⁴	OH	OH	CH ₃	CH ₃	OH
Phallacine ⁰⁵	H	H	CH(CH ₃) ₂	OH	OH
Phallacidine ⁰⁶	OH	H	CH(CH ₃) ₂	OH	OH
Phallisacine ⁰⁷	OH	OH	CH(CH ₃) ₂	COOH	OH
Phalline B ⁰⁸	H	H	CH ₂ C ₆ H ₅	CH ₃	H

Amatoxines are bicyclic octapeptides having a common base comprising an indole ring with a thiolic bridge.

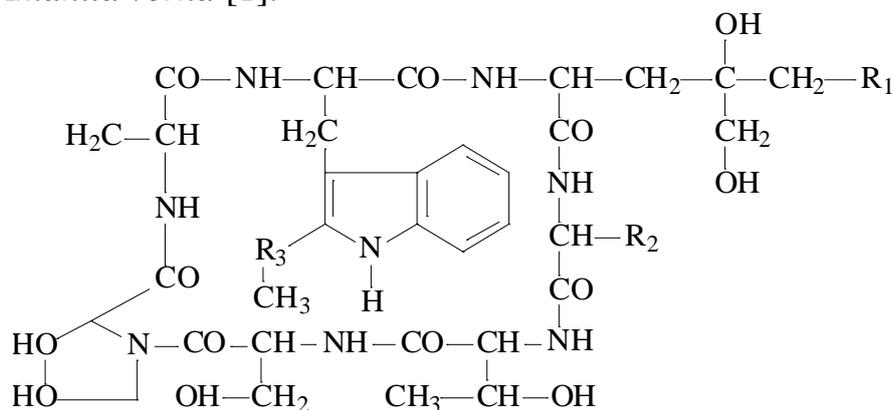
The most toxic of them is α -amanitin. It is an octapeptide having specific amino acid (α -dihydroisoleucine) in its structure. The sulphur atom of cysteine

molecule is bound with tryptophan residue and divides the cyclopeptide in two rings [1, 2, 4, 5, 7, 8].



	R ₁	R ₂	R ₃	R ₄	R ₅
α -amanitin ⁹	OH	OH	NH ₂	OH	OH
Methenyl-amanitin ¹⁰	OH	OH	NH ₂	OCH ₃	OH
β -amanitin ¹¹	OH	OH	OH	OH	OH
γ -amanitin ¹²	H	OH	NH ₂	OH	OH
ϵ -amanitin ¹³	H	OH	OH	OH	OH
Amanin ¹⁴	OH	OH	OH	H	OH
Amaninamide ¹⁵	OH	OH	NH ₂	H	OH
Amanullin ¹⁶	H	H	NH ₂	OH	OH
Amanullinic acid ¹⁷	H	H	OH	OH	OH
Proamanullin ¹⁸	H	H	NH ₂	OH	H

Virotoxines are monotoxic heptapeptides containing 2-methylsulfonyltryptophan and dihydroxyproline. They were isolated from *Amanita virosa* and *Amanita verna* [1].



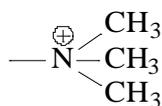
	R ₁	R ₂	R ₃
Viroidine ¹⁹	H	CH(CH ₃) ₂	SO ₂
Desoxoviroidine ²⁰	H	CH(CH ₃) ₂	SO
Alaviroidine ²¹	H	CH ₃	SO ₂
Aladesoxoviroidine ²²	H	CH ₃	SO
Viroisine ²³	OH	CH(CH ₃) ₂	SO ₂
Desoxoviroisine ²⁴	OH	CH(CH ₃) ₂	SO

Alkaloids are a group of nitrogen-containing organic compounds, mainly of plant origin displaying basic properties and high biological activity, often being toxic [6].

As regards chemical structure most of the alkaloids belong to heterocyclic compounds. Alkaloids are widely spread in the flora, while poisonous mushrooms are especially rich in them.

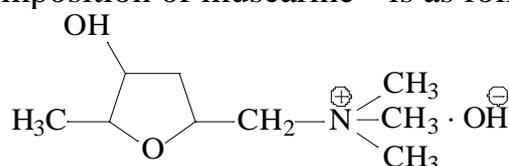
In terms of structure alkaloids can be divided into trimethylammonium derivatives, indole and tropane alkaloids, bipyridine derivatives and amino acids, dividing into cyclopropanol andazole derivatives (such as isoxazoles isoxazolidines and oxazolines).

Trimethylammonium derivatives are organic compounds with the base group:



As it was already pointed above, the first fungal toxin obtained raw in crystalline form by S. Kobert in 1866, was muscarine from *Amanita muscaria* [1, 2]. The first muscarine preparations were contaminated with acetylcholine and other cholines. Only 90 years later sufficiently pure muscarinic preparations were obtained, allowing to establish the formula [1, 2, 4, 5, 7, 8, 11].

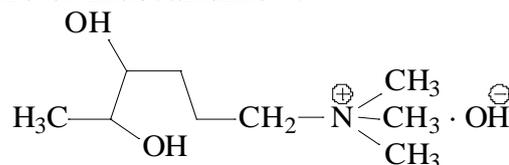
The chemical composition of muscarine²⁵ is as follows:



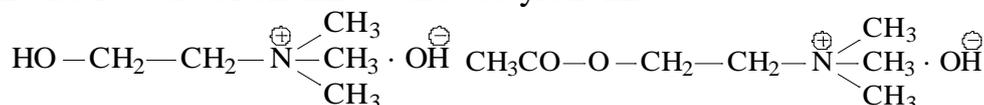
A. muscaria contains a very small quantity of muscarine being irrelevant to most symptoms that occur at poisoning by this mushroom. Interestingly, species of *Inocybe* genus have the content of muscarine 20 times higher than that of *A. muscaria*, which prompted suggestions recorded in literature to rename muscarine in inocybine [1, 2].

Later, a number of other toxins characterized by muscarine-like activity was isolated from *Amanita muscaria*, such as muscaridine, acetylcholine, betaine and others [1, 2, 5].

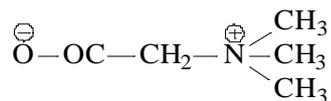
Chemical structure of muscaridine²⁶:



Chemical structure of choline²⁷ and acetylcholine²⁸:

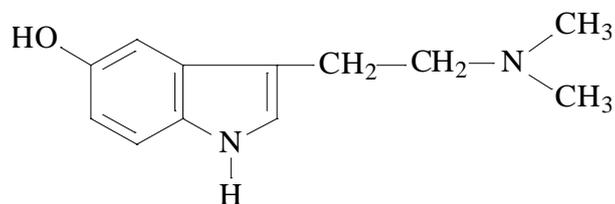


Chemical structure of betaine²⁹:



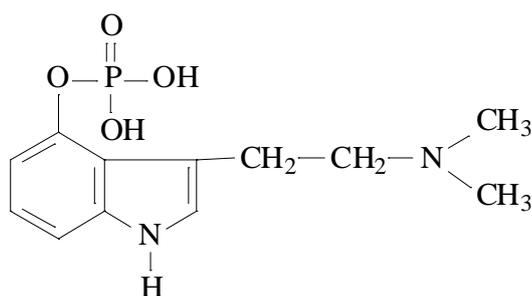
Indole alkaloids are alkaloids containing indole base ring.

A. muscaria contains bufotenine³⁰ [1, 4, 5]:

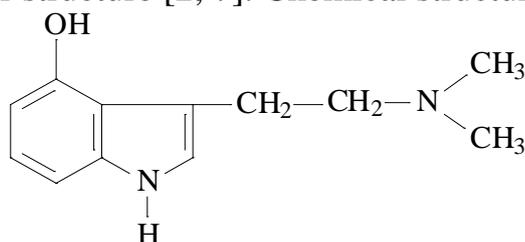


The content of bufotenine as well as muscarine in *A. muscaria* fruit bodies is variable.

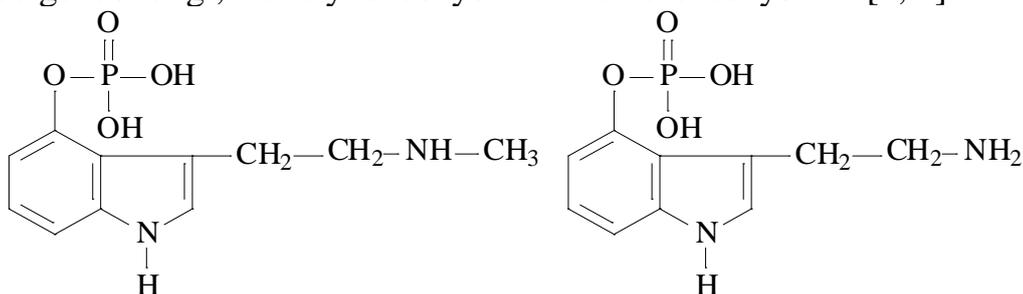
Chemical analysis of *Psilocibe* genus fungi, mainly *Psilocybe mexicana* or *Psilocybe cubensis*, made it possible to identify the active substance producing hallucinogenic effects. The substance was named psilocybin [2, 4, 7]. Psilocybin is an indole derivative phosphate ester of 4-oxy-methyl-tryptamine [2]. Chemical structure of psilocybin³¹:



Psilocin (4-hydroxy-N, N-dimethyltryptamine), a dephosphorylated derivative of psilocybin has similar structure [2, 7]. Chemical structure of psilocin³²:

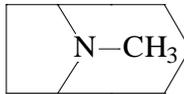


The formulae clearly demonstrate that psilocin and bufotenine are isomers. Apart from psilocybin and psilocin, two other indole alkaloids were isolated from *Psilocibe* genus fungi, namely: baeocystin³³ and norbaeocystin³⁴ [2, 4]:

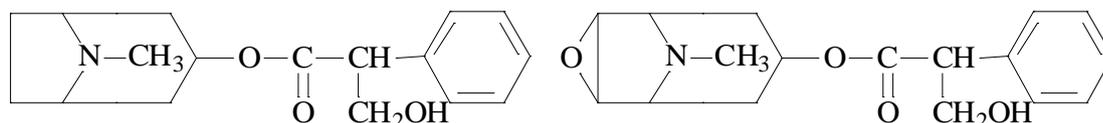


After discovery thereof it was determined that the alkaloids cause a pathological process in the cerebral cortex resulting in intensive secretion of serotonin, which had previously been considered a fungal toxin [2].

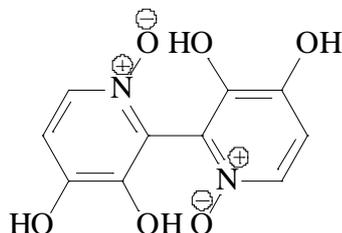
A. pantherina fruit bodies contain **tropane alkaloids** (tropane derivatives),

being alkaloids with tropane nucleus base [6]: 

They include hyosciamine³⁵ (atropine) and hyoscine³⁶ (scopolamine) [5, 6, 7]:

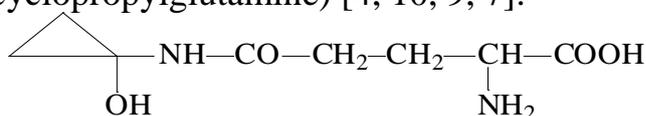


Bipyridine derivatives are organic substances with two pyridine nucleus in the base [6]. One of these is orellanine contained in *Cortinarius orellanus* [2, 4, 8]. Chemical structure of orellanine³⁷ is as follows:



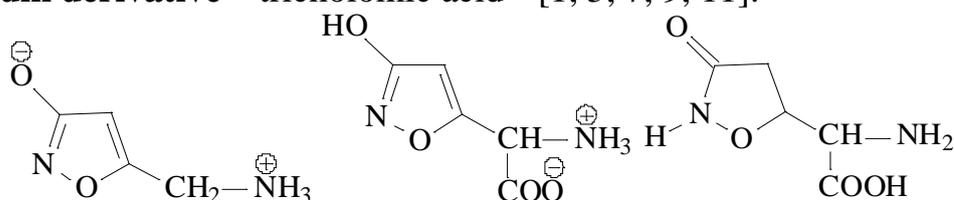
Cortinarius orellanus also contains cyclopeptides, such as cortinarine, mesonine, grjymaline, but their structure remains to be exactly ascertained [2, 8].

Of **cyclopropanol amino acids** contained in mushrooms the poisonous one is coprine³⁸ (hydroxycyclopropylglutamine) [4, 10, 9, 7]:

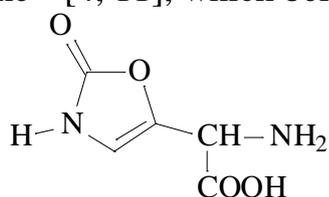


Found in *Coprinus atramentarius*, it causes poisoning only in combination with alcohol. The poisoning is mainly due to the inhibition of aldehyde dehydrogenase which causes an accumulation of acetaldehyde in the body after ethanol ingestion [2, 5, 7, 9, 10].

A. muscaria contains **azoles** – five-membered heterocycles, having in a ring not less than two heteroatoms, from which, at least, one is the atom N [6]. This group of **amino acids** includes **isoxazoles**, such as muscimol³⁹, ibotenic acid⁴⁰ and the **isoxazolidin derivative** – tricholomic acid⁴¹ [1, 5, 7, 9, 11].



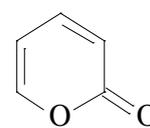
Tricholomic acid is also found in fungus *Tricholoma muscarium*. Ibotenic acid has an isomer – muscazone⁴² [4, 11], which belong to **oxazolines**:

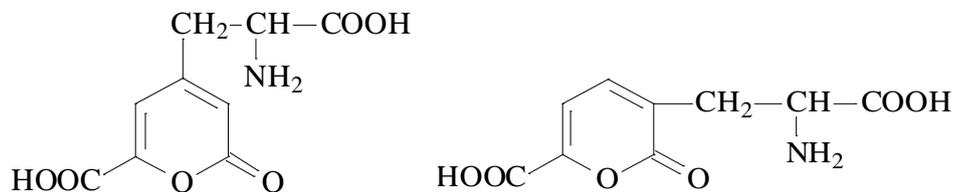


Muscazone is also found in *A. muscaria*[1, 7, 11].

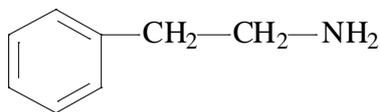
A. pantherina contains **amino acids** with **pyrone** nucleus base [6]:

They include stizolobic⁴³ acid and its isomer stizolobinic acid⁴⁴ [9, 11]:



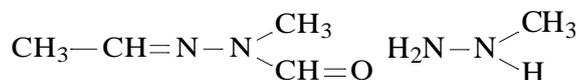


A. muscaria contains certain **amines** being ammonia derivatives in molecules of which one, two or three hydrogen atoms are substituted with hydrocarbon radicals [5, 6]. These include ethylamine⁴⁵ (aminoethane) $\text{CH}_3\text{—CH}_2\text{—NH}_2$ and its derivative - phenylethylamine⁴⁶:

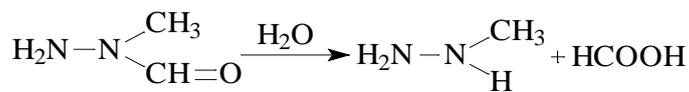
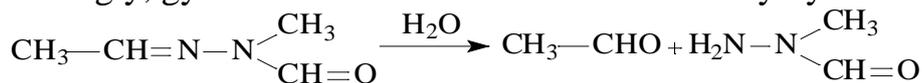


Putrescine⁴⁷ $\text{NH}_2\text{—CH}_2\text{—CH}_2\text{—CH}_2\text{—CH}_2\text{—NH}_2$ belongs to diamines [5, 6].

During the study of *Gyromitra esculenta* such **hydrazine derivatives** ($\text{H}_2\text{N—NH}_2$) as gyromitrin⁴⁸ and its analogue monomethylhydrazine⁴⁹ were isolated [4, 5, 8, 9]:



Interestingly, gyromitrin can transform into monomethylhydrazine [8]



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УДК 535.372+543.42+547.814.1

BIS-FLAVONOL: ON THE WAY TO DESIGN NEW RATIOMETRIC PROBES WITH AN INCREASED NUMBER OF DATA-COLLECTING CHANNELS

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Language supervisor: Kholmogortseva I.S.

Summary: Synthesis and systematic investigation of the spectral-luminescent properties of “*bis*-flavonol” {1,4-bis-(3-hydroxy-4-oxo-4H-chromen-2-yl)-benzene} has been performed. Principle possibility for the double excited-state proton transfer reaction in *bis*-flavonol the article discussed basing on both quantum-chemical modeling and experimental data. Consecutive S_1^* -state transfer of the two protons of the title molecule is shown to be energetically unfavorable, however, still preserving a possibility for the concerted double proton transfer in the excited dienol form.

Key words: 3-hydroxychromones, bis-flavonol, double proton transfer, ESIPT.

Анотація: Був виконаний синтез і систематичне дослідження спектрально-люмінесцентних властивостей "біс-флавонолу" {1,4-біс-(3-гідрокси-4-оксо-4Н-хром-2-іл)-бензену}. Принципова можливість подвійного переносу протону у збудженому стані в біс-флавонолі обговорюється як на основі квантово-хімічного моделювання так і на основі експериментальних даних. Показано, що послідовний перенесення протонів є енергетично не вигідним, проте, принциповою можливістю подвійного перенесення протона у збудженому стані зберігається.

Ключові слова: 3-гідроксіхромон, біс-флавонол, фотоперенос протонів.

Аннотация: Был выполнен синтез и систематическое исследование спектрально-люминесцентных свойств "бис-флавонола" {1,4-бис-(3-гидрокси-4-оксо-4Н-хромен-2-ил)-бензола}. Принципиальная возможность двойного переноса протона в возбужденном состоянии в бис-флавоноле обсуждается как на основе квантово-химического моделирования так и на основе экспериментальных данных. Показано, что последовательный перенос протонов является энергетически невыгодным, однако, принципиальная возможность двойного переноса протона в возбужденном состоянии сохраняется.

Ключевые слова: 3-гидроксихромон, бис-флавонол, фотоперенос протонов.

Compounds exhibiting excited-state proton transfer process (ESIPT) have been a subject of extensive scientific interest over the years. Due to the formation of several light-emitting species in the excited state of such molecules, they possess a unique feature: at least two well-resolved bands in their fluorescence spectra. Numerous investigations revealed that fluorescent properties of the ESIPT compounds are in most cases highly sensitive to the variety of characteristics of the closest fluorophore's environment on the molecular level. The spectral response of such compounds is rather complicated: while the excited-state proton transfer process is influenced by the dye's molecules surrounding, not only the individual emission bands positions and intensities depend on the intermolecular interactions

(intensometric approach, see Figure 1), but also their intensity ratio does. This gave rise to a promising approach in the fluorescence-based analytical methods – the so-called ratiometric fluorescent monitoring (Figure 1), where the analytical signal is “absolute”, “self-calibrated” and does not depend on the fluorophore concentration, excitation light intensity, etc. This opens new horizons in the analysis of environmental and biological objects, where control of these parameters becomes challenging or even impossible.

From a number of different classes of organic compounds for which the ESIPT process is characteristic, 3-hydroxychromones (3HC) – a large family of natural and artificial dyes – attract particular attention. Their dual-banded fluorescence being very sensitive to the various characteristics of the surrounding media, 3HC derivatives have been successfully suggested for their practical application as probes for solvent polarity, hydrogen bonding ability, metal ions contents, as well as for a number of biologically-oriented investigations, such as proteins, nucleic acids and individual nucleotides, cell membrane studies, etc.

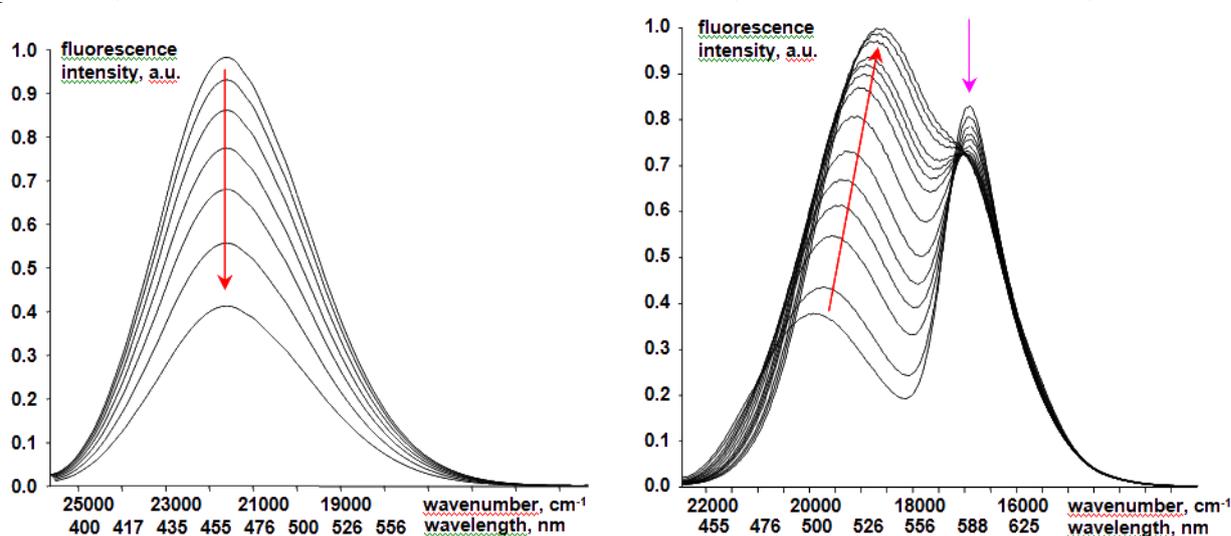


Figure 1. Schematic illustration of the principles of intensometric (*left*, simulated spectra) and ratiometric (*right*, our own data) fluorescence probing.

Despite the fact that the dual-banded fluorescence gives the possibility for the ratiometric fluorescence probing, it also allows to use the increased number of the data-collecting channels in comparison to traditional intensometric measurements. Thus, not only the fluorescence intensity ratio depends on the microenvironment characteristics, but also emission bands positions, and together with the absorption data – fluorescence Stokes shifts. This allows researchers to build multiparametric correlations, and thus to increase the reliability of the obtained results, as well as to perform simultaneous and mutually independent analysis of two or more parameters of the probe microenvironment.

In the framework of novel ESIPT compounds application for the multiparametric probing, design and synthesis of the multi-banded fluorescent dyes exhibiting yet more complex emission spectra becomes highly promising. For example, compounds with several proton transfer sites could demonstrate single- and double- (dESIPT) excited state proton transfer reactions giving raise to the appearance of additional emission bands. The double proton transfer is a very

important process in biologically relevant systems, thus, understanding its photophysics is crucial for the development of both fundamental and applied science. Within last decades, the possibility of the transfer of two protons is widely discussed for the molecular dimers and ensembles and symmetrical molecules with two (inter/intra)molecular hydrogen bonds. Also, the issue of the mechanism of such a double proton transfer has been discussed for various systems, distinguishing between concerted and consequent ones.

The first thoroughly investigated molecule among the 3HC derivatives with a possibility of the excited state double proton transfer was diflavonol (Fig. 2). However, only the single proton transfer was shown to be most favorable for this molecule. The interplay between intermolecular and intermolecular proton transfer reactions were discussed for diflavonol as well. At the same time, the excited state double proton transfer was reported for the *bis*-diethylamino substituted diflavonol.

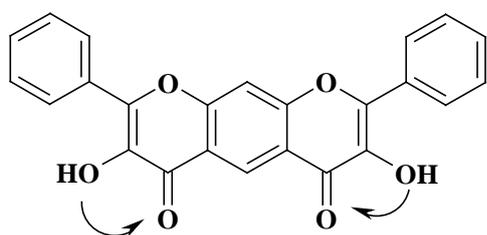


Figure 2. Considering the excited state double proton transfer in diflavonol molecule.

Another representative of 3HC family having potential to the excited state double proton transfer – 1,4-*bis*-(3-hydroxy-4-oxo-4H-chromen-2-yl)-benzene, *bis*-flavonol – has been recently synthesized. This molecule contains two 3-hydroxychromone bi-cycles bound to *para*-positions of the same benzene ring, and thus possesses two intermolecular hydrogen bonds formed by the corresponding hydroxy- and carbonyl groups. As far as it is known, no further spectroscopic and physico-chemical studies, particularly of the ESIP/T process, have been reported for the molecule under discussion.

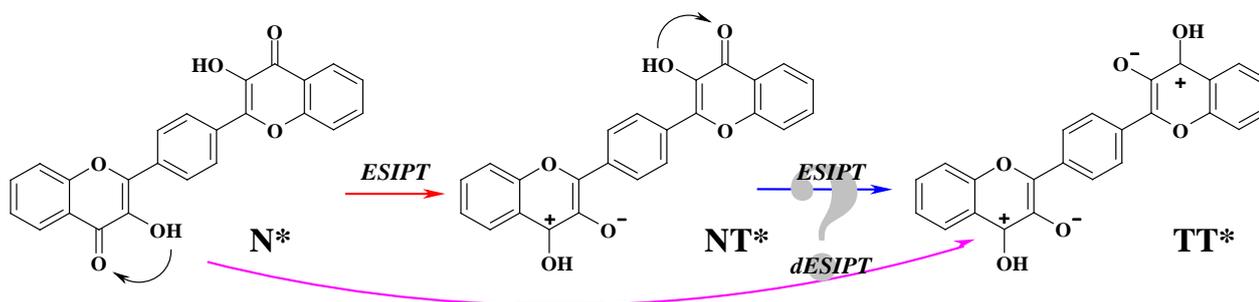


Figure 3. Possible excited state single and double proton transfer in the *bis*-flavonol molecule.

In the present paper, we report investigation of spectral and fluorescent properties of *bis*-flavonol, as well as its suitability for ratiometric probing of various characteristics of the liquid phase. Possibility of the realization of the excited state double proton transfer is discussed basing on both spectral data and results of our quantum-chemical calculations.

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COMPLEX STRUCTURES FORMED ON THE SURFACE OF AMINOSILICA

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Summary: The article represents the description of sounding of aminosilica with Cu(II) ions. Basing on the spectra of diffusion reflection, there has been assumed the composition of complexes forming on the aminosilica surface. Despite the H⁺ sorption being well described by the model of fixed bidentate centres, there are centres with larger dentation on the surface.

Key words: aminosilica, bidentate centre, dentation, surface

Анотація: В роботі проведено зондування аміноксерогелів іонами Cu(II). На основі спектрів дифузного відбиття зроблено припущення про склад комплексів, що утворюються у приповерхневому шарі аміноксерогелів. Показано, що незважаючи на те, що сорбція іонів H⁺ добре описується моделлю фіксованих бідентантних центрів, на поверхні існують центри з більшою дентантністю.

Ключеві слова: аміноксерогель, бідентантний центр, дентантність, приповерхневий шар

Аннотация: В работе проведено зондирование аминоксерогелей ионами Cu(II). На основе спектров диффузного отражения, сделано предположение о составе комплексов, образующихся в приповерхностном слое аминоксерогелей. Показано, что хотя сорбция ионов H⁺ хорошо описывается моделью фиксированных бидентантных центров, на поверхности существуют центры с большей дентантностью.

Ключевые слова: аминоксерогель, бидентантный центр, дентантность, околоповерхностный слой.

Introduction. Nowadays the study of properties, application optimization, synthesis of new species of organically modified silica is an important and perspective branch of chemistry [1]. Porous materials, such as materials based on amorphous silicon oxide, are widely used as catalysts, sorbents, chemical sensors etc. in the technological process of substances synthesis and treatment [2, 3, 4, 5]. Silicon oxides are used as solid-phase analytical reagents and as an immovable phase in the chromatography [6].

Aminosilica (silica with amino groups with covalent bonds on the surface) possessing complex properties is one of the widespread species of organically modified silica. The surface behaviour is of great importance in the study aminosilica properties.

In general the difficulty of foreseeing surface behaviour as well as that of aminosilica creates the impossibility to give functional aminosilica properties as a sum of aminosilica medium and fixed reagent properties. The aim of this investigation is to examine complex properties of aminosilica on the base of sounding the surface by with copper (II) ions and to determine the composition of complexes, which were formed on the surface.

Experiment

Materials. 3-aminopropyltrimethoxysilane [(C₂H₅O)₃Si(CH₂)₃NH₂, (APTES) (Merck, 98%), tetramethoxysilane [(C₂H₅O)₄Si, TEOS] (Acros, 98%) were used without further purification. Copper sulfate solution (initial concentration

$\sim 0.1 \text{ mol}\cdot\text{l}^{-1}$) was prepared in bidistilled water from $\text{CuSO}_4\cdot 5\text{H}_2\text{O}$. The concentration of the obtained solution was measured using chelatometry titration with the solution of Trilon B ($0.052 \text{ mol}\cdot\text{l}^{-1}$) in the presence of murexide as an indicator []. The desired concentrations were obtained by dilution.

Synthesis of modified silica. Modified aminosilica sorbents were prepared by sol-gel technology []: 20 ml ethyl alcohol was added to 8 ml mixture of APTES and TEOS, stirred for 5 min, and then 8ml distilled water was added. The obtained gel was vigorously stirred for 35 min. Then the gel obtained was dried in microwave oven with 70W for 15 min and with 150 W for 10 min.

Determination of physical, chemical and morphological properties of aminosilica. The pH-metric titration was used for determining the quantity of active amino groups according to the following procedure: $\sim 0.1\text{g}$ aminosilica was added to 20ml distilled water and the suspension obtained was titrated with the solution of hydrochloric acid (0.1 mol/l).

Sounding the surface with copper (II) ions was carried out by the method of individual preforms. A few suspensions under consideration were prepared. Aminosilica ($\sim 0.1\text{g}$) was suspended in 15.0 – 20.0 ml distilled water, 1 – 10 ml solution CuSO_4 ($0.001\text{-}0.1 \text{ mol}\cdot\text{l}^{-1}$) was added to aminosilica. The solution of hydrochloric acid (0.1 mol/l) was used to obtain suspensions solution with $\text{pH}\sim 5.5$. The mixture was stirred and stored for 24 h in the weighing bottle. Then pH and pCu values were measured with the ion meter with H^+ and Cu^{2+} selective electrodes respectively. The error of measure was no more than 5%.

The apparent density was determined as relation of the samples mass to the samples volume in its natural form. The graduated cylinder (the mass and the volume of this cylinder were known) was filled with aminosilica, then the cylinder was shaken 600 times; the filled cylinder was measured for aminosilica mass and volume.

The porosity of the material which is represented by the relation of interstice volume to the total volume of the materials, was calculated using the following equation (1) (Table 1):

$$P = (1 - d_a / d_r) * 100\% \quad (1)$$

where P is the porosity of materials, d_a is the apparent density, g/ml , d_r is the real density, g/ml .

Table 1. The porosity and density of the synthesized materials

Material	1	2	3
Real density, g/ml	2.57	1.99	1.70
Apparent density, g/ml	0.22	0.31	0.59
Porosity, %	91	84	65

Characterizations. To measure solution pH there have been used: a glass electrode with hydrogen function ES-10603 (production by Russia, Moscow), chlorinesilvery reference electrode EVL-1M3 (production by Belarus, Gomel) and saline-bridge, with a saturated solution of KNO₃ in agar-agar, the laboratory ion meter U-160 Mu (production by Russia, Moscow). Ion meter was graduated by standard buffer (pH of this solution was pinpoint). Selective electrode to Cu² ELIS-131Cu (production by Russia, Moscow) was used to measure the concentration of copper (II) in the solutions.

Electronic spectra of the samples diffusion reflections were measured with Specol 1 (Karl Zeiss, production by GDR) in the wave-length range from 400 nm to 800 nm. The reflection standard was magnesium oxide; the absorption standard was soot. The value of reflection (R) was used to calculate the value of Gyrevich-Cubelka-Munka function (2) []:

$$F=(1-R)^2/2R \quad (2)$$

The suspensions sounded by copper (II) ions were filtered and dried with about T=293 ± 2 K for 24 h. The samples obtained (~0.5 g) were used for receiving electronic spectra of diffusion reflections

The electronic spectra of diffusion reflections were managed with Origin 7.0 software []. The real density of the examined materials was measured using the bottle method [Ошибка! Закладка не определена.].

Results and discussions. Three samples of aminosilica with different mole fraction of APTES in initial mixture were synthesized.

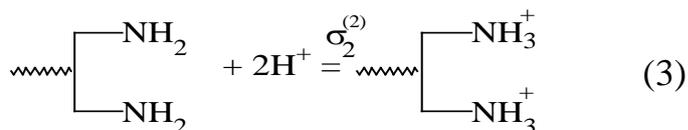
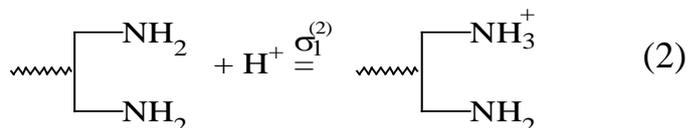
The data (about concentration of active aminogroups, t (Q)) presented in Tab. 2 were calculated according to Langmuir adsorption model (3):

$$\frac{1}{D} = \frac{1}{\beta \cdot t(Q)} + \frac{1}{\beta} \cdot [H^+] \quad (3)$$

where D=a(H⁺)/[H⁺] is the distribution percentage (a(H⁺) is the adsorption capacity at equilibrium (mol g⁻¹); [H⁺] is the equilibrium concentration of hydrogen ions in solution); β – is the Langmuir constant which is related to the strength of adsorbent / adsorbate interaction (l mol⁻¹).

The obtained values t (Q) were smaller than theoretical values in 2.5, 1.8 and 1.2 times for the samples 1, 2 and 3 respectively (Table 2). It is caused by the fact that a part of aminogroups are situated in the inside interstice. The samples porosity decreases with the APTES mole fraction increase; the part of internal aminogroups decreasing.

As it is known [], the model of fast bidentate binding is the best model to describe aminosilica protonation process. The equilibrium constants for the reactions of protonation aminogroups ((2) and (3)) were calculated using the model of bidentatum and program CLINP 2.1 []:



The maximum of absorption band provides information about the composition of aquaaminocomplexes [] (Table 3).

Table 2. Some physical and chemical properties of synthesized aminosilica

No	Mole fraction of APTES, %	c[(CH ₂) ₃ NH ₂] _{theor} , mmol/g	c[(CH ₂) ₃ NH ₂] _{exp} , mmol/g	lg σ ₁ ⁽²⁾	lg σ ₂ ⁽²⁾
1.	9.6	1.2	0.5	3.9±0.2	6.7±0.2
2.	29.0	3.1	1.8	6.2±0.2	10.3±0.2
3.	48.9	5.0	4.2	8.7±0.2	14.6±0.2

The samples of sorbents were kept in CuSO₄ solution (c=0.04 mol/l), then filtered and dried, thereafter the electronic spectra of samples diffusion reflections were measured (Fig. 1).

Having analyzed the obtained spectra to Gauss's curve, we can see, that there are three absorption bands for Sample 1 and 2, which can correspond to complexes: [Cu(NH₂R)(H₂O)₅]²⁺ – 715-735 nm, [Cu(NH₂R)₂(H₂O)₄]²⁺ – 670-680 nm – [Cu(NH₂R)₃(H₂O)₃]²⁺ 630-650 nm.

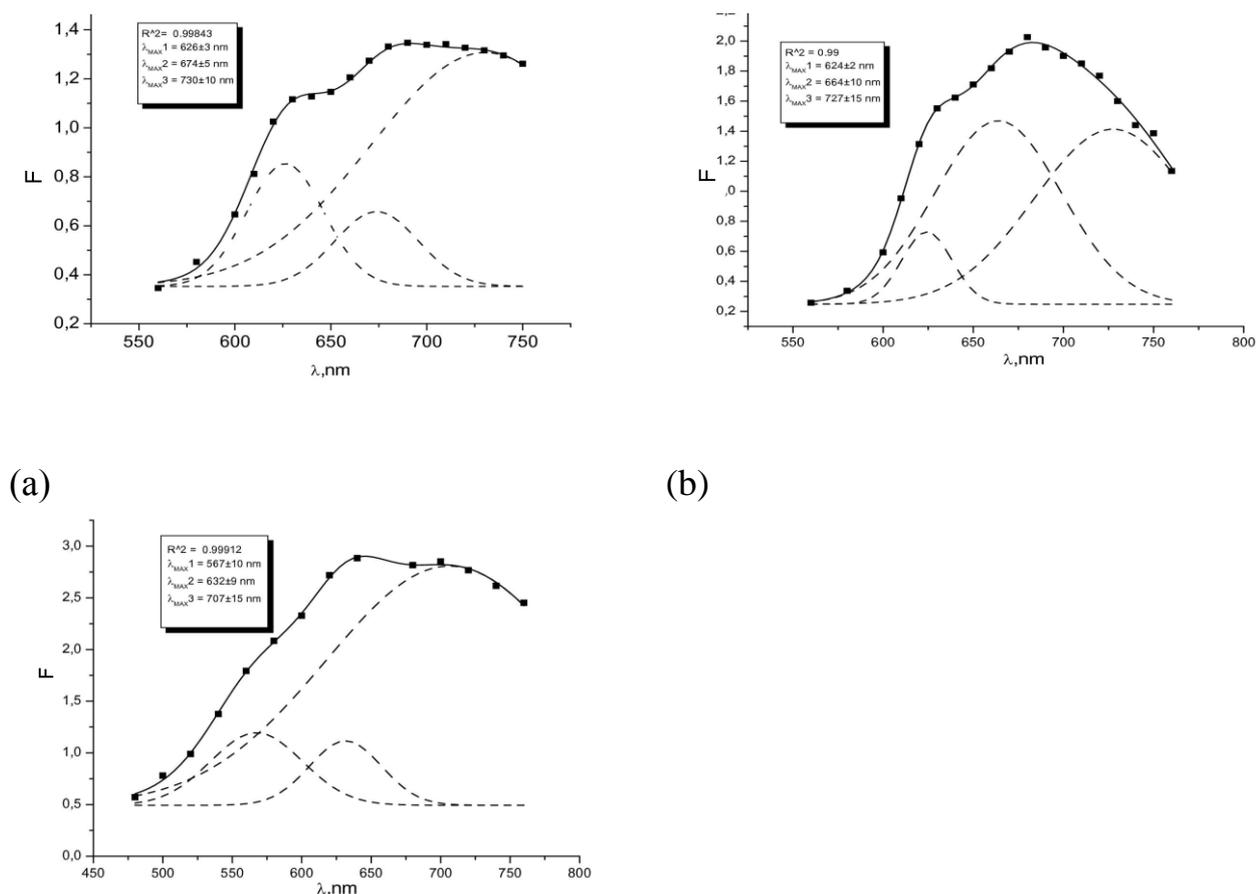
The absorption band corresponding to complexes [Cu(NH₂R)(H₂O)₅]²⁺ appeared to be more insensitive for Sample 1 than Sample 2, which can be caused by the presence of a bulk of monodentate centres on the surface and a less surface density of amino groups for Sample 1.

Table 3 Composition of aquaaminocomplexes Cu(II) and their of absorption band maximu:

Complex*	[Cu(NH ₃)(H ₂ O) ₅] ²⁺	[Cu(NH ₃) ₂ (H ₂ O) ₄] ²⁺	[Cu(NH ₃) ₃ (H ₂ O) ₃] ²⁺	[Cu(NH ₃) ₄ (H ₂ O) ₂] ²⁺
λ _{max} ,nm	715-735	660-670	630-650	580-600
Complex*	–	[Cu(EA)(H ₂ O) ₄] ²⁺	–	[Cu(EA) ₂ (H ₂ O) ₂] ²⁺
λ _{max} ,nm	–	675-690	–	535-550
Complex	[CuQ(H ₂ O) ₅] ²⁺	[CuQ ₂ (H ₂ O) ₅] ²⁺	[CuQ ₃ (H ₂ O) ₅] ²⁺	[CuQ ₄ (H ₂ O) ₅] ²⁺
λ _{max} ,nm	715-735	670-680	630-650	560-570
* according to [Ошибка! Закладка не определена.]				

The large surface density of amino groups for Sample 3 determine the presence of bidentate acentres only, which form complex [Cu(NH₂R)₂(H₂O)₄]²⁺ with a wide absorption band of λ_{max} ≈ 705 nm. Beside, there appears to be an absorption band of λ_{max} ≈ 565 nm, which corresponds to [Cu(NH₂R)₄(H₂O)₂]²⁺ complex. It is to be noted that this complex is relevant only for Sample 3, and absence for Sample 1 and 2.

If the concentration of Cu^{2+} increases in the solution, the adsorption band of $\lambda_{\text{max}} \approx 730 \text{ nm}$ corresponding to complex $[\text{Cu}(\text{NH}_2\text{R})(\text{H}_2\text{O})_5]^{2+}$ can appear:
 $[\text{Cu}(\text{NH}_2\text{R})_4(\text{H}_2\text{O})_2]^{2+} + \text{Cu}^{2+} + \text{H}_2\text{O} \rightarrow [\text{Cu}(\text{NH}_2\text{R})(\text{H}_2\text{O})_5]^{2+}$.



(c)
 Figure 1. The electronic spectra of samples diffusion reflections 1 (a), 2 (b) and 3 (c)

It is to be noted that in spite of the fact that the model of fast bidentate binding centres describe the process of H^+ sorption very well, we should assume a larger dentation for aminosilica with large APTES mole fraction.

Conclusion.

1. The model of fast bidentate binding centres describes the process of H^+ sorption of by aminosilica (which were investigated) very well;
2. The obtained values of concentration amino groups were smaller than their theoretical values. It can be explained by the fact that a part of aminogroups are situated in the inside interstice;
3. Cu^{2+} sorption contributes the formation of complexes with ratio $\text{Cu}:\text{NH}_2$ from 1:1 to 1:4 on the surface, the latter forming at a large APTES mole fraction in a parent mixture.

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PREFERENCES OF THE CHROMATOGRAPHY IN MONITORING THE ENVIRONMENT

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Summary: Main advantages of chromatographic method over other methods in the environmental monitoring are considered by means of general examples in this article. The problem

of environmental pollution is raised. A close relationship between chromatography and computer technology is also discussed together with their harmonic combination that considerably facilitates both the process of carrying out and the controlling the analysis, information processing and calculations of theoretical characteristics.

Key words: chromatography, environment, monitoring, pollution, protection.

Анотація: У цій статті розглядаються на загальних прикладах головні переваги хроматографічного методу перед іншими методами в моніторингу навколишнього середовища. Гостро порушена проблема забруднення середовища. Також обговорюється тісний взаємозв'язок хроматографії та комп'ютерних технологій, їх гармонічне поєднання, що значно полегшує як сам процес проведення та контролю за аналізом, так і обробку експериментальних даних і розрахунок теоретичних характеристик.

Ключові слова: забруднення, захист, моніторинг, навколишнє середовище, хроматографія.

Аннотация: В данной статье рассматриваются на общих примерах основные преимущества хроматографического метода перед другими методами в мониторинге окружающей среды. Остро затронута проблема загрязнения природы. Также обсуждается тесное взаимодействие хроматографии и компьютерных технологий, их гармоническое совмещение, что значительно облегчает как сам процесс проведения и контроля анализа, так и обработку экспериментальных данных и расчет теоретических характеристик.

Ключевые слова: загрязнение, защита, мониторинг, окружающая среда, хроматография.

At present the problem of environment has acquired a sharper character. In connection with this the necessity to undertake radical measures of pollution prevention and nature cleaning arises. To get the solution of the problems mentioned above, it is necessary to know a chemical composition of the investigated objects (substances). The chemical methods of qualitative and quantitative analyses can help herein. One of these methods can be a chromatography method.

An awareness and competence of chromatography consists in the fact that this method possesses a number of advantages as compared with other methods. Chromatography includes multifarious division methods playing an important role in analytical chemistry, as they often allow to separate, insulate and identify components of a complex mixture, which division by means of other methods is difficult or generally impossible. An extensive information on the structure and properties of many classes of organic compounds was obtained by means of chromatography. The application of chromatographic methods for the division of proteins has caused the enormous influence on the development of modern biochemistry. Chromatography is successfully applied in research and clinical purposes in the various areas of biology and medicine, in pharmaceuticals and criminalistics, etc. Such properties as universality, express-testing and sensitiveness make chromatography a major analytical method.

The chromatographic method of analysis was developed by a Russian botanist M.S. Civet in 1903. A noticeable development of chromatographic methods began in the 30-s of the XXth century, when a sharp requirement in the new method of division of mixtures and the cleaning of substances decomposing by heating appeared. Chromatography continues its rapid development and at present it is one of the most prospective methods of analysis. The fact that the work in this field was awarded by 14 Nobel Prizes for the contribution made with the application of chromatographic method, indicates the significance of chromatography.

As it has already been noticed, chromatography involves a great number of methods. Besides, the same task can be fulfilled by means of several methods, and this fact illustrates broad differentiation of the method of analytical chemistry by the determining methods.

In addition, another advantage of the chromatographic method is a possibility of multicomponent mixture division of complex substances to have a different state, and to receive qualitative and quantitative characteristics by means of the only analysis.

Thus, for example, the analysis of water contaminations can be made by the method of gas, liquid, thin-layer, ion-exchange or paper chromatography.

Liquid chromatography (LC) was found as the most applicable method of all chromatographic methods. With the appearance of a gas chromatography (GC), application of a liquid chromatography for the analysis of nonpolar, volatile and low-molecular substances became inappropriate as a result of considerable advantages of gas chromatography in selectivity, efficiency, rapidity of division and sensitivity. However, liquid chromatography saves its significance in preparative methodologies – preliminary division by functional groups and purification preceding other final division methods. As before, it is used during the analysis of very polar compounds, high-molecular and non-volatile and also thermolabile compounds.

As for the soil it effects as a sponge (reservoir) absorbing all substances having impregnated ground, including pesticides very well. Stability of pesticides strongly depends on a type of the soil: heavy clay loams retain pesticides longer than light sandy soil. Pesticides can be found everywhere in the environment. Pesticides are carried in areas where they had never been used by wind, water, with foodstuff and fodder. The most major factor characterizing the stability of pesticide residues is its structure. Presence of ions Fe (II), Al (III), Mg (II) and moisture in acid soils influences the adsorption and stability of insecticides in the soil [4, p. 233–234].

Herbicides as opposed to insecticides decompose rather well. Nevertheless their stability in the soil depends on the factors of the stability of insecticides.

Gas chromatography makes it possible to determine very accurately, rapidly and with high sensitivity the pesticides extracted out of soil, sedimentary rocks and plant tissues. The method of gas chromatography permits to divide and determine many insecticides, however, before the analysis of a thorough purification of extracts has been conducted. Secure determination in the gas chromatography is realized by means of using specific detectors and two or more columns [4, p. 92].

In this way, e.g., the analysis of soil can be carried by means of gas, column, thin-layer, ion-exchange and paper chromatography.

The analysis of air pollution is also presented by variety of methods which can be used for the determination of chemical composition and its quantity characteristics. Thus, the composition and quantity of components can be determined by the method of gas, liquid, thin-layer and paper chromatography.

Of course, all methods of chromatography listed above are not limited because chromatography is being developed and improved continuously.

At the age of computer technology development it can't remain unnoticed that the chromatographic analysis is tightly coordinated with apparatus of artificial intelligence. Lately the possibilities of scientific measuring equipment have increased

rapidly owing to the application of computers. The progress in the automation of scientific investigations is generally connected with the capacity of computers to keep and compare the information and to show the required results more promptly and reliably than people. Due to the computers most chromatographic processes are automated, starting with the moment of turning on the equipment up to the analysis of the observation being completed. The application of computers is the most productive source for the analysis of the observation. This procedure consists of two phases: data gathering and calculating, conversion of a detector signal into the information. The procedure of data gathering consists of the conversion of the detector analog signal into the digital form.

The introduction of the automatic chemical analysis of measuring methods was a great advance in the development of the quantitative analysis. For the conversion of the original digital data into the final result of the analysis it is necessary to perform a number of different mathematical operations. Accumulating, averaging, smoothing, conversion, integration and differentiation – this is not the full list of operations made by computer. Processing a great number of the data obtained during the analysis, a computer invaluablely assists the analyst, creating various tables and drawing black-and-white or colorful diagrams and graphics. The application of computer systems permits to automate this procedure overall at relatively reasonable prices [6, p. 257].

Therefore, at the time of extremely intensive development of chemical technologies the problem connected with the environmental pollution both by industrial and domestic wastes has appeared. Because of special chemical properties in their composition, these products cannot be processed for their utilization naturally. Accordingly, it is an important task of harmful substances identification in nature and their quantitative determination facing chemists and analysts. Hence, this task includes the search of means to decrease the harmful influence of industrial manufacture and to refine our habitat – nature. As it turned out chromatography is the most suitable instrument for the solution of this problem. The chromatographic method of environmental monitoring possesses a prevalent number of advantages over other methods. Thus, it is necessary to stimulate the developing of chromatography as a multiple applicable method in various fields of people's life.

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УДК 502/504:66

INFLUENCE OF CHEMICAL INDUSTRY OF UKRAINE ON ENVIRONMENT AND HUMAN HEALTH

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Summary: The article looks at the problem of harmful influence of chemical industry on environment and human health. It has been established that production by-products negatively influence on environment and human health both directly and through the finished goods of industrial production causing acute poisoning, chronic illnesses, death.

Key words: chemical industry, nitrates, mineral fertilizers, paints, chemical contaminations, solvent.

Анотація: У статті описується шкідливий вплив хімічної промисловості на довкілля і здоров'я людини. Встановлено, що побічні продукти виробництва негативно впливають на навколишнє середовище та здоров'я людини як прямо, так і опосередковано через кінцеві продукти виробництва промисловості, викликаючи гострі отруєння, хронічні хвороби, смерть.

Ключові слова: хімічна промисловість, нітрати, мінеральні добрива, фарби, хімічне забруднення, розчинники.

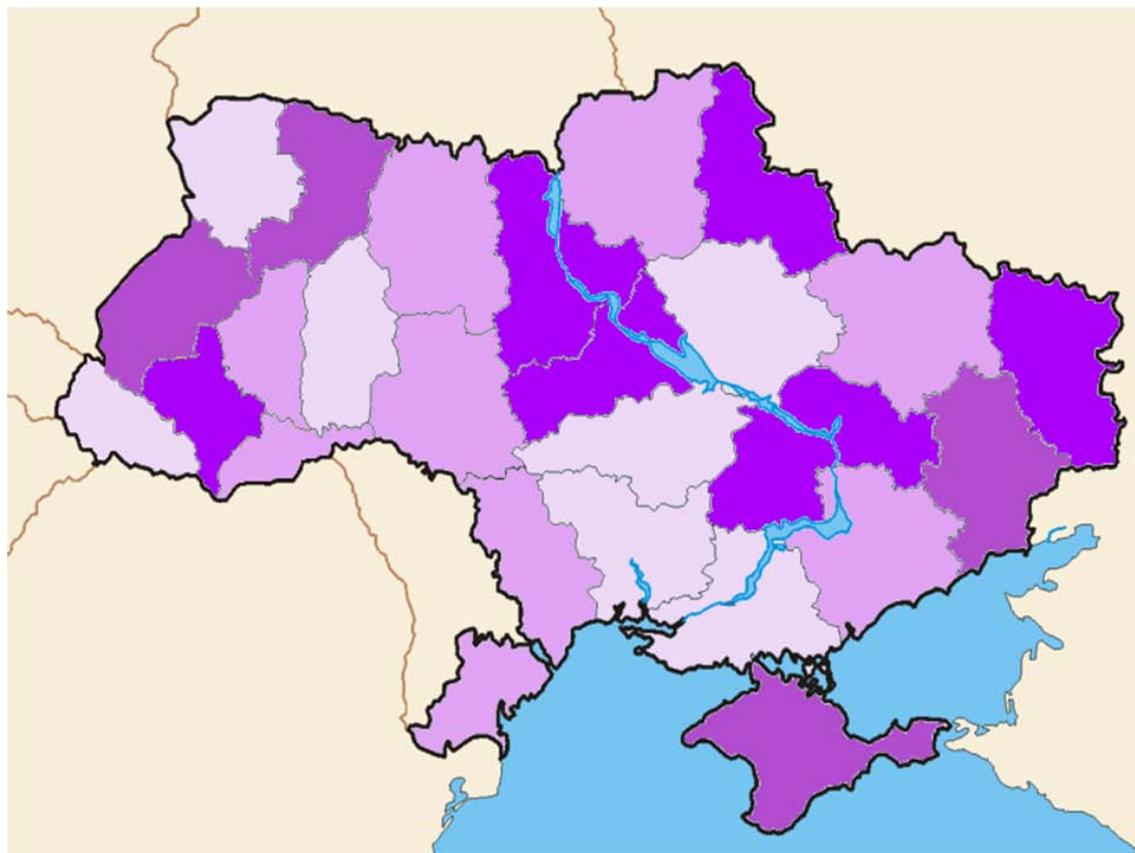
Аннотация: В статье описывается вредное влияние химической промышленности на окружающую среду и здоровье человека. Установлено, что побочные продукты производства негативно влияют на окружающую среду и здоровье человека как прямо, так и опосредовано через конечные продукты производства, вызывая острые отравления, хронические заболевания, смерть.

Ключевые слова: химическая промышленность, нитраты, минеральные удобрения, краски, химическое загрязнение, растворители.

On all stages of the development man was related to nature, moreover he has come out of it. The necessities of population grew constantly, and the supply of natural resources diminished. Search for additional raw materials and technologies of producing goods with the required properties became necessary.

Chemical industry is a complex industry which provides all industries of economy with chemical technological materials and produces goods of mass consumption. Industry has attained most development in Kyiv, Sumy, Ivano-Frankivsk, Zaporozhia and Lugansk regions (pic.1) [4].

Picture 1. – Chemical industry of Ukraine. Color mark the level of development of



chemical industry in the different areas of Ukraine from darker to lighter: the highest, high, middle, low.

A chemical complex includes enterprises of the followings industries: metallurgical – chemical, alkaline chemistry, chemical fibers, plastic masses, paint-and-varnish and synthetic dyes, chemical – pharmaceutical, petrochemical and rubber – asbestoses. Alkaline chemistry which produces acids, soda, alkali, mineral fertilizers, makes 40% of chemical complex products [3]. As a result of production oxides and dioxides of nitrogen and sulfur, and HCl, HF, NH₃, other harmful substances are emitted into the atmosphere.

The structure of chemical industry wastes is characterized by the following indexes: hard matters (ash, coal, organic and inorganic dust) make 13,4% from the total amount of by-products; liquid and gaseous by-products (86,6% including carbon dioxide (CO₂) – 32,6%; volatile organic compounds (LOS) – 24,4%; sulfur dioxide (SO₂) – 19,3%; nitrogen oxide – 8,8%; hydrocarbons – 4,8%.

Soil unlike atmospheric air has the ability to accumulate contaminants which get on it. Unusual matters accumulate in huge amounts due to industrial wastes.

Soils are contaminated mainly by fertilizers which with the purpose of economy are added into the soil unrefined and thus, quite a lot of toxic metals and metalloids get into soil. In addition, fields are polluted by pesticides. An equilibrium

is upset in the processes of nitrification and denitrification, what surplus of nitrates appears in the case of.

Industrial wastes such as harmful gasses and chemicals, pesticides, fertilizers and insecticides are the most common causes of the soil pollution. Acid rains, when fumes released from industries get mixed with rains. It causes negatively effects. Among them is decreasing in soil fertility and therefore decreasing in the soil yield. Loss of soil and natural nutrients present in it. Plants also would not thrive in such soil, which would further result in soil erosion, increase the salinity of the soil.

All water objects are connected with environment. The terms of forming of superficial and underground gully, natural phenomena, economic and domestic activity of man, influence on it. The pollutants of hydrosphere can be divided into organic (hydrocarbons) and inorganic (salts, acids).

Industrial and agricultural work involves the use of many different chemicals that can run-off into water and pollute it.

Metals and solvents from industrial work can pollute rivers and lakes. These are poisonous to many forms of aquatic life and may slow their development, make them infertile or even result in death.

Pesticides are used in farming to control weeds, insects and fungi. Run-offs of these pesticides can cause water pollution and poison aquatic life. Subsequently, birds, humans and other animals may be poisoned if they eat infected fish.

Petroleum is another form of chemical pollutant that usually contaminates water through oil spills when a ship ruptures. Oil spills usually have only a localized affect on wildlife but can spread for miles. The oil can cause the death of many fish and stick to the feathers of seabirds causing them to lose the ability to fly.

Among the by-products of production widespread is an earth-flax, formaldehyde, methyl and ethyl alcohols, acetone, phenol, ac.a.. Earth-flax can cause such illnesses, as bronchial carcinoma. The small quantity of breathing formaldehyde irritates respiratory tracts. And huge quantity of breathing can cause death. The degenerative defeats of liver, buds, heart and cerebrum develop under action of formaldehyde.

Methyl alcohol strikes the retina of eye and visual nerve, and sometimes results in incurable blindness. Methanol violates acid – basic equilibrium in cages and tissues; it can lead to death as a result of stop of collapse breathing, brain and lungs edema.

A waterless ac.a. affects blood and kidneys, contacting with skin it causes burns; inhaling of ac.a. vapors irritates mucus hair of respiratory tracts, causing bronchitis etc.

In addition, chemical and petrochemical is characterized by emissions of metallic mercury, that makes about half of total volume of emissions of Ukraine industry, as well as vanadium oxide, which belongs to the I class of dangerous compounds.

Despite the fact that 90 % of all emissions are cleared up[3], chemical industry harms the environment, including man. That is why it is necessary to develop methods to reduce chemical complex influence on living organisms.

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ECOLOGICAL ADVANTAGES AND DISADVANTAGES OF USING WIND ENERGY

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Summary: The article looks at the problem of negative and positive influence of wind generators on environment. It is set, that wind generators do not use fossil fuels to produce energy so they do not create pollutants. But they mainly influence on environment through noise pollution.

Keywords: wind energy, wind generator, influence on environment.

Анотація: У статті описується негативний і позитивний вплив вітроенергетичних установок на навколишнє середовище. Встановлено, що вітроенергетичні установки не використовують паливних ресурсів для виготовлення енергії, а отже вони не створюють забруднюючих речовин. Але вони впливають на навколишнє середовище переважно через шумове забруднення.

Ключові слова: вітрова енергія, вітроенергетична установка, вплив на довкілля.

Анотация: В статье описывается негативное и позитивное влияние ветроэнергетических установок на окружающую среду. Установлено, что ветроэнергетические установки не используют топливных ресурсов для добычи энергии, а значит и не создают загрязняющих веществ. Но они оказывают влияние на окружающую среду преимущественно через шумовое загрязнение.

Ключевые слова: ветровая энергия, ветроэнергетическая установка, влияние на окружающую среду.

The growing interest to the problems connected with the use of renewable energy increases due to the unprecedented scale of fossil fuel consumption.

Currently, most people around the world understand that reserves of fossil fuels are being depleted and they are used huge quantities of it which leads to environmental pollution. Emission of carbon dioxide leads to global warming. Allocation of sulfur dioxide causes acid rains.

The use of renewable energy is the most attractive, while it does not break the natural balance of received energy of our planet. If humans continue to pollute the Earth's atmosphere at the same rate, it can lead to dramatic climate change, to the

melting of polar sea ice and as a result to the rising of ocean level. All this can lead to the destruction of animal habitat and threaten the existence of mankind.

So, what is renewable energy? It is energy which comes from natural resources such as sunlight, wind, and geothermal heat, which are renewable [3].

The advantages of renewable energy are that it is sustainable (nondepletable), ubiquitous (found everywhere across the world in contrast to fossil fuels and minerals), and essentially nonpolluting. Wind turbines and photovoltaics (PV) do not use water and fossil fuels and minerals in the production of electricity, which is another major advantage in dry areas of the world, or in areas which are poor in fossil fuels and minerals. This is in contrast to thermal electric plants, including nuclear power, which use large quantities of water and fossil fuels and minerals [2].

The disadvantages of renewable energy are low density and variability which results in higher initial cost because of the need for large areas and storage or backup power. For different forms of renewable energy there are other disadvantages or perceived problems such as visual pollution, odor from biomass, birds and bats on wind farms, and brine from geothermal sources. In addition, wherever a large facility is to be located, there will be perceived and real problems to the local people. For conventional power plants using fossil fuels, for power plants using nuclear energy, and even for renewable energy, there is the problem of not in my backyard. In the United States there is considerable opposition to a wind farm offshore of Cape Cod, and there are areas off limits for drilling for oil and natural gas, such as the coasts of Florida. We also notice the infrastructure problems associated with transmission lines for electricity and pipelines for oil and gas [2].

This is the general overview of advantages and disadvantages of renewable energy. The next step is to review the positive and negative influence of wind turbines on the environment.

To begin with, wind turbines produce no carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen dioxide, mercury, radioactive wastes, particulates, or any other type of air pollutants and other hazardous wastes, unlike fossil fuel power sources. According to the experts of the United Kingdom, 100-kW wind turbine eliminates the emission of 1 ton of hydrogen sulfide H_2S , 167 tons of carbon dioxide CO_2 and a significant amount of dust [1]. In general, the already existing wind farms on the territory of the European Union ($P = 4425$ MW) can prevent emission of 7.8 million tons of CO_2 , 26000 tons of SO_2 and 22500 tons of NO_x per year [1].

Moreover, wind generators do not use fossil fuels and minerals to produce energy that allows saving them. This is especially important, as fossil fuels and minerals are being depleted.

But wind turbines have also negative effects on environment.

Among the disadvantages of wind power stations is need for large areas. About 8-10 hectares are required per 1 MW of installed capacity. Actually the foundations for roads and directly for wind turbines occupy only 2% of this area and the other 98% could still be used for farming [1].

Wind farms are often built on land that has already been impacted by land clearing. The vegetation clearing and ground disturbance required for wind farms is minimal compared with coal mines and coal-fired power stations. If wind farms are decommissioned, the landscape can be returned to its previous condition.

The land can still be used for farming and cattle grazing. Livestock are unaffected by the presence of wind farms. International experience shows that livestock will "graze right up to the base of wind turbines and often use them as rubbing posts or for shade".

The land problem simplifies when placing wind farms on the water areas. In this case significant areas of economic use are not excluded. Moreover, offshore windmills give some "protection" to marine life because territories which are allocated for wind farms are least exposed to unauthorized fishing and pollution from large passing ships.

Another disadvantage is noise pollution from a windmill. Windmills produce mechanical noise (from the work of mechanical and electrical components) and the aerodynamic noise (from the interaction of wind blades installation). The latter may be low frequency (less than 16-20 Hz) and high (from 20 Hz to several kHz). Noise effects in close proximity to wind farms, depending on its capacity can reach 50-80 dBs. Effect of acoustic radiation mainly affects fauna. They do not die, but go away from the wind turbine. Also noise affects birds, knocking them out of their way and they may leave their habitat because of nearness of windmills proximity.

Wind farms may affect weather in their immediate vicinity. Spinning wind turbine rotors generate a lot of turbulence in their wakes like the wake of a boat. This turbulence increases vertical mixing of heat and water vapor that affects the meteorological conditions downwind. Overall, wind farms lead to warming at night and cooling during the day time. This effect can be reduced by using more efficient rotors or placing wind farms in regions with high natural turbulence [3].

A number of studies have used climate models to study the effect of extremely large wind farms. One study reports simulations that show detectable changes in global climate for very high wind farm usage, on the order of 10% of the world's land area. Wind power has a negligible effect on global mean surface temperature, and it would deliver "enormous global benefits by reducing emissions of CO₂ and air pollutants". Another study published in Atmospheric Chemistry and Physics suggested that using wind turbines to meet 10 percent of global energy demand in 2100 could actually have a warming effect, causing temperatures to rise by 1 °C in the regions on land where the wind farms are installed, including a smaller increase in areas beyond those regions. This is due to the effect of wind turbines on both horizontal and vertical atmospheric circulation. Whilst turbines installed in water would have a cooling effect, the net impact on global surface temperatures would be an increase of 0.15°C [3].

There is an assumption that the screening effect of wind farms in the way of natural air flow will be negligible and can be ignored. This is because the wind turbine uses a small ground-level layer of moving air masses (about 100-150 m) and moreover, no more than 50% of their kinetic energy. However, strong wind farms may have an impact on the environment: for example, reduce the air ventilation in the placement of the wind park that may cause changes in the climate of this region. The screening effect of the wind park can be the equivalent of the hill of the same area and height of about 100-150 m.

A study estimates that wind farms are responsible for 0.3 to 0.4 birds fatalities per gigawatt-hour (GW/h) of electricity while fossil-fueled power stations

are responsible for about 5.2 fatalities per GW/h. The study therefore states that fossil fuel based electricity causes about 10 times more fatalities than wind farm based electricity, primarily due to habitat alteration from pollution and mountain-top removal for coal mining. In Denmark, where wind turbines generate 9% of electricity, wind turbines kill about 30,000 birds per year. In comparison, 80,000 birds are killed by aircraft, 1 million are killed by cars, and 500 million killed by cats every year. Even greater numbers of bird deaths are attributed to collisions with buildings. An article in Nature stated that each wind turbine kills an average of 4.27 birds per year [3].

Some paths of bird migration, particularly for birds that fly by night, are unknown. A study suggests that migrating birds may avoid the large turbines, at least in the low-wind non-twilight conditions. Because turbines have 3 blades in general, which move with speed 10 - 30 turn /min., birds can easily pass through the blades without harm.

So, wind power consumes no fuel, and emits no air pollution, unlike fossil fuel power sources. The energy consumed to manufacture and transport the materials used to build a wind power plant is equal to the new energy produced by the plant within a few months. While a wind farm may cover a large area of land, many land uses such as agriculture are compatible, with only small areas of turbine foundations and infrastructure made unavailable for use.

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УДК 543.26:640.522 (477.54)

AIR POLLUTIONS IN AREAS OF MEDICAL ESTABLISHMENTS IN INDUSTRIALIZED CITIES

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Language advisor: Cherkashina N.I.

Summary: The article contains the research results of heavy metals content in atmospheric air on the territory of medical establishments in Kharkiv (in 2010 and 2011) and compares the received data with average daily maximum allowable concentration.

Key words: atmospheric air, heavy metals, average daily MPC.

Аннотация: В публикации приведены результаты исследования содержания тяжёлых металлов в атмосферном воздухе территорий медицинских учреждений г. Харькова за летние периоды 2010, 2011 года и сравнение полученных данных с предельно допустимыми концентрациями.

Ключевые слова: атмосферный воздух, тяжёлые металлы, среднесуточная ПДК.

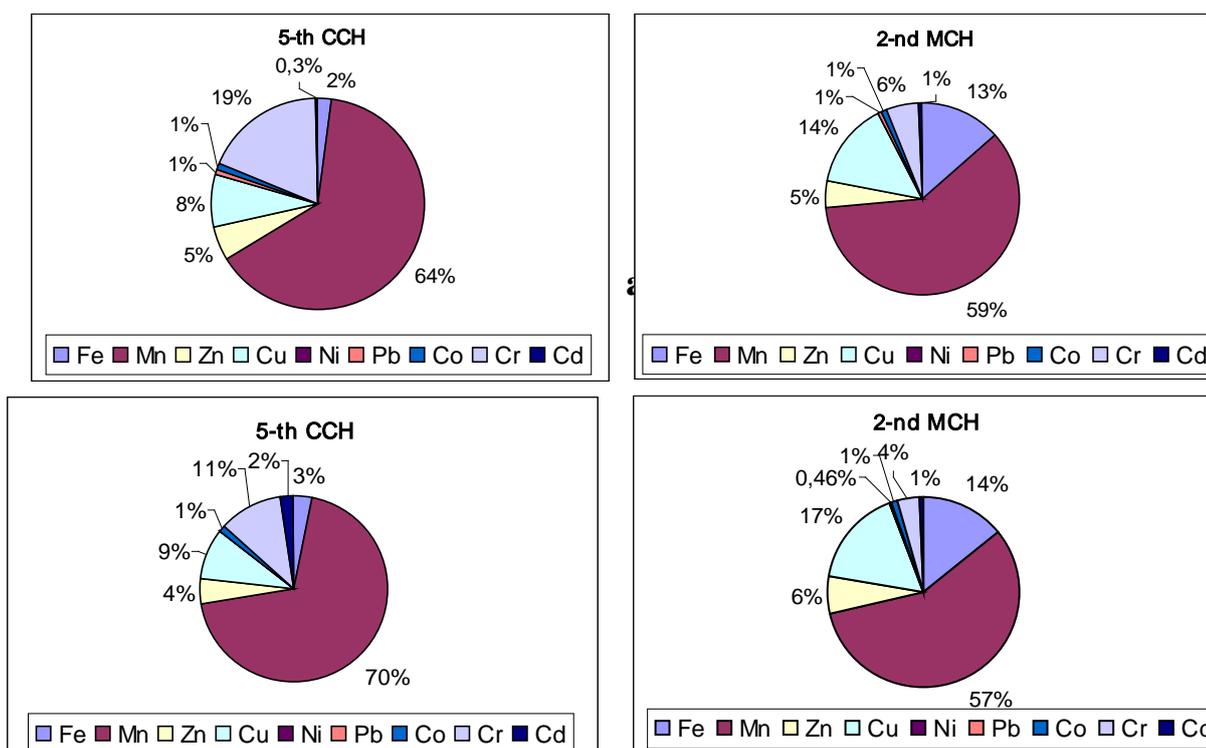
Анотація: У публікації наведено результати досліджень вмісту важких металів у атмосферному повітрі територій медичних закладів м. Харкова за літні періоди 2010, 2011 рр. та порівняння отриманих даних з гранично допустимими концентраціями.

Ключові слова: атмосферне повітря, важкі метали, середньодобова ГДК.

Air pollution is one of the most significant ecological problems in big cities. Emissions from industry and transport are coming into the atmosphere in the form of gases and particulate pollutants. The deleterious effect of these contaminants is the higher, the more sources of air pollution are in the city and the more toxic emissions are. The danger from particulate pollutants is increasing by its ability to absorb harmful gases and other substances including heavy metals. Heavy metals are exceptionally detrimental to human health. They can cause general intoxication, disturbances in nervous, digestive, endocrine and cardiovascular systems' functioning and cancer.

Premises problems exist in Kharkiv city as it is an important industrial and transport centre. In this connection, arises the necessity both to investigation air pollution in Kharkiv, and searching the ways of its decreasing.

Territories of two social infrastructure establishments were chosen for our investigation: 5-th central clinical hospital (CCH) in Dzerszhinskiy district and 2-nd municipal clinical hospital (MCH) in Ordzhonikidze district. These establishments have different environmental conditions: CCH №5 is located near a forest park and MCH №2 is located in an industrial area (with such enterprises as "Turboatom", "KEMP" – Kharkiv electro-mechanical plant and heavy transport load). Samples of atmospheric air have been taken by aspirating method in 2 periods (in 2010 and 2011), which contained 2 stages (in June and August). The samples were analyzed for presence of heavy metals (Fe, Mn, Zn, Cu, Ni, Pb, Co, Cr, Cd) by atomic absorption spectrometric method.



b)

Fig. 1. Heavy metals content ratio in samples of atmospheric air taken in 2010: a) – first stage (June); b) – second stage (August)

The results of the first period (2010) showed the absence of Ni in samples of both stages. Dominating elements in association were "Mn (64-70%) – Cr (11-19%) – Cu (8-9%)" in samples from 5-th CCH area and "Mn (57-59%) – Cu (14-17%) – Fe (13-14%)" in samples from 2-nd MCH area (Fig.1). Total content of heavy metals in samples of atmospheric air from 2-nd MCH area was 2,53 times higher than from 5-th CCH area by results of the first sampling stage and 2,42 times higher by results of the second sampling stage. Content of each of the investigated heavy metals in air samples from 5-th CCH area was higher than in air samples from 2-nd MCH area. The difference in samples of first stage varied between 2 times (Mn, Co) and 10 times (Fe), the variation was between 2 (Pb) and 15,3 (Fe) times in samples of the second stage.

During the summer 2010 heavy metals content in air rose 1,5 times both in 5-th CCH area and 2-nd MCH area. The average daily maximum permissible concentration was 3 times exceeded by Mn in samples from 2-nd MCH area and 1,3 times – in samples from 5-th CCH area.

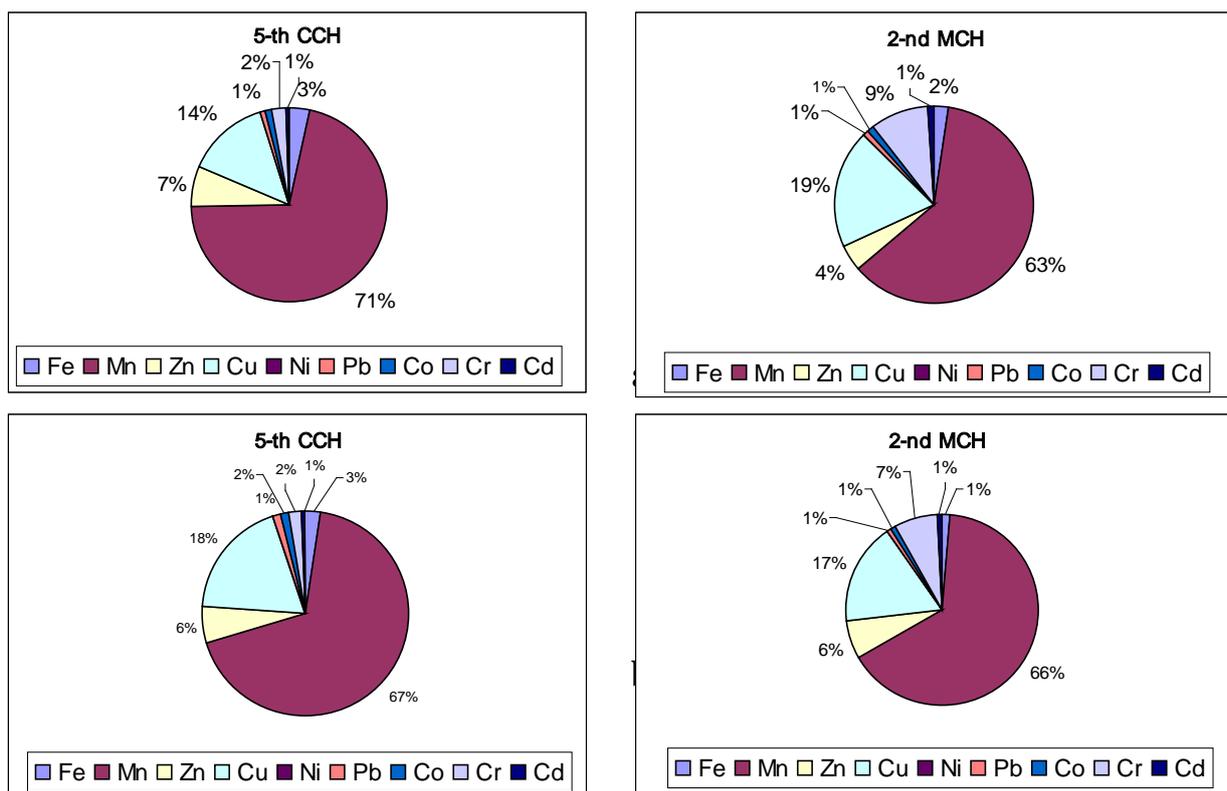


Fig. 2. Heavy metals content ratio in samples of atmosphere air taken in 2011: a) – first stage (June); b) – second stage (August)

According to data of 2011 dominating elements in association were changed to "Mn (67-71%) – Cu (14-18%) – Zn (6-7%)" in samples from 5-th CCH area and "Mn (57-59%) – Cu (17-19%) – Cr (7-9%)" in samples from 2-nd MCH area (Fig.2). Also absence of Ni in samples of both stages of sampling was repeatedly registered.

The results of the 2-nd stage of sampling showed that the heavy metals content in air has 1,24 times decreased in 5-th CCH area and 1,1 times increased in 2-nd MCH area. Average daily maximum permissible concentration exceeded by Mn was repeatedly detected. It came to average 1,3 times in samples from 5-th CCH area and 3 times in samples from 2-nd CCH.

Comparing the results of heavy metals content in 2010 and in 2011 we have noticed that atmospheric air from 2-nd MCH contained 5% more heavy metals and atmospheric air from 5-th CCH contained 6% more heavy metals in 2011.

Thus, the harmful influence of Mn in areas of Kharkiv hospitals has been detected. This fact requires further observation detecting of Mn sources incoming into the atmospheric air of the investigated establishments' areas.

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ENERGY-EFFICIENT CARS AS ONE OF THE WAYS OF ENVIRONMENTAL PROTECTION

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Summary: Energy-efficient cars as one of environmental protection ways are considered in the present paper. The ways of environmental protection are described as the main factor to be considered nowadays.

Key words: Energy-efficient cars, environmental protection.

Анотація: В статті розглядаються економні автомобілі як один з шляхів захисту навколишнього середовища. Шляхи захисту навколишнього середовища досліджені як головний фактор сьогодення.

Ключові слова: економні автомобілі, захист навколишнього середовища.

Аннотация: В статье рассматриваются энергосберегающие автомобили как один из путей защиты окружающей среды. Пути защиты окружающей среды исследованы как главный фактор в наше время.

Ключевые слова: экономные автомобили, защита окружающей среды.

Social and economic development of mankind, scientific and technical progress in the second half of the twentieth century were and continue to be accompanied at the beginning of the third millennium by various negative consequences, one of the most significant of which is the depletion of natural resources. According to some data non-renewable natural resources will deplete in 50-100 years. Another negative factor of the scientific and technological progress is the environmental pollution. The main sources of environmental pollution are emissions of power plants, furnaces, metallurgical works, industrial and municipal sewage, burning municipal solid wastes and many others [2, p. 84].

One of the major air, water and soil pollutants is transport. Although it has brought a lot of benefits to mankind in various spheres of our life, it has also caused many problems. Degradation and destruction of ecosystems under the influence of traffic pollution, particularly intense in urban areas take place, the problem of waste recycling generated during vehicles operation and their utilization at the end of service life, the level of transport noise impact also increase. However the main problem caused by transport is depletion of natural resources, primarily natural fuels which include gas, oil and coal. In addition transport is the main pollutant of air, water and soil.

ICE exhaust gases contain about 200 components. The period of their existence lasts from several minutes up to 4-5 years. According to the chemical composition and properties, as well as the character of their influence on human health they are divided into several groups. The first group includes non-toxic substances: nitrogen, oxygen, hydrogen, water vapor, carbon dioxide and other natural components of the air. The second group includes only one substance – carbon monoxide which can poison drivers when they sleep in the cab with the engine running or warming up the engine in a closed garage. The third group consists of nitrogen oxides, mainly NO – nitric oxide and NO₂ – nitrogen dioxide. When the concentration of nitrogen oxides is too high their can appear asthmatic manifestations and pulmonary edema [3, p. 24].

The fourth group includes a variety of hydrocarbons which affect the human cardiovascular system. The fifth group consists of aldehydes. The sixth group includes soot and other dispersed particles (products of the engine wear, sprays, oils, soot, etc.) that can irritate the respiratory tract.

The seventh group consists of the sulfur compounds – inorganic gases such as sulfur dioxide, hydrogen sulfide which appear in the composition in the engine exhaust gas if you are using fuel with high sulfur content. Sulphur compounds irritate mucous membranes in the throat, nose and eyes.

The eighth group includes lead and its compounds.

Lead accumulation on the roadside leads to the pollution of ecosystems and makes the surrounding soil unsuitable for agricultural use. Adding to the gasoline R-9 additive makes it very high-toxic.

There are several ways to solve the problem of environmental pollution caused by road transport: tactical (or short-term), which involves strict control over the level of exhaust gases at least in cities where their concentration is the highest, strategic – involving transfer to ecologically friendly fuels (vegetable oil, hydrogen,

and others), production and installing car engines with a new construction. It can lower harmful emissions of the same fuel [1, p. 55].

Another way out is new generation vehicles development and introduction into exploitation. One of them is the use of energy efficient vehicles, such, for example, as "Hadi, 34", which was developed and is being worked at in the High-speed Automobiles Laboratory (HAL) of KhNAHU. The oil company Shell got interested in this problem and decided to hold the competition in fuel economy, the so-called "economic run". The purpose of this competition was to inspire young designers and engineers worldwide to develop new approaches to stable mobility, namely the development of cars that could run the longest distance using a minimum amount of fuel. For the first time such competitions were held in 1939, and since then they are conducted annually. In 1969, the British subsidiary of Shell initiated a "Super Shell marathon" in which the cars of any construction with at least three wheels and which can reach a set speed at the distance can take part. These innovations were noticed by amateur constructors among pupils, students of technical schools and students. In 1977 youth teams already became serious competitors to the teams representing motor, motorcycle and bicycle companies. For the last few years the European stage of the competition has taken place on the sports track of Nogaro, France.

As part of scientific and research activities in Kharkiv National Automobile and Highway University (KhNAHU) the High-speed Automobiles Laboratory (HAL), which provides opportunities for young people to self-realize, get professional knowledge and skills has been working for over 50 years. The Students Design Bureau (SDB) operating within the laboratory, is the author of 34 projects of record-racing and racing cars. The cars with "Hadi" brand are well known not only to professionals but to numerous fans. These unique automobiles have set up 42 speed records, 16 of which exceed the world's achievements. On the basis of the laboratory a sports team "LSA Hadi," which since 1992 has been a participant of Ukrainian championships in motor circuit races, in E8 class. The highway-circular team is the most titled team of the Ukrainian championship. More than ten times it has become the winner of the Ukrainian championship and in 1996, 2003 and 2005 – the champion of the country. "LSA Hadi" consists mainly of students. Moreover, it is the only team that not only exploits existing models of racing cars but also creates its own ones.

In 2007 Eco-marathon became a great event in the life of a small gascon town Nogaro near which there is a race circuit rented by Shell for a few days. The students and specialists from all spheres work at the creation of a special car in KhNAHU. Economists develop the budget of the team, seek sponsors, the specialists of humanitarian disciplines write about the process of automobiles creation in press, technicians are engaged in constructing the car itself. Sponsors are, as a rule, the companies with international capital, bearing in mind the enormous informational support of «Shell Eco-marathon». Taking into account the worldwide popularity, the staff professionalism and innovative ideas used in practice, the representative office of "Shell Exploration and Production" in Ukraine and the Ministry of Environmental Protection of Ukraine invited the students and specialists of KhNAHU to take part in the creation of the first Ukrainian team to participate in «Shell Eco-marathon». With

this aim, the representative of SDB was invited to the European competition of the most fuel-efficient cars. It is held on the sports track of Nogaro, France. Taking into account the experience gained in this way, the team decided to participate in a conceptual class, in a subgroup using the internal combustion engine. Working at the design of a future car finished when the team got a financial possibility to implement the most successful of the variants.

The first proposed variant of the car had a space frame as a bearing system. There were three wheels: one in the front and two – at the back. The engine and the transmission were behind the cockpit in the rear part of the car. Then there was the research in aerodynamics with the aim to find the optimum shape of the car fairings, ensuring minimal air drag. In order to reduce the weight, at this stage of development it was decided to use a monocoque made of composite materials as a bearing system. In May, 2010, the team including the students and the staff of KhNAHU "Hadi LSA-Honda» became the first team in the CIS which was a participant of the prestigious educational, international competition «Shell Eco-marathon» having developed a special car («Hadi 34») for the fuel economy competition. According to the results of the competition, the car created by Kharkiv team demonstrated the ability to overcome 570 km with one liter of gasoline. The achieved result is recorded in the book of records of Ukraine. The activities of the team were actively discussed by leading European and more than one hundred national media and it is only for the first two months after the presentation of the project. In 2011, despite the tightening conditions of the competition, the only Ukrainian team was able to improve its result. The distance increased to 575 km. For this achievement it was listed in the Ukrainian Book of Records as the most energy efficient. In fact, this car is very light. It weighs only 41kg. The height of the vehicle is 700mm, its width is 1000mm and the length is 3500mm. The base of the car is 1530mm. Transmission efficiency is 0.97%. The coefficient of air resistance is equal to 0.97%. The coefficient of swinging resistance is 0.00618. The maximum value of the total road resistance is 0.032. In the "Hadi-34" there is a 4-stroke gasoline engine with air-cooling of HondaGX35 model, eight step gliding transmissions. ICE power is 1.2 kW at 7000 min⁻¹. The maximum speed is 60 km/h.

The analogues of "Hadi, 34" have all chances to replace the modern automobiles in several decades. Thereby they will greatly reduce emissions of harmful substances into the atmosphere and stop the depletion of natural resources. The problem of the environmental pollution is very urgent nowadays. It concerns every person living on the Earth. Each of us should think about it and try to do everything to preserve our natural environment.

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SYNERGETIC VEHICLE WITH DIFFERENT TYPES OF ELECTRIC DRIVE

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Summary: Synergetic vehicle as an alternative to the traditional vehicles is considered in the present paper. The necessary calculations for the construction of such a model are given.

Key words: synergetic vehicle, an alternative, a traditional vehicle.

Анотація: Синергетичний автомобіль як альтернатива традиційному автомобілю розглядається в наступній статті. Подані необхідні обчислення для конструкції такої моделі.

Ключові слова: синергетичний автомобіль, альтернатива, традиційний автомобіль.

Аннотация: Синергетический автомобиль как альтернатива традиционному рассматривается в данной статье. Предоставлены необходимые вычисления для конструкции такой модели.

Ключевые слова: синергетический автомобиль, альтернатива, традиционный автомобиль.

Exhaustion of natural energy resources and global environment pollution are caused by permanent growth of automobiles quantity. That makes a problem of creating ecologically a safe vehicle with minimal energy consumption very urgent. Combined power unit that includes the internal combustion engine (ICE) and the traction motor is the most promising alternative [1].

The automobiles, which are driven using ICE, don't fit modern requirements of ecological safety and fuel economy standards. An alternative to the traditional vehicles with ICE are production models of automobiles with the hybrid power unit. The first production model and the most large-scaled hybrid vehicle is Toyota Prius [1, 2].

The main objective of the present paper is increasing economic efficiency of hybrid vehicles. Research tasks are building a model of a synergetic automobile, simulation of the brushless DC electric motor, induction motor and a DC motor in Simulink software, comparative analysis of automobile with different types of electric drive.

The first step to create virtual model of automobile is construction of a model of a free-piston engine. To build external speed characteristic the Layderman's empiric formula has been used:

$$N_e = N_{e\max} \left[A_1 \frac{n}{n_N} + A_2 \left(\frac{n}{n_N} \right)^2 - \left(\frac{n}{n_N} \right)^3 \right] \quad (1)$$

where N is current value of engine power, kW,

n – corresponding shaft rotating frequency at maximum power level, rpm,

n_N – shaft rotating frequency at maximum power level, rpm,

$N_{e\max}$ – maximal engine power, kW,

A_1, A_2 – empirical coefficients that describes an engine type.

When N_e value for n values have been calculated, the model calculates an appropriate value of engine torque M_e

$$M_e = 9550 \frac{N_e}{n} \quad (2)$$

Then we have to calculate traction on the drive wheels:

$$P_k = \frac{M_e u_k \eta}{r_d} \quad (3)$$

where u_k is a transmission ratio;

η – is transmission efficiency;

r_d – dynamic radius of the wheel, which is equal to r_{cr} at standard conditions.

On the next stage we have to consider the total resistance force of a road, which is calculated by the following formula:

$$P_\psi = \psi G \quad (4)$$

where $G = gm$ – full weight of the automobile, N;

$g = 9,81 \text{ m/s}^2$ – acceleration of free fall

The influence of moving speed on the coefficient of rolling resistance is not considered in computations.

Also we need to consider the force of air resistance, which can be calculated by the following formula:

$$P_w = \frac{kFv^2}{3,6^2} \quad (5)$$

where k is the coefficient of air resistance;

F is a frontal area of an automobile, m^2 ;

v is a speed of an automobile, km/h.

The frontal area of a vehicle can be calculated using drawing of an automobile. In the absence of it, we can get its approximate value by the following formula:

$$F = \alpha B_r H_r \quad (6)$$

where α is an area filling factor.

B_r is width of a vehicle, m;

H_r is height of a vehicle, m.

Dynamic factor of the vehicle can be calculated by the following formula:

$$D = \frac{P_k - P_w}{G} \quad (7)$$

Using formula (9) we calculate the resistance of the road, which a vehicle can overcome :

$$\Psi_{\max} = D_{\max} \quad (8)$$

$$i_{\max i} = (\Psi_{\max i} - f) \cdot 100\%$$

where $i_{\max i}$ is maximal slope of the road;
 f is rolling resistance.

So now we can calculate “Slope” – maximum slope of the road, which an automobile can overcome.

To calculate the acceleration j according to D values, we shall use the following formula:

$$j = (D - \psi) \frac{g}{\delta} \quad (9)$$

where $\delta = 1,04 + 0,04u_k$ is the coefficient to consider mass inertia.

We need to calculate vehicle speed. For this purpose we have to use the following formula [3, 4]:

$$v = 0,377 \frac{r_{\kappa} n}{u_k} \quad (10)$$

We simulate general blocks. The system that we have constructed is called “Automobile”. The present model considers the traction on the drive wheels, the force of the air resistance and a force of the total road resistance. The model calculates maximal slope of the road, which an automobile can overcome, its maximum speed and acceleration time from 0 kmph to 100 kmph. We have performed simulating of the brushless DC electric motor, the induction motor, the DC motor. Created systems have been named “VED”, “AD”, “DPT”. We have constructed Simulink-model of the synergetic automobile. Then we have connected them to “automobile” using Multiport Switch.

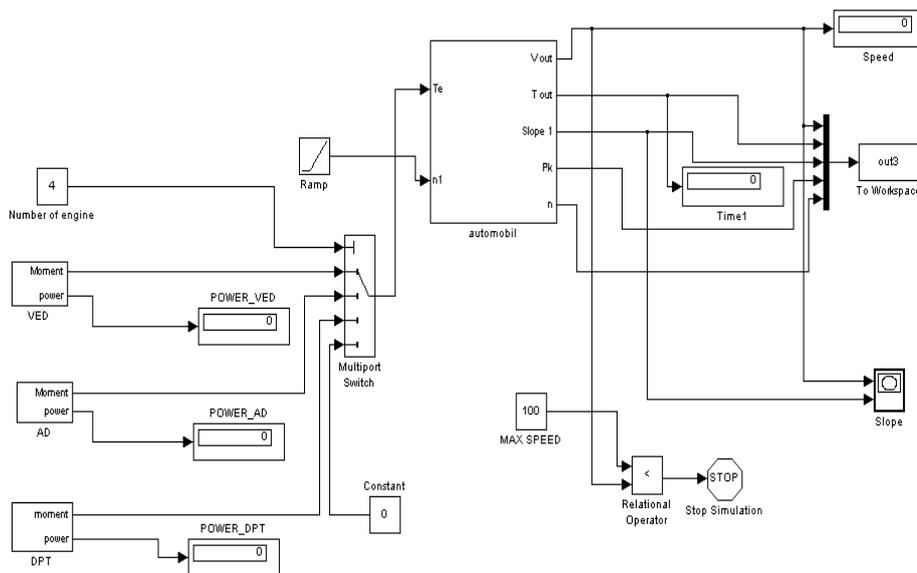


Fig. 1 – Simulink-model of the synergetic automobile

Simulating results are shown in Fig. 2.

With this model we have received the following data: Time acceleration, Traction on the wheels, Slope, Max speed.

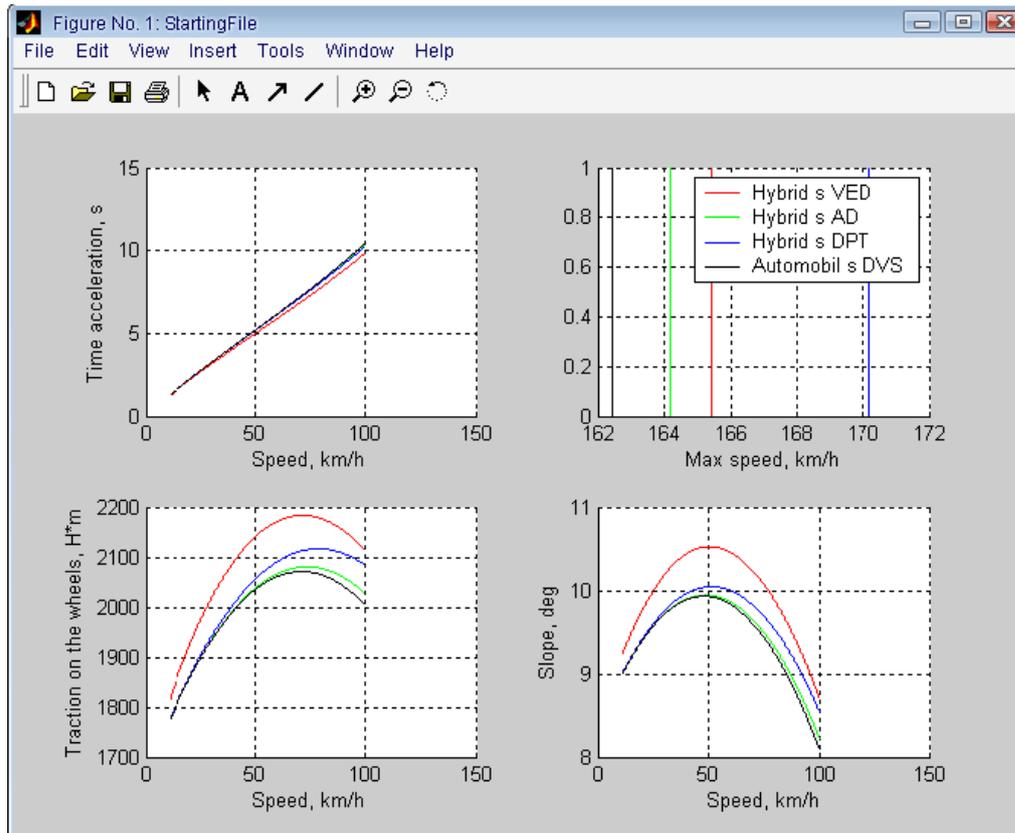


Fig.2 – Simulating results

Acceleration time from 0 km/h to 100 km/h using electric the brushless DC electric motor is performed for 9,8 sec, which is at least 1 sec greater than the acceleration time of two other electric motor. This is due to brushless DC electric motor has greater overload capability by torque and wide range of speed management and high efficiency. The main advantage of brushless DC electric motor is its ability to change armature vector according to rpm. So the efficiency of brushless DC electric motor is permanently maximal. But the situation is not so promising when we talk about the dependence of efficiency on rotary rotations per minute of other two electric machines. Brushless DC electric motor has another important advantage is high reliability index of the power set and its small size.

During the simulating process of the synergetic automobile with different types of the electric drive and performing comparative analysis we have reached the conclusion that the most promising electric engine to use on the automobile with hybrid power unit is brushless DC electric motor.

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EFFECTS OF PESTICIDES ON ENVIRONMENT AND LIVING ORGANISMS

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Summary: The relevance of this work is in expansion of plants protection by chemical methods, increased demand in chemicals which is explained by intensification of agriculture as well as urgent need to describe and solve the problems of negative ecological influence of pesticides on environment, quality of animal and plant products and consequently the impact on human health.

The object of research is the impact of pesticides on the ecosystem components: the biotic and abiotic side.

The aim is to identify the main problems arising with the use of pesticides.

Key words: pesticides, toxicity, metabolites, bioconcentration.

Анотація: Актуальність даної роботи полягає у розширенні сфери застосування хімічних засобів захисту рослин, збільшення потреб у даних хімічних препаратах, та викликаній нагальній потребі опису та вирішення проблем негативного екологічного впливу пестицидів на навколишнє середовище, якість тваринної та рослинної продукції, і, як наслідок, вплив на здоров'я людини.

Об'єктом дослідження роботи є вплив використання пестицидів на складові екосистеми: на біотичну та абіотичну сторони.

Мета роботи є визначення основних екологічних проблем, що виникають при застосуванні пестицидів.

Ключові слова: пестициди, токсичність, метаболіти, біоконцентрація.

Аннотация: Актуальность данной работы заключается в расширении сферы применения химических средств защиты растений, увеличение потребностей в данных химических препаратах, и вызванной настоящей необходимостью описания и решения проблем негативного экологического воздействия пестицидов на окружающую среду, качество животной и растительной продукции, и, как следствие, влияние на здоровье человека.

Объектом исследования работы является влияние использования пестицидов на составляющие экосистемы: на биотические и абитотические стороны.

Цель работы является определение основных экологических проблем, возникающих при применении пестицидов.

Ключевые слова: пестициды, токсичность, метаболиты, биоконцентрация.

Pesticides are chemicals widely used as an effective means of combating pests and plant diseases as well as means of protecting animals from ectoparasites.

By way of getting into the body, pesticides are divided into intestinal, contact and fumigation.

The degree of pesticide toxicity is estimated by lethal dose (LD50) or concentration (LK50) that causes the death of half of the test animals at one time of the pesticide in the living organism.

According to LD50 value pesticides are divided into poisonous substances, for which the LD50 value is less than 50 mg / kg of live weight, highly toxic drugs - for which LD50 is 50-200 mg / kg of live weight, medium poisonous - which LD50 is 200-1000 mg/ kg and low toxic drugs - for which LD50 is 1000 mg / kg live weight [3].

Rate of metabolism of pesticides for different classes of chemicals are different and, on this basis, pesticides are divided into very stable (during the metabolism of non-toxic components of more than 2 years), stable (during the metabolism of 6 months to 2 years), moderately resistant (the period of metabolism 1-6 months) and low resistant (during the metabolism of less than 1 month) [4].

Forbidden for use and unsuitable pesticides constitute a separate class of highly toxic waste that can be divided into three groups:

1. Prohibited for use.
2. Unusable (expired shelf life, warranty periods).
3. Pesticides of unknown composition (it is impossible to determine the primary structure and assignment) [1].

Under the influence of oxygen, light, wind, temperature, moisture, soil type and condition pesticides can be transported for long distances and accumulate in animals and humans. Decomposition of pesticides in the environment leads to new chemical compounds formed with different chemical and biological properties. In most cases, these substances are more toxic and persistent in comparison with the original pesticides.

Pesticides get into the atmosphere by falling directly onto crops, and as a result of evaporation from the soil surface and plants. In the most cases significant quantities chemical substances enter the air by aviation method. It is estimated that 98% of insecticides, 60-95% herbicides do not reach suppressed objects, and fall into the water and get into the air [3].

Mass of Earth's atmosphere is about $5.3 * 10^{15}$ ton, if the atmosphere gets 1 million tons of pesticides, their concentration in air is 0.0002 mg/m^3 . But the chemicals that get into the atmosphere do not remain there permanently. Part of them enter the hydrosphere and soil, exposed parts of photochemical decay, hydrolysis. The compounds of mercury, arsenic, lead, cadmium and some other elements cannot be converted into nontoxic compounds, thereby increasing their concentration in the hydrosphere, soil and food chains [4].

Pesticides can fall into water from the atmosphere, soil, as byproducts of living organisms and the direct use of water bodies.

Negative impact of pesticides significantly increases the fact that water bodies have already been polluted by sewage, which leads to the deficiency of oxygen. Pesticides which are carried into the sea by rivers, are dissolved in petroleum products, which pollute sea water and inhibit photosynthesis of marine plankton (within 95%) which leads to a decrease in primary production plankton inhibition of occurs at concentrations of $10^{-3} \text{ mg / liter}$ the substance. The concentration of pesticides in organs and tissues of aquatic organisms depends on the concentration of the substance in water [3].

Herbicides are inhibitors of photosynthesis primarily violate processes of phototrophic carbon assimilation and formation of biogenic oxygen. Under prolonged

exposure to these two important hydrochemical processes the aquatic system can turn into a photosynthetic anaerobic one.

There are several forms of pesticide toxicity influence on aquatic organisms:

1. Direct effects of poisoning.
2. Refresh- the death of animals from deficiency of oxygen.
3. Slow chronic poisoning.
4. Effects on reproductive ability of living organisms.

Pesticide contamination of soil occurs as the direct contact and through the plants and animals persistent organochlorine drugs which accumulate in soft tissues and fruit trees with fallen leaves. But this part of pesticides with respect to that applied to plants is much smaller because pesticide metabolite in the tree. It should be noted that reducing the content of substances such as arsenic compounds, is only due to removal of their plants.

The amount of pesticides that move together with surface runoff is about 5% of the total number submitted [4].

In many unsystematic use the same pesticides gave uneven distribution of soil microflora and partial destruction of certain areas. Also it should be noted the negative impact of pesticides on bubble bacteria that leads to a reduction in natural nitrogen fixation, nitrogen cycling violation and the accumulation of harmful nitrogen compounds.

One of the most dangerous pesticide property is of their high biological activity and ability to be transported in food chains. If you build a chain of increasing concentrations of residual pesticides in the body of vertebrate animals, it will have the following form: herbivorous - omnivores - predators.

Application of even small doses of organochlorine insecticides causes thinning and increased fragile shell eggs with subsequent decrease in the number of chicks birds of prey [2].

Among the diseases that may be due to pesticides toxicant human body, malignant tumors (mainly liver tumors), chromosomal abnormalities, increasing the intensity of mutation process are observed which is associated with increased prevalence of inherited diseases of metabolism, abnormalities of development etc.

More than half of pesticides belongs to mutagens. Pesticides adversely affect human reproductive function. Contact of pregnant women with pesticides several times increases the risk of infant leukemia, cancer and other diseases of internal organs [1].

Much of the pesticide gets into the human body through food. A number of dangerous to the safest food according to pesticides content is as follows:

1. Fish is the most dangerous.
2. Fruit and vegetables (green peas, pears, apple juice, blackberries and green onions).
3. Cereals.
4. Milk, meat, dairy products, eggs [2].

Crucial to improving the safety of pesticide formulations: are suspension, suspension or waterdispersive dry granules, microcapsules.

An important way to solve this problem is to implement alternative methods of farming: biological, organic, ecological farming, use of biological crop protection

(use of entomophagous, phytophagous, pathogenic microorganisms, cultivation of resistant crop, pests' sterilization).

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УДК 332

LAND REFORM IN UKRAINE. ITS CONSEQUENCES AND PERSPECTIVES

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Summary: The article deals with some positive and negative aspects of the land reform being implemented in Ukraine. Prerequisites, the process and the consequences of the land reform in Ukraine have been investigated and summarized. Scientific groundlessness of the reform processes has been determined. It is pointed out that the advantages of the absolute state ownership on land have not been estimated and used in a proper way during the period of planning and implementing of land reform. Attention is paid to the model of ownership relationships borrowed from Western and European countries which has its historical and cultural origin. But this fact makes it of little use for Ukraine.

Key words: land reform, private property, agricultural lands market

Анотація: Досліджено та узагальнено передумови, процес та наслідки земельної реформи в Україні. Відмічено наукову необґрунтованість реформаційних процесів. При плануванні та здійсненні земельної реформи не були належним чином оцінені та використанні переваги абсолютної державної власності на землю. Акцентовано увагу на тому що запозичена у західноєвропейських країн модель відносин власності має історичний та культурний генезис, а це робить її малоприсадатною для України.

Ключові слова: земельна реформа, приватна власність, ринок земель сільськогосподарського призначення

Аннотация: Исследованы и обобщены предпосылки, процесс и последствия земельной реформы в Украине. Отмечено научную необоснованность реформационных процессов. При планировании и осуществлении земельной реформы не были должным образом оценены и использованы преимущества абсолютной государственной собственности на землю. Акцентировано внимание на том, что заимствованная у западноевропейских стран модель отношений собственности имеет исторический и культурный генезис, а это делает её малоприсадатной для Украины.

Ключевые слова: земельная реформа, частная собственность, рынок земель сельскохозяйственного назначения

Ukraine has a powerful land resource potential that is concentrated mainly on the agricultural lands. In the structure of the land fund that makes 60354.8 thousand hectares agricultural lands occupy 69.2 %, including arable lands – 53.8%.

In December, 18, 1990 implementing land reform began in Ukraine. It was as a component part of the total economic reform carried out in Ukraine in connection with transferring state economy towards market relations. The task of this reform was redistribution of lands with their simultaneous transmission in private and communal property and also in the use of the enterprises institutions and organizations with the aim of creating conditions for the equal development of different forms of land management, formation of multiform economy and rational land use and guard [1].

During the period of land reform realization a considerable redistribution of property took place, namely 31.0 mln of hectares (51.3%) were passed in the property of legal and natural persons. 30.6 mln of hectares from this area were agricultural lands.

Unfortunately Land reform had a series of negative consequences for the agricultural land-tenure. In fact, land funds breaking up large collective agricultural enterprises, the number of which was over 11.000, and excretion and transmission of 6.7 mln of land shares with an average area of 4.2 ha to a private property put Ukrainian agriculture in a difficult situation because historically middle and large forms of management were characteristic for agriculture in Ukraine [3]. Actually powerful though morally out-of-date material base of collective agricultural enterprises was destroyed. The new landowners faced the problem of necessity to process too large plots of land without having the appropriate agricultural machinery. The situation became still more complicated by the fact that 80 % of owners of the land plots which had been distinguished as land shares were on an old-age pension or under this age and were not able to work on these plots individually.

Thus, at present peasants cultivate individually only 10 % of land parcels received as a result of land shares dividing. The peasants were forced to lease 62 % of lands divided into shares and over 28 % of lands as a whole remained without tilling [2].

The land reform conducted in the state has as its main consequence only socialization of the earth, the earth redistribution between the people. It should be noted that the value of earth as the resource of productive forces territorial development and the basic environmental component was scorned during the period of land reform realization. This factor caused the rise of a number of crisis phenomena of economic and ecological character in land-tenure and the difficulties in solving them were essentially complicated by the relations of property.

There are many reasons that have resulted in such situation in Ukraine. The main of them are as follows: land in Ukraine was passed in property in mass order without realization of sound economic grounds of this process and prognostication of consequences for the agrarian sector of economy. The inventory of land was not made, there was no single state automated registration system and the legislative base was not worked out. Nowadays all the efforts of the government are directed to the removal of moratorium on the sale of agricultural lands and land market development. But this process can have the following negative consequences in the existing conditions: firstly, buying up considerable areas of agricultural lands by

financial industrial groups that will actually result in dispossessing land for peasants; secondly, the sale of agricultural lands by peasants at very low non-market prices; thirdly, the uncontrolled change of a specially aimed setting of land might take place [4]. Besides, a sound legislative base is needed in order to introduce a market of agricultural lands. The essence of this improvement system is in bad need of the introduction of some other systems such as:

- 1) the single system of spatial coordinates;
- 2) the system of land plots authentication;
- 3) the single automated system of land cadastre information and its authenticity.

In addition to the above-stated measures, taking the inventory of lands and carrying out the agricultural lands estimation in accordance with the world criteria will have to be done.

The draft law “On Land Market” has been prepared in Ukraine. It is to open the agricultural land market. It is to open the agricultural land market. The analysis of the draft bill testifies the reverse nature of land reform. Thus, according to the documents the state represented by a specialized institution that acquires a preferential right to buy these lands becomes the main “players” at the market of agricultural lands.

The data can give unsatisfactory assessment of land reform in the country. A unique situation appeared in Ukraine as well as in the other post-Soviet states at the time of their leaving the USSR when 100 % of lands were in the state property. Land reform in Ukraine was held on the “emotion” with a focus on Western countries with a developed institution of private property. But no one took into account the fact that historically the private ownership had been created for some countries there. Many developed countries would like to return the land to state ownership but in a democratic society such mechanisms are not possible and not acceptable. The situation when all the lands are exclusively in the state ownership gives unlimited opportunities for the country development. On the contrary, in the situation when a large number of lands are privately owned, the placement of national and regional importance objects faces the need to remove and purchase the land necessary for the location of these facilities from private owners. The situation like this decelerates greatly and sometimes even makes the development of the country impossible in certain directions. Another disadvantage of private property is a limited possibility of preventing irrational use of land by owners. In our opinion, the most effective is the state of things when all state lands are in public ownership and citizens acquire the right to use land under long-term lease with the ability to transfer their right to land inheritance. A legitimate user should have a preferential right of the extension of the contract. In this case the state may to remove quickly the land parcel from public necessity of appropriate damages to the user when it is needed. At the same time, lease relationships will effectively promote the rational use of land. Because the right of ownership is an absolute right when a person uses the land for the purpose and such use does not cause any harm to the others to the environment he lives in. The right to lease in its turn is based on the contract of time paid possession and use of land. The conditions under which a person-tenant loses the right to use the land parcel must be clearly defined in the contract and there should also be a fixed statement which runs that in other cases the tenant can not be denied the right to use land. Lease

prevents “no use” of the land parcel. After all, the need for continuous payment of lease rent under the threat of deprivation of rights on land use is the basis for the fact that the land has always had a wise boss. In turn, ownership can not prevent “idle” land because the land tax rates are very low and it is too difficult to deprive the right on land ownership for systematic non-payment of the land tax.

Summarizing the above-stated ideas, it can be concluded that land reform in Ukraine was a hasty and unjustified step, blindly copying the developed countries experience without any proper assessment of our needs and capabilities. To turn the situation back is not possible. Under these conditions the introduction of lands market is currently unavoidable. First, it is necessary to create an effective cadastral system and fix the most transparent procedure for the sale of agricultural lands.

In general, the trends highlighted in the draft law “On Land Market” are considered to be right. But in our opinion, the market of agricultural lands should not be introduced immediately. It is necessary first to conduct pilot auctions in different regions of Ukraine to monitor the demand and the final prices on land. Agricultural lands acquired by a specialized state institution should be left in public ownership and provided only for lease in addition to the moment of stabilization in the agricultural sector of economics.

Finally, the last and the most important prerequisite for the introduction of agricultural land market has to become a creation of a state reserve lands. Lands that are in reserve should not be transferred to private ownership in order to ensure public safety.

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SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF CULTURAL LANDSCAPES

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Summary: This article is about main principles of cultural landscapes creating and also opportunity of their development for getting better functionality and environment management on the example of Kharkiv district.

Key words: landscape, landscape environment, cultural landscape, environment management.

Стаття: В статті йдеться про головні принципи створення культурних ландшафтів, а також можливий розвиток для отримання кращої функціональності та раціонального користування ландшафтів на прикладі Харківської області.

Ключові слова: ландшафт, ландшафтне середовище, культурний ландшафт, раціональне природокористування.

Статья: В статье раскрываются главные принципы создания культурных ландшафтов, а так же их развития для получения лучшей функциональности и рационального пользования ландшафтов на примере Харьковской области.

Ключевые слова: ландшафт, ландшафтная среда, культурный ландшафт, рациональное природопользование.

In modern times, when civilization is experiencing an environmental crisis at the international level developing a strategy for environmental protection. One possible way out of the crisis is the preservation, restoration and development of the cultural landscape. The modern idea of the cultural landscape unique. This situation is typical for world geography, as well as for the Russian (Soviet) geography. At present there three fundamentally different interpretation of the term "cultural landscape":

1. In the tradition of Russian geography, it means "good" man-made landscape, modified by man for a particular program and has a high aesthetic and functional quality.

2. The second definition describes the cultural landscape as a kind of locality, which for a long period of history has been home to a group of people who are carriers of specific cultural values.

3. In the third case, a cultural landscape to understand the landscape, in the formation and development of which the active role played by the spiritual and intellectual values, stored and transmitted from generation to generation in the form of information that are part of it and is having an impact other physical components of the landscape.

The concept of "cultural landscape", which was introduced in the scientific revolution in the early XX century, has gained extraordinary popularity in the late second and third millennia. It proved to be the focus of researchers' interests, traditionally divided still on the "naturalists" and "humanities." It should be noted that in the classical landscape studies are used mainly natural science approach, although it is recognized that human exploration of landscapes are largely the product of the history of their people, their material and spiritual culture.

A number of studies carried out in line with human geography, the role of environmental factors in shaping the cultural landscape is reduced to the background, a landscape - that is, the external component of the landscape. The natural landscape - the same part of the cultural landscape, as, for example, the local language system and the local community. In the cultural landscape explicitly emphasizes the role of intellectual and spiritual activity in shaping the cultural landscape. In the cultural landscape include, along with toponyms, archival and bibliographic sources, as well as a variety of subjects, indicating the relationship of the landscape with historical events.

Landscape environment is became the part of human existence and human impact on the landscape is inevitable. "Landscape is a genetically homogeneous environmental system which has same geological framework, terrain, climate and consists of characteristic for the complex set of dynamically connected and naturally repetitive tracts" [1]. Isachenko see in the landscape "genetically homogenous geosystem same in zonal and azonal signs which consists of specific set of connected local geosystems" [1]. Mil'kov "Cultural landscapes are complexes in which because of the human impact every component changed significantly on the whole area or in its part, even vegetation" [3]. Using natural resources for creation of cultural landscape we have to determine and follow some principles:

1) principles of natural and economic adaptability, which approximates to the functioning of anthropogenic landscape features as a local landscape;

2) "law" of necessary diversity, when in the system functioning interacting heterogeneous elements;

3) presence of the environmental framework that is binding point for cultural landscape;

4) dividing landscape on functional zones intended to carry out socio-economic functions;

5) functional polarization - separation of industrial and energy facilities, traffic areas and adjacent areas of residence of people and recreation and fitness areas;

6) allotment of space for protected areas [2].

Following these criteria, as well as views V.O. Nikolayev [4] we can create the map of cultural landscape in Kharkov region and analyze the development and optimization of nature management.

1. Landscapes of Kharkov region belong to the four provinces of dry grassland zones of Ukraine. Local landscapes are flat terrain. Fields to be treated the same as the natural landscapes on morphology - meet the meadow dry grassland landscape and evenly spread the region.

2. Complementary elements in the area will be forest belts that differentiate planted fields and protect soil from erosion. It also applies to forested areas and not cultivated fields.

3. The ecological framework is a system of environmentally-related natural areas that helps maintain ecological balance in the area. All elements of landscape – natural and cultural –are interspersed and form a network of commercial land, protected areas and recreational areas that can withstand technogenic load. An example is the town of Kharkov and surrounding areas with a high degree of

specialization and concentration of industry. On all sides of the area presence "support" parks (Staromerchytsky, Lyubotynskogo, forest park, etc.), forest tracts as Coropove, Mohnach; recreational areas as Rai-Olenevka, Berezovskaya Mineral Water, Roshcha.

4. Anthropogenic landscapes are divided into zones of recreation, intended for building and industrial zones. In recreation areas include: Krasnokutsky Park, Manor and Parks Volodymyrivka and Old Merchyk, a number of health centers and more. In zones are intended for building the city and surrounding area, among which are industrial areas.

5. Functional polarization also takes place in the area. For example, centers of traffic circulation are: Lozova - in the south region, Kharkov - in the north, Kupyansk - in the east. Cities with the chemical and construction industries – Balakliya and Pervomaysky - separated by several natural landscapes, though not quite polarized from each other.

6. There are three national parks in the Kharkiv region: "Gomolsha forests", "Slobozhansky", "Dvurechansky" several landscape parks, dozens of local nature reserves and 11 – state reserves.

We can conclude that the ancillary criteria for creating cultural landscapes can be achieved quite productive results of economic and recreational development. When creating a cultural landscape can not only you cannot use only a few criteria, because it is not rigid system. It has no active intervention, a system of complementary components that are exposed to revision and updating.

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PHYTOHORMONAL STATUS OF VISCUM ALBUM

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Summary: The issue of greenery saving is one of the key problems in present-day biological research. One of the factors that cause its destruction is *Viscum album*. This article investigates the problem of water metabolism of this hemiparasite and its correlation with phytohormonic status.

Key words: hemiparasitism, phytohormones, *Viscum album*, water metabolism.

Анотація: Проблема збереження зелених насаджень є однією з ключових у сучасних біологічних дослідженнях. Одним із факторів, які сприяють їх знищенню, є Омела

біла. У даній статті розглядається проблема водного обміну цього напівпаразиту та його взаємозв'язок із фітогормональним статусом.

Ключові слова: водний обмін, напівпаразитизм, Омела біла, фітогормони.

Анотація: Проблема сохранения зеленых насаждений является одной из важнейших в современных биологических исследованиях. Одним из факторов, способствующих их исчезновению, является Омела белая. В данной статье рассматривается проблема водного обмена данного полупаразита и его взаимосвязь с фитогормональным статусом.

Ключевые слова: водный обмен, Омела белая, полупаразитизм, фитогормоны.

Viscum album as an object is an evergreen, perennial, epiphytic, hemiparasitic shrub that lives on a wide range of woody plant species. Nowadays it is one of the most widespread hemiparasitic plants in the world. The entire distribution area extends from 10° W to 80° E and from about 60° N (max. 59°38 N) to 35° S, which includes most of Ukrainian territory. Recently, there is a current trend toward further widening of distribution area, which is a result of global warming and migration of the birds, which spreaded seeds and fruits [4, p. 183].

The effects of mistletoes on their hosts include reductions in growth, vigor, fruiting, and seed production. Severe infection by mistletoes is often associated with premature mortality of host trees. In addition, severely infected trees are often predisposed to infection by other pathogenic agents and/or attacks by insects, which often contribute to the death of the mistletoe-infected plant. These effects are the result of direct divert of recourses by hemiparasite from the host plant. Mistletoe gets significant quantities of water, mineral salts and organic compounds from infected plants [1, p. 311; 2, p. 61]. It is considered to be a main reason of destruction of Alpine forests caused by drying [3, p. 216].

There is no denying that all kinds of interaction between *V. album* and host plant are regulated by phytohormonal system. Without exploring of the latter fight against mistletoe is ineffective. However, small attention was paid to this question in Ukraine. These facts account for the timeliness of this topic.

Over the last decades there appeared a lot of articles and research devoted to this issue which certifies great interest aroused by this problem and at the same time discloses the absence of common views on how it should be solved. The aim of this research is to identify correlation between the rate of water metabolism and phytohormonal status of *V. album*.

The objects of the study are plant recourses of Ukraine and Kharkiv region. The investigation was carried out in 2008-2010. During the research the species composition, the rate of affection by mistletoe and the rate of evaporation were determined.

The research of the distribution of mistletoe in Ukraine showed that it occurs in most of the regions of our country except for the South. It was established that southern border of area has moved 100-200 km further into Lugansk and Dnipropetrovsk regions.

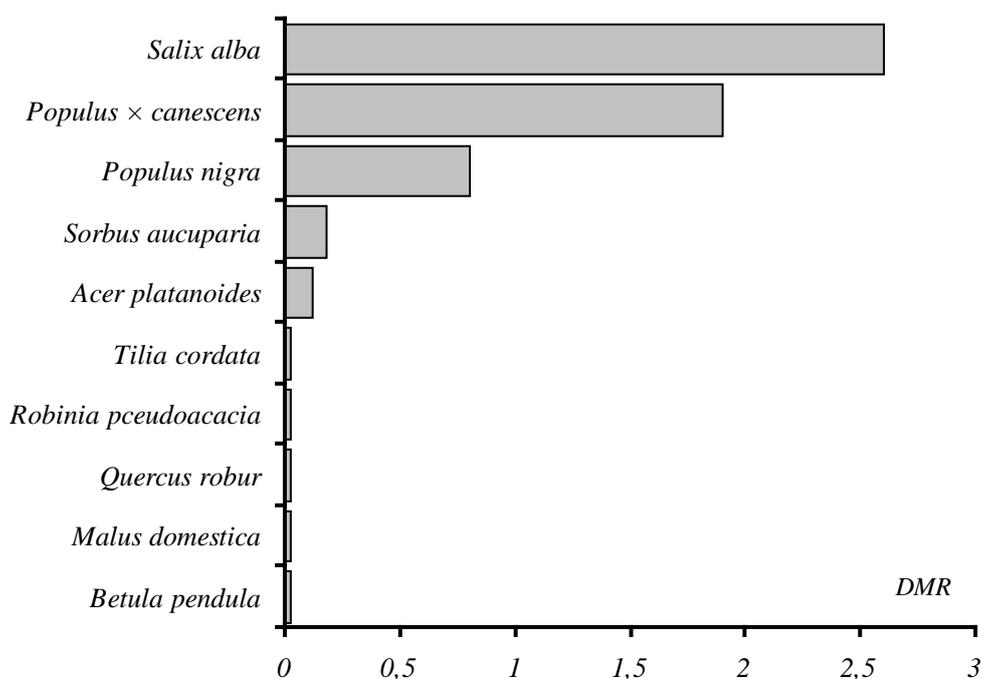
Studying of the age characteristics of *V. album* populations shows that the majority of hemiparasites were 16 or 8 years old in southern direction. It indicates that infestation was the result of bird migration in the middle of 1990s when winters were severe. An enormous number of mistletoe plants were found in Novomoskovsk,

which is a big industrial city. This fact is an evidence of synanthropic way of its distribution.

The analysis of deciduous broad-leaved trees, that can be potential host-plants of *V. album*, revealed that there are 10 species of the most wide spread dicotyledon plants in Kharkiv.

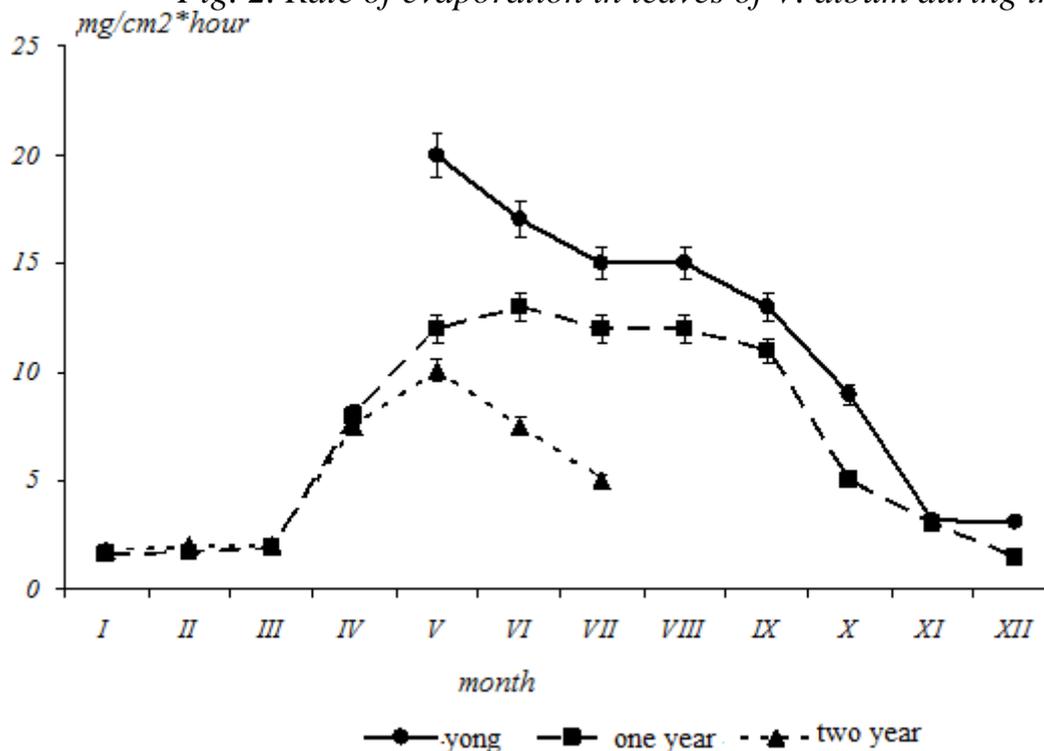
There was a correlation between the tree height and the rate of affection by mistletoe, the shape of the crown and the presence of hemiparasite. The rate of plant extermination greatly differed. The lowest rate had plants of *Quercus robur*, and the highest was on *Salix alba*. It was 1% and 100% respectively. The study of distribution of affection was made using the DMR index. It differed depending on the species of the tree from 0.03 on *Quercus robur* to 2,6 on *Salix alba*. According to this the average and maximum number of mistletoe plants was intrinsically different too. It changed from one to 156 plants. This characteristic also depended on the species of host plant. It was because of the fact that the most injured trees are soft species or they didn't have enough protective chemicals (Fig. 1).

Fig. 1. Rate of affection by *V. album* (DMR index)



Since *V. album* is an evergreen plant it has to transpire even in winter period in order to sustain water balance. The research of transpiration rate was made on *Sorbus aucuparia* leaves collected during different seasons of a year. It was determined that the evaporation rate gradually increased in young leaves since the moment of explication even in winter. Transpiration rate was always higher in young leaves than in one-year ones. It is necessary to notice that in two-year leaves the transpiration rate decreased before the leaf fall. Therefore, *V. album* is able to evaporate even in winter conditions when water metabolism has to be minimized. In such a way mistletoe interferes with water status of host plants that can cause drying.

Fig. 2. Rate of evaporation in leaves of *V. album* during the year



The comparison of transpiration rate of one-year leaves of *V. album* with evaporation rate of host plants leaves of tree species shows that it was always higher in hemiparasites ones. The highest rate was in mistletoes leaves that lived on trees of *Populus* genus.

In view of the fact that transpiration is regulated by phytohormonal system, we studied the content of cytokinins and abscisic acid in hemiparasites leaves. The study of cytokinin content in one-year leaves of mistletoe showed that zeatin concentration was the highest in plants collected from *Populus*. The concentration of zeatinryboside was the highest in hemiparasites from *Acer platanoides*. *V. album*, collected from *Sorbus oucuparia*, had the highest concentration of zeatine glycosides. The content of zeatin can be regulated by the rate of incoming from the host plant or by linking with the protein viscotoxine I.

The research of absizic acid content in *V. album* leaves demonstrated that the concentration of free phyhormon form was rather low. The highest one was in the leaves of mistletoe from *Populus* that can be explained by peculiarities of root system structure, synthesis and transport of phytohormon.

Thus *V. album* is the main hemiparasite of woody plants in most regions of Ukraine. High abundance of mistletoe in industrial cities can indicate synanthropic way of distribution. 10 most widespread trees are affected by *V. album*, especially *Salix alba*. Rate of affection depends on the shape of a crown and the height of a tree. Pathogenic effect of this hemiparasite is caused by its evaporation. This process is regulated by abscisic acid and cytokinins. Mistletoe plants have higher concentration of these phytohormones than host plants. Summarizing all the abovementioned it should be noted that the pathogenic influence of *V. album* by evaporation is mostly determinated by phytohormonal status of hemiparasite. Many issues have been raised which could benefit from further research.

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PLEUROTOID FUNGI OF FOREST AREAS IN KHARKIV REGION

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Summary: The biodiversity and taxonomic structure of the pleurotoid fungi biota of forest areas in Kharkiv region are considered.

Key words: pleurotoid fungi, biodiversity, Kharkiv region.

Анотація: Розглядається видове різноманіття і таксономічні структури біоти плевротоїдних грибів лісових районів Харківської області.

Ключові слова: плевротоїдні гриби, видове різноманіття, Харківська область.

Аннотация: Рассматривается видовое разнообразие и таксономические структуры биоты плевротоидных грибов лесных районов Харьковской области.

Ключевые слова: плевротоидные грибы, видовое разнообразие, Харьковская область.

At the present stage of biology development, one of the priorities is a comprehensive study of diversity of specific groups of organisms, as well as geographical and climatic patterns of their distribution. Such studies may be the basis for the formation of a balanced approach to the protection of these or other organisms, and groups. The results of these studies provide rich material for fundamental ecological researches, to deepen and clarify understanding of specific phenomena and processes in ecosystems [12, p. 20; 13, p. 204].

Pleurotoid fungi, along with aphyllorphoid fungi are decomposers of dead wood so they are an element of the ecosystem. Defining the species composition of pleurotoid fungi can lead to a better understanding of the relationship in these ecosystems. Also, the results of such studies can identify and protect rare species of fungi [12, p. 21; 13, p. 210; 14, p. 5].

Kharkiv region has a large and diverse territory, and therefore is of considerable interest in the study of biological diversity. On its territory there are objects of natural reserve fund. They tend to have relatively integral, intact ecosystems, with data on their biological diversity being often incomplete [8, p. 81; 10, p. 22; 13, p. 218].

On the territory of the Kharkiv region pleurotoid fungi have never been the subject of the special study. Fragmentary data on the species composition and distribution of the given group can be found in unpublished work of staff and

students of V.N. Karazin Kharkiv National University. These are mainly students' diploma papers.

The purpose of our study was to summarize and supplement the data on the species composition and taxonomic structure of the biota pleurotoid fungi of forest areas in Kharkiv region.

2. Materials and methods

The object of the study were fungi that belong to the "pleurotoid fungi" (Basidiomycota) morphological group. Research materials were obtained from the field diaries and the collection of fruiting bodies of pleurotoid fungi taken on the territory of the Kharkiv region of 2007-2011 seasons. During the collection of fruiting bodies standard methods were used [14, p. 18].

Identification was made using standard methods. The morphological study was carried out using a light microscope MBI-1 (increase of $\times 450$, $\times 900$ and $\times 2025$). Micromorphological data were derived from dried specimens. Preparations of tissue plates and pilepelius were fabricated in a 5% KOH or lactic acid (to detect incrustated elements). Identification was carried out using specialized determinants of fungi [3; 7; 14].

3. Results and discussion

3.1. Systematic description of the pleurotoid fungi biodiversity of the forest areas of the Kharkiv region.

During the study made we have identified 14 species of pleurotoid fungi by processing 49 samples from the collection of the Department of Mycology and Phyto-immunology of V.N. Karazin KNU. Eight of them have been found on the territory of the Kharkiv region for the first time. Thus, taking into account the scientific data, the species composition of the territory of the Kharkiv region has 19 species in 8 genera, 7 families, 3 orders of the class of Agaricomycetes of Basidiomycota division.

The dominant families were *Inocybaceae* Jülich and *Pleurotaceae* Kühner. The rest of the families were represented by single species (Fig. 1).

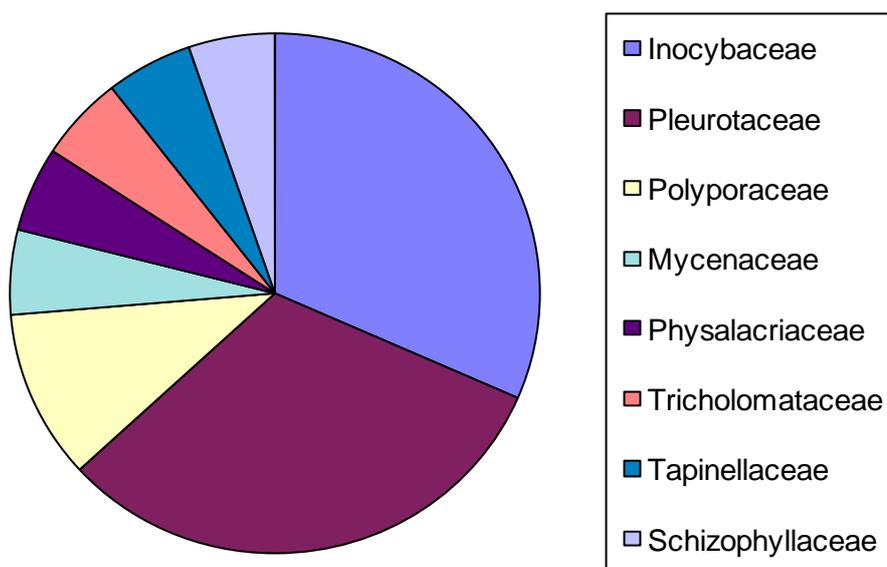


Fig.1. Taxonomic structure of pleurotoid fungi of Kharkiv region at the family level.

Leading genera according to the number of species were *Crepidotus* (Fr.) Staude (6 species) and *Pleurotus* (Fr.) P. Kumm. (4 species).

Data generalization on the species composition of pleurotoid fungi in the Kharkiv region has been made by us using both our results and scientific data. Below there is a systematic list of taxa belonging to the pleurotoid fungi group in our understanding, and known for the Kharkiv region.

DOMEN OPISTHOKONTA Caval.-Sm. 1987, emend. Caval.-Sm. and Chao 1995, emend. Adl et al. 2005

KINGDOM FUNGI T. L. Jahn et F. F. Jahn ex R. T. Moore 1980

DIVISION BASIDIOMYCOTA Bold ex R.T. Moore 1980

SUBDIVISION AGARICOMYCOTINA R. Bauer et al. 2006

(= Hymenomycetes Swann et Taylor 1995)

CLASS AGARICOMYCETES Matheny, Hibbett et Binder 2006

SUBCLASS AGARICOMYCETIDAE (Fr.) Parm. 1986

ORDER AGARICALES Clem.

Inocybaceae Jülich Family

Genera *Crepidotus* (Fr.) Staude

Crepidotus epibryus (Fr.) Quél. [4]

Crepidotus crocophyllus (Berk.) Sacc. [3; 4]

Crepidotus caspari Velen. (= *Crepidotus lundellii* Pilát) [4]

Crepidotus mollis (Schaeff.) Staude [1; 4]

Crepidotus subverrucisporus Pilát [4]

Crepidotus variabilis (Pers.) P. Kumm. [1]

Pleurotaceae Kühner Family

Genera *Hohenbuehelia* Schulzer

Hohenbuehelia atrocoerulea (Fr.) Singer [3]

Hohenbuehelia reniformis Singer [1; 2]

Genera *Pleurotus* (Fr.) P. Kumm.

Pleurotus calyptratus (Lindblad) Sacc. [3; 4]

Pleurotus cornucopiae (Paulet) Rolland [1]

Pleurotus ostreatus (Jacq.) P. Kumm. [2; 4]

Pleurotus pulmonarius (Fr.) Quél. [1; 4]

Mycenaceae Roze Family

Genera *Panellus* P. Karst.

Panellus stipticus (Bull.) P. Karst. [4]

Physalacriaceae Corner Family

Rhodotus palmatus (Bull.) Maire [4]

Schizophyllaceae Quél Family

Genera *Schizophyllum* Fr.

Schizophyllum commune Fr. [1; 4]

Tricholomataceae (Fayod) R. Heim ex Pouzar Family

Resupinatus applicatus (Batsch) Gray [4]

ORDER BOLETALES E.-J. Gilbert

Tapinellaceae C. Hahn Family

Genera *Tapinella* E.-J. Gilbert

Tapinella panuoides (Fr.) E.-J. Gilbert (= *Paxillus panuoides* (Fr.) Fr.) [1; 4]

Polyporaceae Fr. Ex Corda Family**Genera *Lentinus* Fr.***Lentinus tigrinus* (Bull.) Fr. [4]**Genera *Lentinellus* P. Karst.***Neolentinus lepideus* (Fr.) Redhead et Ginns (= *Lentinus lepideus* (Fr.) Fr.) [4]

Further there is a summarized information about the collectors, who registered this type in the area of research:

1. Species were found during 2000-2009 years by A.Yu. Akulov and his graduate students S.S. Molodikova, E.V. Syvokon, O.I. Sidoryuk, and D.V. Leontyev and his graduate student L.N. Rybalko [15, p. 59-103];
2. Species were discovered during 1970-1980 years by R.I. Meshcheryakova and her graduate student L.P. Babariko [9, p. 89];
3. The results of research of N.P. Prydyuk and his colleagues, M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, published in the collective monograph "Гриби заповідників та національних природних парків лівобережної України" ("Fungi of the natural reserve fund and natural park areas of the left-bank Ukraine") [13, p. 203-226];
4. Results of our research.

One species, *Pleurotus populinus* O. Hilber et O.K. Mill, listed in this area before, is excluded from the list.

3.2 *Pleurotus populinus* problem species in Kharkiv region

While making analysis of published data on the species composition of pleurotoid fungi of the area under the research we have found the mention about the discovery of species of *Pleurotus populinus* O. Hilber et O.K. Mill, belonging to R.I. Meshcheryakova and her graduate student L.P. Babariko (1974). The specimen, confirming this finding is not available. However, based on the data published on the biology and distribution of the *Pleurotus* genus, as well as on our own sample study, whether the species above mentioned has been revealed can be doubtful [15, p. 98].

Pleurotus populinus, according to the literature, is close to *P. pulmonarius* (Fr.) Quél. and differs from the latter by the strict conformity of the substrate to the wood of *Populus L.* species, and slightly longer spores (9 - 12 μm) (Petersen et al.). *P. pulmonarius* is characterized by a wide range of tree substrates, as well as 7 - 10 μm spores (Petersen et al.). But it is worth mentioning that some authors suggest a wide variation of *P. pulmonarius* spores - 7.5 to 12.5 μm , an average of 8 - 11 μm (Дмитрович, 2004; Funga Nordica, 2008). In addition, *P. populinus* is widely spread, along with *P. pulmonarius*, in North America. The data of the *P. populinus* occurrence in Europe are very scanty and doubtful; this species was not included in the main European reports on this genus [1, p. 120; 2, p. 19-30; 3, p. 425].

Additionally we have analyzed our own samples of *P. pulmonarius*-like fungi collected in the "Gomolshanskiesk Lesa" NPP and "Slobozhanskiy" NPP 4 samples were selected. All fungi have evolved on the hardwood died off recently, viz.: maple (*Acer sp.*), Hazel (*Coryllus avellana L.*) and aspen (*Populus tremula L.*).

15 spores of each sample (except for sample number 3, with only 11 spores available because of their scarcity) were measured. The results were compared with the help of Kruskal - Wallis-test and U-test Mann-Whitney.

As a result, it was found that significant differences existed only between samples 2 and 3, 4 and 3. Significant difference between the length of spores of the samples collected on aspen (1 and 4) and maple (2) wasn't observed.

Remarkably, significant differences have not been shown between the samples collected on aspen and the other ones. It should be noted the missing samples in the selection to be really distinguished by spores length from all the others. Sample 3, whose spores are much less than all the ones of samples 2 and 4, was collected, according to field notes, in a rather young state. Its spores are possibly finer because of incomplete development.

Based on these data, as well as on the scientific data about the *Pleurotus* species spreading, we can make at least a preliminary conclusion about fallacy of determining the *Pleurotus populinus* species in the Kharkiv region.

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УДК 602 05

THE EFFECT OF VARIOUS MEDIA ON THE PROLIFERATION OF ANIMAL STROMAL CELLS

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Language supervisor: Nikitina L.D.

Summary: The influence of four different culture media on the activity of cell proliferation and viability of primary cultures of human mesenchymal stromal cells in bone marrow were studied. The study was conducted on primary cultures of laboratory animals - rats and mice, as well as the culture of stromal cells of dogs.

Key words: mezenchym stromal cells, bone marrow, monolayer, fibroblast-like cells.

Анотація. Було досліджено вплив чотирьох різних культуральних середовищ на активність проліферації і життєздатність первинних культур мезенхімальних стромальних клітин кісткового мозку. Вивчення проводилося на первинних культурах лабораторних тварин - щурів і мишей, а також культурі стромальних клітин собак.

Ключові слова: мезенхімальні стромальні клітини, кістковий мозок, моношар, фібробластоподібні клітини.

Аннотация. Было исследовано влияние четырех различных культуральных сред на активность пролиферации и жизнеспособность первичных культур мезенхимальных стромальных клеток костного мозга. Изучение проводилось на первичных культурах лабораторных животных – крыс и мышей, а также культуре стромальных клеток собак.

Ключевые слова: мезенхимальные стромальные клетки, костный мозг, монослой, фибробластоподобные клетки.

For the past 20 years around the world it has become popular to use mezenchym stromal cells (MSCs) of bone marrow and adipose tissue in replacement therapy. Such a change helps to restore normal function of lost tissue or organ. Techniques of regenerative medicine promise to replace various medical devices, pharmaceutical and molecular therapy. Stromal cells are characterised by nonlinear plasticity according to transdifferentiation. Tissue regeneration is the most widely studied and debated example of stem cell plasticity. To date, the stromal cells are found in almost all of adult tissues. Main sources of theirs in experimental and clinical operations are bone marrow, adipose tissue, umbilical cord blood and placenta [1, 2, 4].

Mesenchymal stem cells are unspecialized cells of the adult organism, found in various tissues in small amounts, which retain the ability to specialize in different cell types of tissues. Introduction of stroma cells is to repair bone, joints, skin, nervous tissue, liver and other organs of the various types of injuries, and degenerative changes [2].

Bone marrow stromal cells were first identified by Friedenstein, who described an adherent fibroblast-like population able to differentiate into bone that he referred to as osteogenic precursorcells. Subsequent studies demonstrated that these cells have the ability to differentiate into various other mesodermal cell lineages, including chondrocytes, tenocytes, and myoblasts. Based on this multilineage

differentiation capacity, Caplan introduced the term mesenchymal stem cells, although many other terms have been introduced to describe a nonhomogenous population of multipotent cells. However, MSCs at a population level fulfill stem-cell criteria (self renewal and multilineage differentiation capacity), it remains questionable whether the qualification “stem cell” is legitimate for MSCs at the single cell level. It was therefore recently proposed to use the term multipotent mesenchymal stromal cells (with the acronym MSCs) to describe fibroblast-like plastic-adherent cells. Recently, Bonnet et al demonstrated that single cell-derived populations of murine bone marrow derived MSCs characterized by stage-specific embryonic antigen-1 expression, were capable of differentiation *in vivo*, thus showing their true stem-cell properties. In this review, we will refer to the multipotent mesenchymal stromal cells with the acronym MSCs.

An important advantage of using mesenchymal stromal cells compared with embryonic and fetal stem cells is to solve the ethical problems associated with not having to kill organisms in the early stages of development [1].

In addition to mesenchymal stromal cells showed no malignant transformation during transplantation. For the treatment of embryonic and fetal cells to tumorigenicity has been a major drawback [6].

Transplantation of human mesenchymal stem cells is currently most often performed in a hospital in specialized medical institutions. Most of patented currently in Ukraine and abroad are autotransplantants. The safety and high efficiency of this therapy is proved [7].

Following the introduction of humane medicine cell therapy is the practice of veterinary medicine. In this area, the market offers a few specimens. There are only some centres in the world specialized in conducting animal stem cell therapy.

The opening of the possibility of autologous transplantation has given broad prospects for the development of human medicine. However, operations for the collection of animal cells are too expensive and time consuming. In this regard, it is promising to create the cryobanks mesenchymal stromal cells for animal allotransplantation. To solve this problem some work has been carried out. The first step while working with primary cell culture is the choice of culture medium.

We have studied four culture media commonly used in our laboratory practice [3, 4].

Materials and Methods

Preparation of working media. To 100 ml of media gentamicin was added to a final concentration of 40 mg / ml. Media was stored and used to flush the cells out of bone marrow, to centrifugate and to cultivate during 24 hours of attachment and cell growth.

Optimisation of growth media for culturing MSCs. Media containing 4 mg / ml of gentamycin and 5, 10, 15% of fetal bovine serum were used to cultivate. Medium used for culturing adherent at 1 day of cell growth. The replacement with fresh medium occurs every three days.

Isolation of cells from the femurs of mice, rats and dogs. Animals anesthetized with ether were decapitated. Bone marrow was flushed from the isolated bones and seeded into culture flasks.

The obtained suspension was centrifugated with 1000 g during 10 min. The supernatant liquid was decontaminated and resuspended. The cells were calculated in

Goryaev's chamber. Then the cells were seeded into flasks and culture plates per 500 - 800 thousand / cm² and put under terms of CO₂.

After 24 hours the medium with unadherent cells was decontaminated and replaced with freshly grown medium. The medium replacement was made every 72 hours throughout the cultivating (12-15 days). During the cultivation observations were made and photos were taken.

Determining the number of cells, as well as the ratio of living and dead, for 120 hours, the cells were removed from the substrate enzymatically and were calculated in Goryaev's chamber. To determine the dead cells they were stained with trypan blue.

Statistical analysis was performed with Statistica 6.0. The distribution for was tested for normality and then we used T-criterion. The significance level was 0,05.

Results and Discussion

We studied four culture media, which are most often used for culturing and specialized medium for the stromal cells, released by PAA, Austria.

First of all, we have studied the influence of concentrations of FBS – 5, 10, 15% on monolayer growth. It was shown that the present parameter has no significant effect.

To assess the state of the cells attention was paid to such factors as the number of flattened cells at 24 hours of growth, percent of the monolayer, colony size. All media were encrypted and the experiment was conducted blind. During 24 hours of growth, all the cells were cultured in DMEM medium with normal glucose containing 4.5 g / l (PAA, Austria). All cells in the wells looked the same: the attached cells were epithelial-form, single-fibroblast.

The results of visual observation allowed us to establish well proliferation of cells. The DMEM nutrient medium with low glucose stable L-glutamine and HEPES was studied. The cells in monolayer neither flattened nor divided. The cells were single and did not form colonies (Fig. 1). Also the total number of cells and the percentage of dead cells were calculated. The average number of cells was 34,75 + 6,99 and 25,17% of them were damaged. It was concluded that this medium had toxic effect.

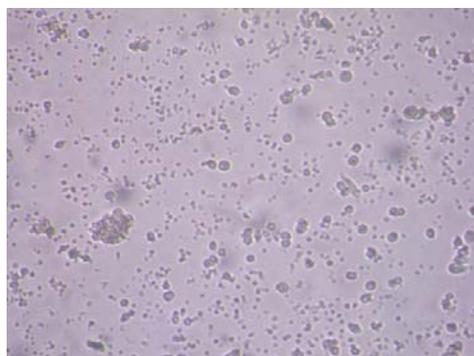


Fig. 1. – 7 days of growth in DMEM with low glucose stable L-glutamine and HEPES.

The culture was grown on DMEM medium with high glucose 4.5 g /l and L-glutamine. Attached cells were flattened and attached fibroblast-like cells (Fig. 2). The cells formed numerous colonies. The monolayer of cells was 40 - 50 percent of the culture flask. The average number of cells was $222,5 + 46,0$ and 15,9% of them were damaged.

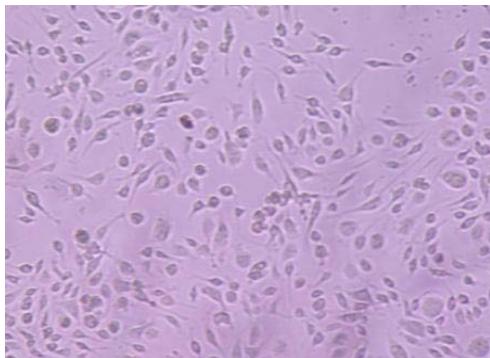


Fig. 2. – 7 days of growth in DMEM medium with high glucose 4.5 g /l and L-glutamine.

The culture was grown in DMEM medium with low glucose 1 g /l and L-glutamine. Attached cells were flattened and attached fibroblast-like cells (Fig. 3) The cells formed numerous colonies but quantities of elements in unit colony were less than in the previous experimental variant. The monolayer of cells was 30 – 35% percent of the culture flask. The average number of cells was $198,0 + 45,0$ and 15,9% of them were damaged.

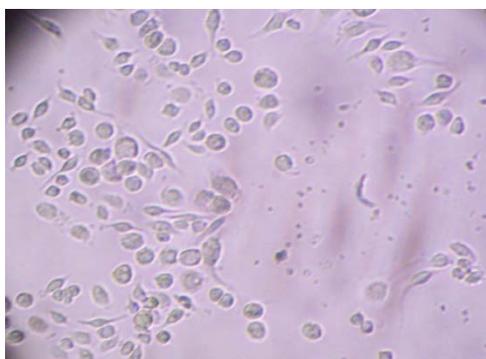


Fig. 3. – 7 days of growth in DMEM medium with low glucose 1 g /l and L-glutamine.

The culture was grown in specialized MesenchymStem Medium with L-Glutamine. Attached cells were flattened and attached fibroblast-like cells (Fig. 4). The cells formed numerous colonies were large. The monolayer of cells was near 50% percent of the culture flask. The monolayer of cells was 40 - 50 percent of the culture flask. The average number of cells was $189,75 + 34,35$ and just 3,38% of them were damaged.

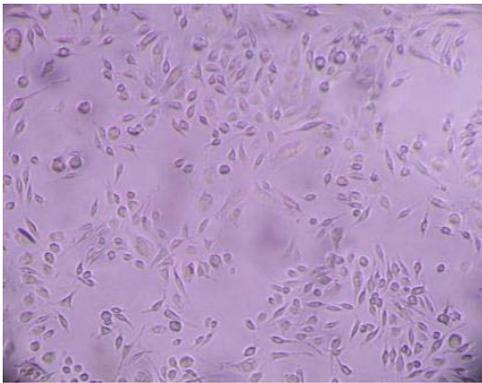


Fig. 3. – 7 days of growth Mesenchymal Stem Medium with L-glutamine.

The cells were seeded into the cameras for visualization. After 72 hours of culture grows it was fixed and stained with Rarrachi's hematoxylin.

Thus, 3 out of 4 investigated environments do not have toxic effects, show good growth properties and can be used for the cultivation of cell cultures of laboratory animals and dogs. The difference between the number of cells are within the statistical margin of error, the number of damaged cells differed significantly.

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EARLY DIAGNOSIS OF BACTERIAL-VIRAL CONTAMINATION FOR PROTECTIVE PURPOSES

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Language supervisor: Belyaeva E. F.

Summary: The findings showing that all living things radiate electromagnetic waves allow to approach treatment and prevention of diseases not with chemical but with physical techniques. The method of resonance testing allows to trace the changes in functional activity by the absence or presence of the resonance response, obtain information about all the organs and systems, identify a wide range of pathogens and pathological conditions, and determine the individual scheme of therapy, providing constant monitoring of the treatment process.

Key words: biologically active points (BAP), resonant frequency, bioresonance influence, induction therapy.

Анотація: Результати досліджень, які показують, що всі живі істоти випромінюють електромагнітні хвилі, дають можливість звернутися до лікування й профілактики захворювань не хімічними, а фізичними способами. Метод резонансного тестування дозволяє простежити зміни у функціональній активності органа по наявності або відсутності резонансної відповіді, отримати інформацію про всі органи й системи, виявити широкий спектр патогенних організмів і патологічних станів, а також визначити індивідуальну схему терапії, забезпечуючи постійний моніторинг процесу хвороби.

Ключові слова: біологічно активні точки, резонансна частота, біорезонансний вплив, індукційна терапія.

Аннотация: Результаты исследований, показывающие, что все живые существа излучают электромагнитные волны, дают возможность обратиться к лечению и профилактике заболеваний не химическими, а физическими способами. Метод резонансного тестирования позволяет проследить изменения в функциональной активности органа по наличию или отсутствию резонансного ответа, получить информацию о всех органах и системах, выявить широкий спектр патогенных организмов и патологических состояний, а также определить индивидуальную схему терапии, обеспечивая постоянный мониторинг процесса болезни.

Ключевые слова: биологически активные точки, резонансная частота, биорезонансное воздействие, индукционная терапия.

Man is a part of the world, he is included in it as one of its subsystems. In turn, within himself, in his biological structure, man has the so-called similarity mini-systems which reflect the whole organism. They are iris, pinna, skin on palms and soles, etc. By controlling the changes in these structures the health state can be diagnosed, while directly acting on them makes it possible to correct deviations. Thus, a new concept of diagnosis and therapy was born.

The method of resonance testing was proposed by H. Schimmel in 1978. It is based on electroacupuncture diagnostics by R. Voll. This principle is based on measuring the electrical conductivity in biologically active points (BAP), which depends on the nature and intensity of the course of biochemical processes in tissues and organs that have meridional (electromagnetic) connections with presentation points of appropriate channels. If, however, for solving the problems of diagnosis and drug testing the method of R. Voll uses up to 450–600 points, the method of resonance test uses a single reproducible measurement point (MP) on which the entire testing process is conducted. According to the logic of investigation, a

sequence of resonant frequencies is included into the resonance circuit of the selector base of hardware and software that responds to the questions: What? (cause) Where? (diseased organ) In what way? (pathogenesis of the process) To what extent? (disease severity) How to treat? (medicine or drug regimen) and many others.

There is a technique called VEGA Resonance Test (VRT) which allows to obtain answers to these questions. This load-based method allows not only to fix the change in the functional activity of the organ judging by the presence or absence of the resonance response, but also to evaluate the significance of this change for the whole organism. The capabilities of VRT can be fully demonstrated on the example of diagnostics of infectious diseases. A method of filtration which is used in VRT allows not only to carry out a highly qualified and exact diagnostics of presence of infectious agent (according to the principle of yes/no) in the organism, but also to separate a harmless absence of infectious basis from harmful influence on the organism of a human being, by means of resonance testing of intensity (potency) of frequency model. Behind this method there is a principle of six-quadrant separations by Voll, but due to the unique technical decisions developed by the Altimed company engineers it is now possible to diagnose 30 segments of the human body. Each segment bears information about certain organ, system and body area, as well as the state of the segmental apparatus of the spinal cord and the vegetative system.

This method allows to receive some information about all organs and systems, their physiological state and pathological changes in them in extremely short time (one test taking exactly 30 seconds), the program's huge selector database allowing to test for the presence of a broad spectrum of pathogens and pathological conditions as well as determine the individual regimens. The APC selector database consisting of more than 35 000 test resonance frequencies allows to reveal parasitic and infectious diseases, their causative factor and its role in the pathogenesis of each specific disease, choosing the best scheme of therapy, creating individually selected and tested complex informational medication and monitoring the entire treatment process [4].

The therapeutic complex is comprised of general and selective BRT programs. The latter, in turn, are divided into the meridian, system and nosological programs. The wide range of BRT programs allows to compound the most effective and comprehensive therapy scheme tailored to the individual patient. With the built-in search system, the doctor can quickly find the right drug in the database of 35 000 items as well as obtain additional background material on its use.

The subsystem of automatic scanning of the frequencies corresponding with the nosodes allows to make a quick decision both of organs and systems, automatically selecting a treatment program through the BRT. In addition to the standard programs, opportunity to conduct targeted treatment of organs and diseases has now appeared.

ATM Express Diagnostics allows to diagnose a wide range of conditions including acute and chronic condition of helminthic invasions; bacterial, viral and fungal infections, and chronic intoxication [6].

There is a nutrition testing as an addition to the ATM-Express and as a separate program for patients with allergies, especially in infancy. A food intolerance

is more common than a true allergy, and it is quite enough just to correct the nutrition to eliminate the process.

At the same time with the adjustment of nutrition the bioresonance therapy is carried out. This is a therapy with the help of electromagnetic waves which come in resonance with the body's structures. The influence can be performed both at the cellular level and at the level of organ, system of organs or an organism as a whole. The main idea of using resonance in medicine is that with proper selection of frequencies and forms of medical treatment (electromagnetic) influence it is possible to enhance the normal (physiological) and reduce the pathological vibrations in the human body.

Bioresonance influence can be directed both to neutralizing the pathological vibrations and restoring the physiological ones disturbed in pathological conditions. The proposed method, unlike the majority of the known methods of physiotherapy, is not connected with tissue heating.

In general, almost all biochemical processes (enzymatic, hormonal, membrane, and genetic) mean constant rupture of old bonds and establishment of new ones.

Each bond, having the specific wave characteristics, changes (increases or weakens, disappears or appears) depending on the wave characteristics of the fields and quanta affecting it. Dynamic changes in chemical bonds lead to changes in configuration and structure of molecules. This process is energetic by nature, because chemical bonds have energy and information characteristics. To perform any of its functions, a living cell needs energy. To control and mutually harmonize the various functions, information is needed.

A carrier of energy and information is the electromagnetic field, which possesses a wide range of energy information. The electromagnetic field has the wave (i.e. vibrational) characteristics that tend to the phenomenon of resonance and interference.

Each bond also has vibrational characteristics, as long as it has an electromagnetic nature. It is known that resonance leads to better results at lower energy costs. Knowing the characteristics of the different chemical bonds (the parameters of the electromagnetic field), it is possible to control them, which means monitoring the biological processes at the systemic, cellular, molecular, atomic, and genetic levels.

How is it possible to cure? It is not necessary to introduce new substances into the body, it is better to apply special sanogenetic program into the cells of organism, which will cause changes of the electromagnetic parameters of the chemical connections in biomolecules through the mechanism of bio-resonance, and restore ruined parameters of homeostasis at all levels of regulation .

There are two main types of bio-resonance therapy:

1) Endogenous or passive bioresonance therapy – it is a therapy by means of own electromagnetic vibrations of the human body after its special treatment.

Each structural unit corresponds to a certain frequency range, which has been used successfully in therapy. The development of pathological processes leads to a change of this frequency spectrum in the form of appearance of disharmonic vibrations. Pathological vibrations can be eliminated with the use of endogenous

bioresonance therapy, thus, increase physiologic and reduce pathologic disharmonious vibrations.

2) Active bioresonance therapy (ABRT)

After years of research, scientists have found that absolutely all living beings (including microorganisms), radiate electromagnetic waves. In humans, the main sources of electric and electromagnetic signals are:

- muscle activity — for example, rhythmic contractions of the heart muscle;
- bioelectrical activity, i.e. transmission of electrical impulses from sensory organs to the brain and the signals from the brain to the executive organs;
- metabolic activity, i.e. the body's metabolism.

At the same time, many microorganisms, including the protozoa, a number of intestinal parasites, fungi, bacteria, and viruses, lack nervous and muscular system, so the only source of electric and electromagnetic fields is their metabolic activity. Metabolism is what distinguishes “live” nature from “lifeless”. The motion of any charged particle creates an electromagnetic field around it, the concentration of charged particles creates an electric potential of a certain sign. These assumptions allow to approach the treatment and prevention of the disease not by chemical (i.e. traditional medical) but by physical methods.

Life activity of human beings, animals, protozoa, bacteria and viruses is accompanied by various kinds of electromagnetic activity. The examples of such activity are the bioelectric potentials recorded by ECG and EEG.

Many diseases are closely connected with the presence in the body of parasitic, bacterial and viral agents, both infectious and living in different organs in a state of symbiosis with tissue structures of this organ. In order to suppress these or other agents, it is not necessary to introduce antibiotics into the body, i.e. to use body-harming methods of chemotherapy. Knowing the rate of the metabolic activity of certain agents, it is possible to act on them by frequency fluctuations, which would violate their own rhythms and thereby inhibit their normal metabolic activity. As it was shown by the appropriate studies, such effects are absolutely harmless to the human body. This method of treatment is called Active Bioresonance Therapy (ABRT) and implemented in Lanta-Z and Helper devices.

The etiology of hard chronic diseases such as Parkinson's disease, Alzheimer's disease, AIDS, cancer, multiple sclerosis, endometriosis, severe arthritis, muscular dystrophy etc. is not always known, but there is a point of view that a major factor of the pathogenesis is a hidden parasitic infection (viral, bacterial, helminth, protozoan).[2]

In the cells and cavities of organs, pathogens and parasites are hardly reachable for any kind of influence, but it is much easier to reach the goal through contact with blood.

It is established that to eliminate pathogens and parasites from the circulating blood is possible by carrying out one cycle of exposure within 7 minutes, which corresponds to the total blood circulation period in the body. After this cycle, it is necessary to take a 20-minutes break to activate tissue drainage and detoxification reactions. Certain intestinal parasites are carriers of bacteria, and bacteria, in turn, may be home to a virus that enters the bloodstream after the death of its “host.”

Therefore, one more session is necessary to eliminate the residual pathogens in the circulating blood.

It is not harmful for an organism to apply such kind of therapy to the human body because the frequencies of parasites lie in the range of characteristics quite different from those in the human body, so even the regular use of these techniques not only does no harm the cellular structures of the body, but does not inhibit the activity of saprophytic microflora (i.e. non pathogenic microorganisms, some of which play an important role in the life of the human body).

The therapeutic levels of exposure can be both psychovegetative and neuroendocrine matrix (mesenchymal).

The characteristics of the electromagnetic signals used in the process of induction therapy coincide with the spectrum of electromagnetic waves emitted by the human brain, detected with the help of EEG. In induction therapy, the physiological frequency range is used which is represented by Beta rhythm (14 Hz – 30 Hz – 14 Hz), Alpha-rhythm (13.5 Hz – 7.5 Hz – 13.5 Hz), Theta rhythm (7 Hz – 4 Hz – 7 Hz), Delta rhythm (3.5 Hz – 0.5 Hz – 3.5 Hz).

The main impact of the induction therapy is carried out primarily through its impact on the limbic system, the structure of the thalamus, which in its turn is closely related to the matrix (the mesenchyme). The extracellular matrix, or mesenchyme, is the space located between the blood vessels and cells (average 25% of body weight). It performs a physiological function of “molecular sieve” in the organism for the cells through which all the substances involved in metabolism penetrate. In the matrix, interaction of the nervous, endocrine and immune systems occurs, the first two starting to cooperate with each other in the hypothalamus. Thus, the matrix is the place of localization in the peripheral tissues of the basic regulation (peripheral neuroimmunoendocrine system), which operates on the feedback principle.

Mesenchyme is one of the major control systems involved in the programs of induction therapy allowing to influence the very process of formation of psychosomatic disorders by influencing the processes of inhibition/excitation in the subcortical structures (limbic system) and the cortex of the brain, as well as the mechanisms of their synchronization. The limbic system (LS), as it is well known, is the center of emotion, motivation, and memory. At the same time, it is one of the suprasegmental vegetative structures.

The hypothalamus, as a part of it, is responsible for the regulation of both the SPA and the endocrine level; centers of aggression, food and sexual centers are situated there. Thus, LS is the highest integrative structure of the central nervous system whose main function is to harmonize the emotional reaction as well as its neurovegetative and neuroendocrine foundation. Besides, LS is the center of memory. The long-term memory is always emotional one. The brighter the emotions are, the more likely the memory trace will be activated in the future. In A. d’Aubigné’s words, “fear has good memory. Once experienced, the stress state is preserved in the long-term memory and stored as “memory traces” (engrams) [5].

As a result, the stock of the already-formed engrams, or psycho-vegetative patterns becomes of particular importance for the development of psychosomatic disorders. The real cause of relapse is often nothing more than “resurrection” of the relevant symptoms due to the revival of the psycho-vegetative patterns. The more

acute was the sense of danger to life and health, the more likely is the emergence of a full-blown clinical picture of depression or its somatic equivalent.

The human body is an open biological system, which constantly exchanges information with the environment. The information provided in the body, with induction therapy, has a harmonizing effect on the operation of its control systems, which allows treating the disease at all levels of pathological changes in the subsystems of adaptation. Due to the resonance effects of the interaction with electromagnetic fields of the brain, induction therapy stimulates restoration of the normal functioning of the central and autonomic nervous systems. Due to the organism's ability to memorize the information received, the effect of induction therapy sessions lasts for a long time.

Thus, using the method of BRT it is possible to eliminate acute and chronic processes in the human body and to prevent activation of pathogenic flora, i.e. to prevent the development of the disease.

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THE FUTURE OF HEALTHCARE: PERSONALITY, MOBILITY AND AVAILABILITY

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Summary: The latest advances in electronics made it possible to introduce mobile technology into medical practice to improve the level of health and quality of life. Biofeedback and the ease of use of the technology allows one to independently perform the procedure in a comfortable environment. The implementation of the certain algorithm enables patients who successfully undergo training acquire ability to adjust the balance of the regulatory systems of the body without the help of professionals. The use of the proposed procedure and its further development and optimization considers a promising direction for the further study.

Key words: mobile technology, wearable sensors, implantable medical devices, biofeedback.

Анотація: Останні досягнення в галузі електроніки дозволили вводити мобільні технології в медичну практику для поліпшення рівня здоров'я і якості життя. Біологічний

зворотний зв'язок (БЗЗ) і простота у використанні дає можливість незалежно проводити цю процедуру в комфортних для пацієнта умовах. Застосування визначеного алгоритму допомагає пацієнту за відповідної підготовки налаштувати регулювання систем організму без участі фахівців. Використання запропонованої процедури і її подальше вдосконалення й оптимізація — багатообіцяючий напрямок для подальшого розвитку.

Ключові слова: мобільні технології, портативні сенсори, імплантовані медичні пристрої, біологічний зворотний зв'язок, БЗЗ.

Анотація: Последние достижения в области электроники позволили вводить мобильные технологии в медицинскую практику для улучшения уровня здоровья и качества жизни. Биологическая обратная связь (БОС) и простота в использовании дает возможность независимо проводить эту процедуру в комфортных для пациента условиях. Применение определенного алгоритма помогает пациенту при соответствующей подготовке настраивать регулирование систем организма без участия специалистов. Использование предлагаемой процедуры и ее дальнейшее усовершенствование и оптимизация — многообещающее направление для дальнейшего развития.

Ключевые слова: мобильные технологии, носимые сенсоры, имплантируемые медицинские устройства, БОС.

There are many quotes by great people advising to live by one day, but the pace of modern life does not allow that luxury. The same rule applies to the technology industry. Purchasing more and more perfect products every year, consumer puts forward more and more “requirements”. Usually it is more comfort, simplicity and mobility at lower price. And looking back at this trend, we can see that the future belongs to mobile technology. The proof of this is modern compact devices that not only make calls, but surf Internet via wireless connection as well. This opens up unlimited possibilities for using these devices in other areas of life. One of the most pressing problems today is medicine in the unity of preventive and treatment sectors.

If we try to look into the not so distant future of mobile technologies used for public health needs, their keywords will be: personality, mobility and availability. Nowadays, scientists develop and successfully test the technologies necessary for creation of really personal medical service: sensors, mobile devices for data acquisition and transmission, wireless technology, mobile communication and positioning systems, storage technologies, mathematical analysis of medical data. They also create computer-based models for forecasting possible individual development, as well as specifying the course and treatment of the particular disease.

The existing health care technology demonstrates achievements in personal mobility and shows the ways of their further development in medicine. Even now, by wearing a set of weightless sensors, the patient may be aware of his or her heart rhythm, blood pressure, body temperature, respiration rate etc. All medical data are stored on the patient's mobile device and can be, if necessary, automatically transferred to the appropriate clinic. The clinic, in turn, will receive real time information about all possible complications and the patient's current location (via GPS). In the nearest future, an increase in usage of wearable sensors, as well as simplification and harmonization of the system itself is expected, which will make the technology much cheaper and more accessible.

The development of implantable sensors will significantly expand the possibilities of wearable health care. Obviously, such common disease as diabetes requires constant monitoring of blood sugar levels, which can be provided by an

implantable sensor. Today, safe-to-implant microsensor system capable of visualization of the measurement results is being developed. Modern nanotechnology allows energizing such implantable medical devices for decades using the energy of blood motion or even cellular energy source (ATP).

The appearance of health technology was originally associated with specialized and highly expensive mobile devices for patients. The basic function of such devices is to collect information from wearable and implantable sensors and to send it to the clinic. Nowadays, the functions of such devices are being increasingly assumed by common smartphones with appropriate software and interface. This makes mobile health service truly popular and affordable.

In the next decade, further development and significant progress in clinical monitoring service, storage and processing of mobile patient data is expected. Thus, the technology of data processing in hospitals will rise to a qualitatively new level by involving mathematical modeling and analysis to forecast the health status of the patients. Thus, a significant step from treatment to disease control and prevention by means of computer analysis and forecast of possible complications will be taken in medical science and practice.

One of the most popular trends in modern medicine is biofeedback. The impetus for development of this area was given by mobile technology.

Biofeedback is a tool for individual self-regulation that helps actively manage the individual's own physiological processes. The wide field of application of biofeedback includes not only medicine (neurology, cardiology, gastroenterology, urology, pediatrics, geriatrics, restorative and preventive medicine), but also stress management, sports, pedagogics, etc.

The optimal functioning of the body is provided by the unity of the sympathetic and parasympathetic nervous systems. Consequently, any deviation from this balance may be a precursor of the patient's distress. The most objective and easy to use index reflecting the state of the body's regulatory systems is heart rate variability (HRV). Studies in this field demonstrate that low HRV indexes correlate with unfavorable prognoses for health and quality of life. At present, there are a number of methods developed to increase and normalize HRV within biofeedback. Owing to the achievements in the field of electronics, there are compact, reliable and precise devices which can be used at home. Reading information from the phone monitor/PDA will enable to use the device at any suitable time: at work, leisure, home; and if the results are controversial, the patient may always show the received note to a specialist for correct interpretation and taking respective measures.

The advantages of the suggested method are the following:

- No limits imposed by age or training level;
- Simplicity and availability of use;
- Unambiguity of the obtained data rules out the possibility of misrepresentation of the assessment results concerning the state of the organism and recommendations as for its optimization;
- Every user of such system becomes an active participant of the process of his or her own health improvement, making the professional's (doctor's) support necessary only at the initial stage of its use;

- Deals not with particular diseases but with regulatory systems, making positive effects easier to achieve;
- Absence of direct impact on the body, all changes are achieved by training;
- Long-lasting effect after sessions;
- Absence of adverse reactions;
- Possibility of performing sessions in the form of a game for children.

Even now there is good evidence of successful biofeedback-involving treatment of insomnia, temporomandibular joint syndrome, migraines, asthma, gastrointestinal disorders, muscular dysfunctions, high blood pressure, anxiety, generalized stress, poor concentration, chronic headache, neck and shoulder pain, whiplash, anorexia nervosa, autism, bed wetting, chronic pain, constipation, depression, diabetes, epilepsy and related seizure disorders, learning disabilities, motion sickness, sexual disorders (including painful intercourse), and spinal cord injuries — and the borders of the method continue to expand.

The suggested method of visualization of the heart rate variability parameters under the action of different factors was tested on the basis of the department of internal medicine of the medical faculty of V. N. Karazin Kharkiv National University. The results of the method's application showed that users can successfully master biofeedback software system and then correct the state of their regulatory systems by themselves, without any special help.

Patients indicated that the ease of use of the proposed program owes not only to its mobility and simplicity, but also to possibility to carry out the necessary procedures at any time. Besides, direct participation of users in the training promotes better results and rapid achievement of the effect of training system.

Thus, these results suggest that development of mobile technologies with special emphasis on biofeedback is a perspective area of the healthcare industry. Introduction of such programs to a wider number of users will improve the quality of preventive medicine. A slightest deviation in the state of the body's regulatory system will be rapidly recorded and analyzed, allowing to take the necessary measures to prevent developing of the disease. Ability to communicate via wireless networks and Internet directly with the clinical physician will provide timely response to changes in the patient's state at the stage of the first precursors. We hope that our proposal will help to keep many people's health and improve the quality of their lives.

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OPTIC NERVE LESION AMONG PATIENTS WITH ACUTE INFLAMMATORY DISEASES OF THE ORBIT

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Summary: The article deals with the analysis of peculiarities of the optic nerve lesion among patients with acute inflammatory diseases of the orbit were analyzed. This abnormality was characterized by intrabulbar and orbital parts of the optic nerve affection. The damage depended on the character of the inflammatory process in the orbit and the total volume of the orbital soft tissues. Damage rate of the visual function was influenced by the degree of diameter extension of the orbital part of the optic nerve and superior ophthalmic vein as well as the change of their diameter ratio.

Key words: acute inflammatory diseases of the orbit, optic nerve lesion, retrobulbar abscess.

Анотація: У статті проаналізовано особливості ураження зорового нерва у 84 пацієнтів з гострими запальними захворюваннями орбіти. Для таких пацієнтів були характерні ознаки ураження інтрабульбарної та орбітальної частини зорового нерва. Ступінь ураження зорового нерва залежала від характеру запального процесу в очній ямці і сумарного об'єму м'яких тканин орбіти. Вираженість порушення зорових функцій залежала від ступеня збільшення діаметра орбітальної частини зорового нерва та верхньої очної вени, а також змінення співвідношення їх діаметрів.

Ключові слова: гострі запальні захворювання орбіти, ураження зорового нерва, ретробульбарний абсцес.

Аннотация: В статье проанализированы особенности поражения зрительного нерва у 84 пациентов с острыми воспалительными заболеваниями орбиты. Для таких пациентов характерны признаки поражения интрабульбарной и орбитальной частей зрительного нерва. Степень поражения зрительного нерва зависела от характера воспалительного процесса в глазной впадине и суммарного объема мягких тканей орбиты. Выраженность нарушений зрительных функций зависела от степени увеличения диаметра орбитальной части зрительного нерва и верхней глазной вены, а также от изменения соотношений их диаметров.

Ключевые слова: острые воспалительные заболевания орбиты, поражение зрительного нерва, ретробульбарный абсцесс.

The scientific objective.

It is well known that acute inflammatory diseases of the orbit are the category of severe conditions that can cause not only blindness but also intracranial complications which directly threaten the patient's life [2]. Osteoperiostitis, subperiosteal and retrobulbar abscess, edema of orbital cellular tissue and phlegmon of the orbit, that are frequently present as stages of the same pathological process, belong to this group of the diseases [1-5, 8].

Visual function disorders appear as severe consequences of acute inflammatory diseases. According to Birch-Hirschfeld [3] prolonged blindness is developing in 16 % of cases, amaurosis fugax in 12 %. Optic nerve lesion [7], edema of the perineural tunics, thrombophlebitis and artery obstruction [9, 10], retinal detachment, panophthalmitis and even glaucoma are identified as causes of the visual function disorders in modern scientific literature [1-7].

According to A. F. Brovkina [2] acute neuritis as a result of embolism or thrombosis of the optic nerve vessels, embolism or thrombosis of retinal or choroidal vessels can be the causes of blindness. Also dramatic increasing of exophthalmos that lead to rapidly tension of the optic nerve, conic extending of the posterior eyeball pole, pressure fall in the arteries and pressure buildup in the veins result into ischemia on the eye grounds.

This research was aimed to study features of optic nerve lesion among patients with acute inflammatory diseases of the orbit.

Materials and methods

Under supervision there were 84 patients diagnosed with acute inflammatory diseases of the orbit aged from 14 to 79 years old, among them 61 (72,6 %) male and 23 (27,4 %) female patients. They were divided into clinical groups depending on the visual acuity: in the first clinical group there were 4 (4,7 %) patients with blindness, in the second group there were 5 (6 %) patients with object vision and in the third

group there were 5 (6 %) patients visual acuity of whose was ranged from 0,2 to 0,8. Visual acuity in the rest 83.33 % of cases (70 patients) was normal and this group was considered as a control one.

To study anatomical and functional changes of the optic nerve in the acute period of inflammatory diseases of the orbit we applied visometry, ophthalmoscopy, exophthalmometry, computed and helical computer tomography, magnetic resonance imaging and magnetic resonance - phlebography with the further analysis of the scanned images with the help of the software «eFilm Lite» that enabled us to measure diameter of the orbital part of the optic nerve and superior ophthalmic vein as well as to calculate the volume of the orbital soft tissue. After OC regress we performed visometry, ophthalmoscopy, perimetry and phosphene diagnostics.

Statistical data manipulation was carried out with the help of various statistics methods and software «Microsoft Excel 2007».

Results

Among patients with blindness phlegmon of the orbit was diagnosed. The exophthalmus among these patients was at the average $28,5 \pm 0,58$ mm, that was accompanied with lagophthalmos and infiltrate of the cornea. There were mydriasis and also absence of the direct and consensual reaction of the pupil to the light and absence of the consensual reaction of the pupil to the accommodation and convergence. Swelling and hyperaemia of the optic nerve head, blurring of its margins, peripapillary haemorrhages, considerable widening of the retinal veins and narrowing of retinal artery (a:v=1:4), flatness of macula reflex were detected. According to tomographic data the volume of the orbital soft tissue was $31,65 \pm 0,47$ sm³, that was accompanied with marked decrease of eye reposition. The diameter of orbital part of the optic nerve ($5,25 \pm 0,17$ mm) exceeded the control group data at 1,6 times ($p < 0,001$). The diameter of superior orbital vein ($4,25 \pm 0,17$ mm) exceeded the control group data at 2,8 times. MR- phlebography detected marked slowdown of blood flow in superior orbital vein.

There was no restoration of visual acuity among patients with blindness towards the reduction of the inflammatory changes in the orbital cellular tissue. Ophthalmoscopic findings were the following: normalization of the diameter of the optic nerve head, its paleness, peripapillary haemorrhages, changes of the retinal arterial venous ratio as a:v=1,5:3,5. And also we detected no phosphene-phenomenon.

Among patients with object vision phlegmon of the orbit was diagnosed. The exophthalmus among these patients was at the average $24,6 \pm 0,27$ mm. There were expressed slowdown of the direct and consensual reaction of the pupil to the light and consensual reaction of the pupil to the accommodation and convergence. Swelling and hyperaemia of the optic nerve head, blurring of its margins, widening of the retinal veins (a:v=2:4), flatness of macula reflex were detected. According to tomographic data the volume of the orbital soft tissue was $28,08 \pm 0,22$ sm³, that was accompanied with decrease of eye reposition. The diameter of orbital part of the optic nerve ($4,32 \pm 0,12$ mm) exceeded the control group data at 1,2 times ($p < 0,01$). The diameter of superior orbital vein ($2,88 \pm 0,19$ mm) exceeded the control group data at 1,8 times. MR- phlebography detected slowdown of blood flow in superior orbital vein.

There was restoration of visual acuity among patients to 0,7-1,0 towards the reduction of the inflammatory changes in the orbital cellular tissue. But there was widening of the blind spot, central or paracentral skotomas and also concentric narrowing of visual field. Ophthalmoscopic findings were the following: normalization of the diameter of the optic nerve head, its paleness, changes of the retinal arterial venous ratio as a:v=2:3. And also we detected increase of the threshold of electrical sensitivity on the phosphene.

Among patients with visual acuity from 0,2 to 0,8 edema of orbital cellular tissue was diagnosed. The exophthalmus among these patients was at the average $22,2 \pm 0,42$ mm. There was slowdown of the direct and consensual reaction of the pupil to the light and consensual reaction of the pupil to the accommodation and convergence. Swelling and hyperaemia of the optic nerve head, blurring of its margins, widening of the retinal veins (a:v=2:4) also were detected. According to tomographic data volume of the orbital soft tissue $25,61 \pm 0,64$ sm³, that was accompanied with moderate decrease of eye reposition. The diameter of orbital part of optic nerve ($3,5 \pm 0,18$ mm) and diameter of superior orbital vein ($1,5 \pm 0,18$ mm) did not differ at all comparing with the control group. MR- phlebography detected normal blood flow in superior orbital vein.

There was restoration of visual acuity among patients to 0,9-1,0 and no visual field defects towards the reduction of the inflammatory changes in the orbital cellular tissue. Ophthalmoscopic findings were the following: normalization of the diameter of the optic nerve head, changes of the retinal arterial venous ratio as a:v=2:3. Electro- physiological data of these patients did not differ at all comparing with the control group.

Statistic analysis of the data detected that the degree of visual acuity decreasing among these patients turned out to be in strong reverse correlated dependence (Spirman`s coefficient $r = -0,79$) with the degree of exophthalmus and volume of the orbital soft tissue (table 1).

Table 1.

Dependency between visual acuity and exophthalmus as well as volume of orbital soft tissue

Group of patients	Exophthalmus (mm)	Volume of orbital soft tissue (sm ³)
Blindness	$28,5 \pm 0,58$	$31,65 \pm 0,5$
Object vision	$24,6 \pm 0,27$	$28,08 \pm 0,2$
Visual acuity 0,2-0,8	$22,2 \pm 0,42$	$25,6 \pm 0,67$
Control group	Not more then 20	Not more then 23,6

And also we could observe the dependency between damage rate of the visual function and the degree of diameter extension of the orbital part of the optic nerve and superior ophthalmic vein as well as the change of their diameter ratio. So, the diameter ratio between orbital part of the optic nerve and superior ophthalmic vein was 1,2:1 among patients with blindness, 1,5:1 among patients with object

vision , 2,3:1 among patients with visual acuity from 0,2 to 0,8 as well as in the control group.

Conclusions:

1) optic nerve lesion among patients with acute inflammatory diseases of the orbit develops in 19 % of cases;

2) intrabulbar and orbital parts of the optic nerve are affected;

3) the degree of optic nerve damage and visual function disorders depends on the character of the inflammatory process in the orbit (infiltrative or purulent), the degree of exophthalmus and the degree of optic nerve and superior ophthalmic vein widening as well as the change of their diameter ratio.

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ALTERNATIVE METHODS OF INSULIN DELIVERY FOR PATIENTS WITH DIABETES MELLITUS

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Summary: The statistical data, presented by international organizations studying the problem of diabetes mellitus, are compared in the article; the effects of the disease are examined. The major attention is given to the problem of finding simple and comfortable methods of insulin delivery.

Key words: diabetes mellitus, stroke, high blood sugar, insulin delivery, hyperglycemia, glucose level.

Анотація: У статті порівнюються статистичні дані, представлені міжнародними організаціями, що займаються проблемою цукрового діабету; розглядаються наслідки

захворювання. Основна увага приділяється проблемі пошуку простих і зручних способів введення інсуліну.

Ключові слова: цукровий діабет, інсульт, високий вміст цукру в крові, введення інсуліну, гіперглікемія, рівень глюкози.

Аннотация: В статье сравниваются статистические данные, представленные международными организациями, занимающимися проблемой сахарного диабета; рассматриваются последствия заболевания. Основное внимание уделяется проблеме поиска простых и удобных способов введения инсулина.

Ключевые слова: сахарный диабет, высокое содержание сахара в крови, введение инсулина, гиперглицемия, уровень глюкозы.

More and more people every year suffer from diabetes mellitus. The statistics shows drastic figures.

According to the data presented by the World Health Organization, 346 million people worldwide have diabetes mellitus. In 2004, as estimated, 3.4 million people died from consequences of high blood sugar. Type 1 diabetes mellitus affects about 5-10% of diabetes population, most of them are children [9].

The International Diabetes Federation in the IDF's Diabetes Atlas, 5th edition, of 2011 presented the following figures: 366 million people have diabetes in 2011; by 2030 this will have risen to 552 million. The number of people with type 2 diabetes is increasing in every country. 80% of people with diabetes live in low and middle income countries. The greatest number of people with diabetes is between 40-59 years of age. 183 million people (50%) with diabetes are undiagnosed. Diabetes caused 4.6 million deaths in 2011. Diabetes caused at least 465 billion dollars (USD) in healthcare expenditures in 2011; 11% of total healthcare expenditures in adults (20-79 years old).

78,000 children develop type 1 diabetes every year [5].

The American Diabetes Association publicized the following facts concerning the situation in the United States: among U.S. residents aged 65 years and older 10.9 million, or 26.9%, had diabetes in 2010. About 215,000 people younger than 20 years had diabetes (type 1 or type 2) in 2010. About 1.9 million people aged 20 years or older were newly diagnosed with diabetes in 2010. In 2005 – 2008, based on fasting glucose or hemoglobin A1C levels, 35% of U.S. adults aged 20 years or older had prediabetes (50% of adults aged 65 years or older). Diabetes is the leading cause of kidney failure, nontraumatic lower-limb amputations and new cases of blindness among adults in the United States. Diabetes is a major cause of heart disease and stroke. Diabetes is the seventh leading cause of death in the United States [2].

Diabetes mellitus, often simply referred to as diabetes, is a group of metabolic diseases, in which a person has high blood sugar. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels. Type 1 diabetes results from the body's failure to produce insulin – a hormone, which is required by the cells in the liver, muscle and fat tissue of the body in order for them to remove and use glucose from the blood.

Insulin marked a tremendous advancement in the treatment of diabetes since its discovery by Banting and Best in 1921[10] and still remains a crucial component for controlling both type I and type II diabetes today. Historically, patients were

injected insulin using glass syringes with needles, which needed to be boiled and then soaked in alcohol between injections to keep them sterile. Nowadays, the most widespread way of insulin delivery for patients with diabetes mellitus is injections with insulin needles or insulin pens. Though injectable insulin is very effective and has many benefits but it is not well accepted by all patients because of the problems associated with using a needle. This difficulty with needles represents more than just a problem of pain or patient convenience. One of the reasons for poor diabetic control is the fact that patients are required to inject themselves every day, which is not comfortable for young people. Since 1920s several researchers have been looking for new methods of delivering this crucial medication. Ever since insulin was identified as the key to restore normal glucose levels in diabetic patients, doctors and patients, both have been hoping for an alternative to insulin injections. The immediate goal we have posed in this article is to review some various alternative insulin delivery systems beneficial to both patients and health care professionals.

Insulin pump therapy is considered to be the most widespread alternative way of insulin delivery. The insulin pump is a continuous subcutaneous insulin infusion device, which includes the pump itself, a disposable reservoir for insulin (inside the pump) and a disposable infusion set, including a cannula for subcutaneous insertion (under the skin) and a tubing system to interface the insulin reservoir to the cannula.

With insulin pumps two types of dose are taken, basal and bolus, using only one rapid-lasting insulin. Basal rate of insulin is the same as a long-acting insulin regime for those diabetics without an insulin pump. This program is consistent and regular, and controls the level of insulin getting into the bloodstream. The bolus dose taken with an insulin pump is designed to counteract the food being eaten. Therefore, when a diabetic eats a snack or at mealtimes, the insulin pump can be programmed to provide an extra boost of insulin. Furthermore, pumps can be programmed to release a bolus dose over a longer period, which could be ideal for meals in restaurants [4]. Many modern "smart" pumps have a "bolus wizard" that calculates how much bolus insulin you need taking into account your expected carbohydrate intake, blood sugar level and still-active insulin.

Probably the most exciting innovation in pump technology is the ability to use the pump in tandem with newer glucose sensing technology [6]. Glucose sensors have improved dramatically in the last few years, and are an option for patients to gain further insight into their patterns of glucose response to tailor a more individual treatment regimen. The newest generation of sensors allows for a real time glucose value to be given to the patient. The implantable sensor communicates wirelessly with an insulin pump. The device is kept in proximity to the sensor to allow for transfer of data, however, it can be a few feet away and still receive transmitted information. Depending on the model, the screen displays the blood glucose reading, a thread of readings over time and a potential rate of change in the glucose values. The sensors can be programmed to produce a "beep" if blood sugars are in a range that is selected as too high or too low. Some can provide a warning beep if the drop in blood sugar is occurring too quickly.

Insulin pump therapy has many advantages. Patients, who suffer from trypanophobia, do not have to do everyday insulin injections. Insulin pumps make it

possible to deliver more precise amounts of insulin than can be injected using a syringe. Programmable basal rates allow for scheduled insulin deliveries of varying amounts at different times of the day. Insulin pumps can provide an accurate record of insulin usage through their history menus. On many insulin pumps this history can be uploaded to a computer and graphed for trend analysis. However, there are some disadvantages of using an insulin pump therapy. Insulin pumps, cartridges, and infusion sets are far more expensive than syringes used for insulin injection. Since the insulin pump needs to be worn most of the time, pump users need strategies to participate in activities that may damage the pump, such as rough sports and activities in the water. Some users may find that wearing the pump all the time (together with the infusion set tubing) is uncomfortable or unwieldy.

Over 50,000 people worldwide are using an insulin pump. This number is growing dramatically as these devices become smaller and more user-friendly. Insulin pumps allow for tight blood sugar control and lifestyle flexibility while minimizing the effects of low blood sugar. At present the pump is the closest device on the market to an artificial pancreas. More recently newer models of the pump have been developed that do not require a tubing, in fact, the insulin delivery device is placed directly on the skin and any adjustments needed for insulin delivery are made through a PDA (Personal Digital Assistant) like device that must be kept within a 6 foot range of the insulin delivery device, and can be worn in a pocket, kept in a purse, or on a tabletop when working.

Injection ports provide an alternative to daily injections. Injection ports look like infusion sets without the long tubing. Like infusion sets, injection ports have a cannula that is inserted into the tissue beneath the skin. On the skin surface an adhesive patch or dressing holds the port in place. The user injects insulin through the port with a needle and syringe or an insulin pen. The port remains in place for several days and is then replaced. Use of an injection port allows a person to reduce the number of skin punctures to one every few days to apply a new port. This way of insulin delivery is suitable for children, helping them to get accustomed to everyday insulin injections [4].

Automatic injectors shoot the insulin into the user by pressing a button. Some automatic injectors release the insulin automatically while others require pushing the plunger. This method is a good option for people who are uncomfortable pushing the syringe into their skin.

Jet injectors are devices that force a tiny stream of insulin through the skin by pressure [1]. Unlike syringes and insulin pens, jet injectors do not puncture the skin, which is good news for people who are afraid of needles. However, jet injectors do have their downsides, and as a result, are not routinely used as alternatives to syringes. The pressure used by the jet injector to deliver the insulin can cause bruising if the correct technique is not used consistently. Moreover, some people feel that they are more painful than injections with insulin needles.

Intranasal insulin delivery was thought to be promising. However, this method was associated with poor absorption and nasal irritation.

Inhalable insulin is a way to deliver insulin using an inhaler. The large surface area of the lungs (more than 100 m²) with its thin and highly vascularised epithelium provides an attractive site for rapid insulin absorption [7]. Inhaled insulin claimed to

have similar efficacy to injected insulin. Absorption via the pulmonary route is similar to or faster than subcutaneous injection of rapid-acting insulin, and the effect is longer lasting. However, patients still need to do long-acting insulin injections to control the blood level. Inhalable insulin is not to be used in regular or intermittent smokers and patients requiring very small doses of insulin. Patients tended to experience more severe hypoglycemia more frequently. Another downside of this method is the amount of inhaled insulin necessary to get enough. Only a small percentage is able to reach the bloodstream, so much of the hormone is wasted. This is reflected in the high cost of inhaled insulin. Additionally, since the lungs are not designed for this purpose, concerns about the safety of this delivery method abound.

The buccal insulin method, still in the final stages of development, uses a device that, which is similar to a spray paint can, delivers a spray that is absorbed into the lining at the back of the mouth and throat [8]. As with the inhaled method, a high percentage of insulin is wasted. However, this method is not associated with the safety concerns attached to delivery via the lungs.

Today patients with diabetes mellitus, who have to do about four injections of insulin a day, may use one of the alternative methods of insulin delivery. Some of these methods, like insulin pump therapy, even have more advantages over traditional insulin injections with needles or insulin pens, helping patients achieve a more physiological daily glycemic profile.

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THE PROBLEM OF THE ELECTRONIC CONTRACT AS EVIDENCE IN CIVIL RELATIONS

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Summary: The paper considers the problem of e-contract as evidence in legal proceedings. It addresses the main aspects of legal regulations both in international law and in various national legal systems.

Key words: E-commerce, electronic contract, validity, digital signature.

Анотація: В статті розглядається проблема електронного договору, як доказу у судовому процесі. Розглядаються основні аспекти правового регулювання, як у сфері міжнародного права, так і в різних національних системах права.

Ключові слова: електронна торгівля, договір в електронному вигляді, юридична сила, електронний підпис.

Аннотация: В статье рассматривается проблема электронного договора, как доказательства в судебном процессе. Затрагиваются основные аспекты правового регулирования, как в области международного права, так и в различных национальных системах права.

Ключевые слова: электронная торговля, договор в электронном виде, юридическая сила, электронная подпись.

E-commerce as an effective means of conducting operations in international trade is rapidly developing now. Its use for commercial and administrative purposes has already received a significant attention in several key industries in Europe, North America, Australia, New Zealand and Asia.

The growing use of electronic commerce is radically transforming the international trade practice, replacing traditional trade based on paper documents by alternative electronic systems. Instead of sending and receiving of the original written documents signed by hand, members of trade operations transfer structured business data from one computer system to another by electronic means, using electronic signatures more often.

However, domestic and international law can provide a very different rule on the admissibility of replacing paper documents with electronic messages. Many conventions and agreements related to international trade do not provide for possible use of electronic documents. This is largely due to the fact that during the development of these international conventions and agreements electronic documents simply did not exist and therefore some necessary changes should be made. Many national laws also raise uncertainty as to the validity of electronic documents or inconsistency in their approach to new technologies. Jurisprudence is more conservative. To adopt a new law regulating new, not previously encountered relationships, it is necessary to conduct extensive preparatory work that can take years. The result is the situations which have become standard for us, do not exist in terms of law.

Speaking about the electronic documents in Ukraine, the law which regulates these relations [1][2] was adopted only in 2003. By this time the Internet has long been spreading ads, negotiated and concluded agreements.

So, are the agreements sent by an e-mail considered valid? If there is no dispute with the counterparty, you shouldn't worry. The basis for resolution of potential problems is a private trust. But if you have transferred a certain amount of money, and your partners are not in a hurry to fulfill their obligation, what is to be done? To protect your interests it is necessary to claim to the court. Here a problem of the evidential value of electronic documents arises.

Nowadays lawyers are increasingly facing the situations where correspondence is conducted through the electronic document. It means they should have effective means of protection when computers are actively used in business.

If the partners do not have sustainable long-term relationship then the contract, which is drawn for a single transaction, may include approximately the following: "The Parties recognize the equal validity with the originals of correspondence and documents received by fax, internet and other electronic means

of communication." The presence of such a rule in the contract will be of great value in the event of a lawsuit.

From a procedural point of view it is necessary to prove that the letter was sent with an authorized person and received by an authorized person. The computer stores information which letters have been sent, when and to whom. And if this information does not change or remove, such computer data could be evidence. However, to refer to them, it is necessary to conduct a forensic examination of the computer equipment. Then it can be even more difficult. Facts of sending messages from your computer and receipt of messages by the recipient's computer are proved. But your ex-partner states that he personally did not receive this letter. How to prove the opposite? Article 11 of the Law of Ukraine "On electronic documents" says that in case the author (addresser) does not receive confirmation, the electronic document is considered not received by the addressee. The above-described evidentiary methods are associated with great technical and material costs. The court also assesses the evidence collected in conjunction with the position of their adequacy. Thus, the more arguments in support of their case you submit the more convincing will your position be.

Although Ukraine (as well as Russia) has gained very little experience in legal regulation of electronic document management and application of relevant law, these relations have already been given significant attention in the UN and the European Union. Two model laws have been developed by the United Nations Commission on International Trade Law – UNCITRAL [3][4]. The European Union has also adopted two directives: Directive on electronic commerce and the Directive on electronic signatures. Countries of the European Union are trying to organize relations with regard to electronic documents.

This goal is pursued, for example, in German proposal on the basics of Digital Signature Act of August 16, 2000, adopted by the Bundesrat on March 9, 2001. Electronic document management, in particular electronic signature is an independent sphere of activity in the telecommunications industry, along with television broadcasting, providing access to the Internet, and, according to the German legislator relations in this sphere should be placed under strict state control. German approach to giving effect to contracts in an electronic form such as legal force of treaties with the handwritten signature is to construct a fairly strict order on the basis of regulating the use of cryptography, public or private key in the process which addresses the technical requirements for certification bodies, which must fully comply with the law in order to obtain a permit to operate. The main emphasis is on the law creating the infrastructure for digital signatures, rather than on the recognition of legal validity of contracts in electronic format.

On March 13, 2000 in France amendments [5] were enacted, which mainly concerned the form and evidential value of the contracts. These changes are aimed at establishing common rules that allow to equalize the legal force of electronic signatures in documents and signatures in paper documents in all aspects of relationships.

Evidence in electronic form by which the person who can reveal the data and the way they have been created can be identified to a sufficient degree of certainty, in case of conflict with paper documents, signed by his own hand, is estimated by the

court, which determines which of them have great probative value, based on a thorough examination of all circumstances and in an unbiased attitude to the media you are using. Keeping to the principle of functional equivalence is much more liberal than in German law, which recognizes the validity of a specific type of electronic signatures. Electronic documents are valid and can be reliably assessed by the court without reference to the technological nature of the document and the associated electronic signature.

Thus, France's position is even more liberal than the provisions of the Directive on electronic signatures because in France, electronic documents have the same recognition of their validity as signed paper documents without reference to specific technological means.

In the United Kingdom implementation of the two Directives of the European Union began with the Act on Electronic Communications, which received Royal Assent on May 25, 2000. Being intermediary between legislation in France and Germany, the Act proposes to extend the legal recognition of electronic signatures that meet certain general criteria and the criterion of functional equivalence. The act has simply created a guarantee that the documents signed with electronic signature will be accepted in the court.

As concerns Ukraine and Russia, the application of laws on electronic document, is still difficult in practice. If the parties have previously agreed in a written form, for example, in the master agreement, to use electronic digital signature (EDS) in their subsequent transaction, it can serve as a basis for the partners, third parties and the court to consider the deal, sealed with EDS, made. However, for this transaction to be recognized as legally significant the parties must properly execute the contract on the use of EDS. Conditions and procedures for electronic documents and EDS used by the parties should be clearly defined in the contract.

Given that the arbitration practice in the use of digital signature at the conclusion of business transactions (contracts) has not been developed yet to date, summarizing some practical results, including the judiciary results, we note that arbitration while clarifying the issue of concluding a contract, pays a special attention to the following circumstances: negotiation between the parties to the contract of the terms on the recognition of legal validity of documents exchanged by fax (e-mail or another form of communication); body of evidence confirming the expression of will of the Parties to the agreement on the conclusion and execution of the disputed contract (business correspondence of the parties, invoices, payment orders, the acts of reconciliation, evidence of the parties, etc.).

Today, the law does not clearly regulate drawing contracts through electronic communications. Consequently, the issue of electronic contracts requires a more detailed and thorough study, both from the regulatory and practical aspects of electronic contracts application in civil law relations.

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УДК 338.488.2:640.43(477.54)

SPATIAL ORGANIZATION OF RESTAURANT INDUSTRY IN KHARKIV REGION

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Summary: The article defines the term «restaurant industry», its place in economic development, have been analyzed the dynamics of trade turnover of restaurant industry companies, their number and the factors affecting on the distribution of restaurants' network by districts of Kharkiv region have been found out.

Key words: cafe, cafeteria, catering, public catering, restaurant industry, trade turnover of restaurant industry enterprises.

Анотація: В статті визначено поняття «ресторанне господарство», його місця в розвитку господарства, проаналізовано динаміку розвитку товарообороту підприємств ресторанного господарства, їх чисельності та з'ясовано чинники, які впливають на розподіл мережі ресторанного господарства по районах Харківської області.

Ключові слова: громадське харчування, їдальні, кафе, кейтеринг, ресторанне господарство, товарооборот підприємств ресторанного господарства.

Аннотация: В статье определено понятие «ресторанное хозяйство», его место в развитии хозяйства, проанализирована динамика развития товарооборота предприятий общественного питания, их численности и выяснены факторы, влияющие на распределение сети ресторанного хозяйства по районам Харьковской области.

Ключевые слова: кафе, кейтеринг, общественное питание, ресторанное хозяйство, столовые, товарооборот предприятий ресторанного хозяйства.

Relevance. One of the components of the service sector is service in restaurants or catering. Restaurant industry is a sector of economy, a set of enterprises, which provides production, distribution and organization of culinary products' consumption [2, p. 405]. Restaurants contribute to saving of social work, material resources, increase of free time of visitors, provide income into the state budget from local residents, tourists; stimulate development of economy, promote meetings with people, expand business contacts, develop public and cultural life.

But along with the constant development of the industry there are disproportions in territorial organization of restaurant industry at a regional level, in particular in Kharkiv region. Therefore the purpose of our research is to analyze territorial differences in development of restaurant enterprises' network in Kharkiv region.

Theoretical research of organization in restaurant industry enterprises was studied by N.O. Puatnitska [3], V.V. Arkhipov [1], L.I. Nechuk [5], N.N. Liashuk [4] but they consider this activity area in terms of economics and management or at

the national level. However, there is shortage of literature on territorial features of the development in this sector at the district levels and regions.

The network of restaurant industry includes restaurants, cafés, coffee bars, dining halls, beerhouses, dumpling bars, snack bars, snack-bar serving patties bars, pizzerias, culinary shops.

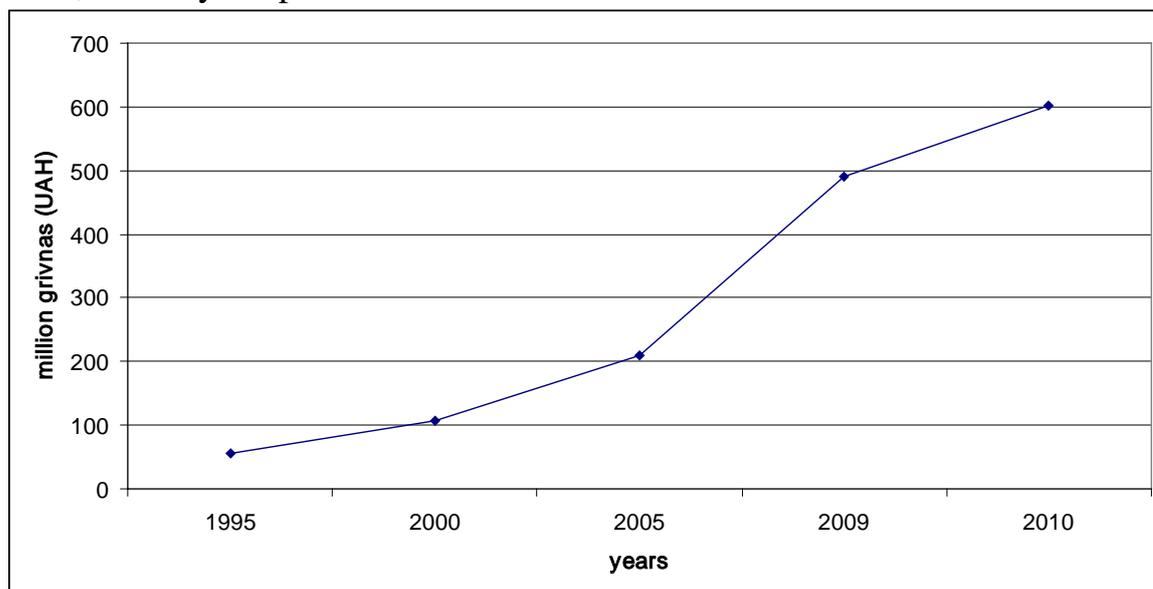


Fig. 1. Trade turnover's evolution of restaurant enterprises in Kharkiv region in 1995-2010 [6, p. 205]

The important factor which characterises the activity of restaurant industry enterprises is a turnover. Fig. 1 shows that trade turnover of restaurant enterprises is constantly increasing. It is connected with inflation, rise in food prices and, accordingly it is reflected on the prices of different dishes, and from the consumers with the view point constantly growing requirements for these services. Evolution of restaurant facilities has unstable dynamics but lately the number of the facilities has been decreasing (figure 2), which is connected with crisis phenomena, as a result some catering enterprises became bankrupt, a competition also gives some results.

In the structure of the restaurant enterprises in Kharkiv region cafeterias and cafes dominate – these types are more accessible by prices level for ordinary citizens, therefore they are widely spread in the region (Fig. 3). Accordingly, there are fewer restaurants because they are of high prices, but the restaurants guarantee high service quality.

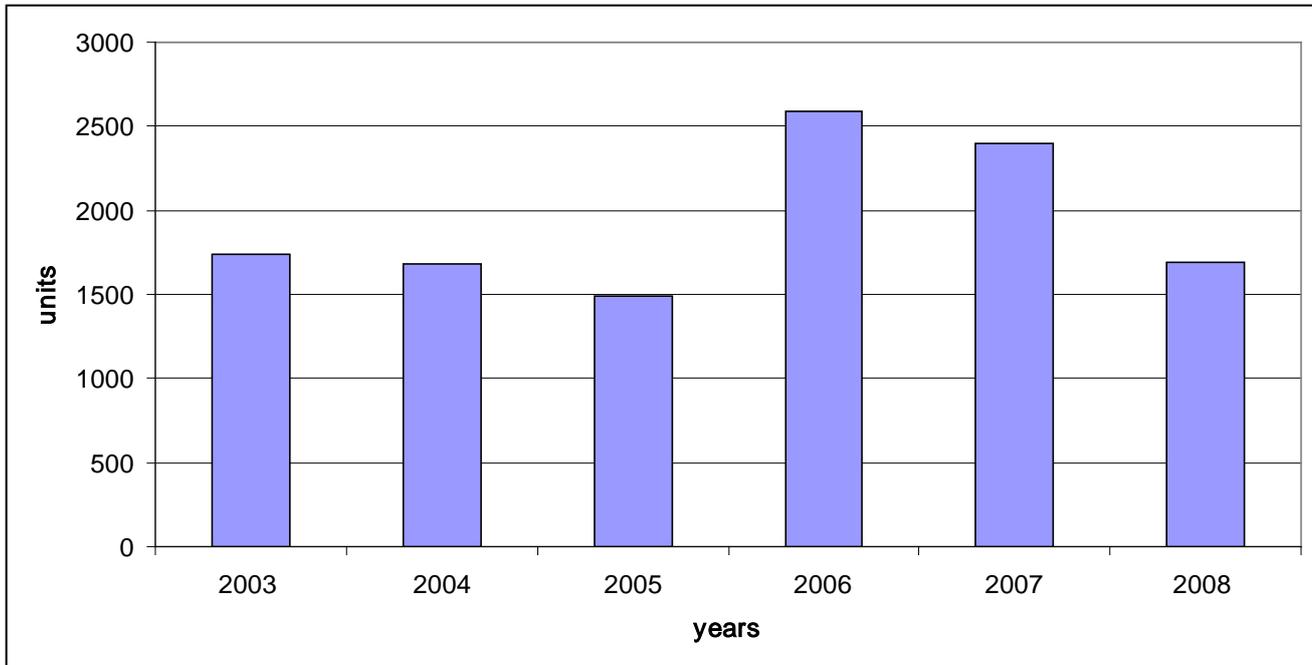


Fig. 2. Evolution of restaurant enterprises number in Kharkiv region in 2003-2010 [6, p. 215]

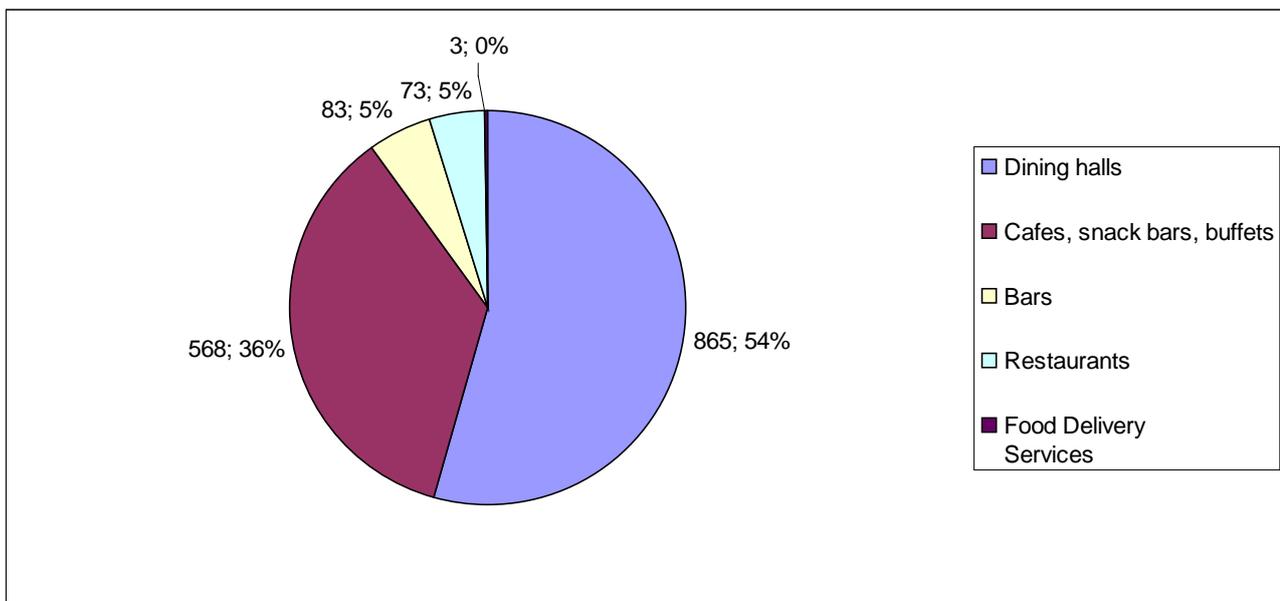


Fig. 3. Specialization of restaurant enterprises network in Kharkiv region in 2010 [6, c. 218]

Recently we have noticed a trend in moving services transfer from restaurant enterprises' halls to workplaces (offices, agencies), recreation zones and homes. Modern enterprises have been opened in towns and districts of region: cosy and comfortable mini-restaurants for a small number of visitors, fast food enterprises like "Бистро", "Pizza", «Пузата хата» which specialize in cooking dishes of Ukrainian cuisine [7].

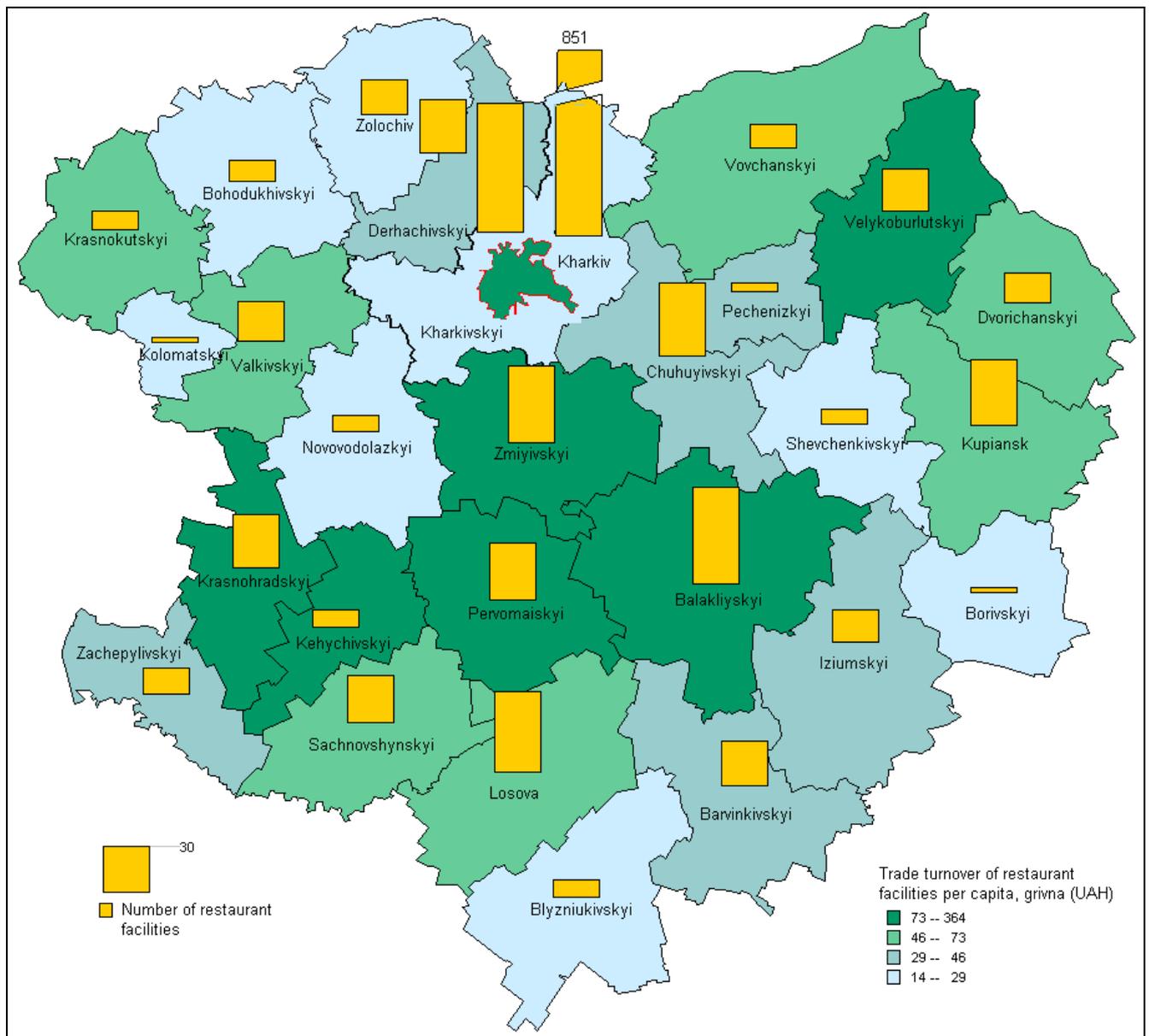


Fig. 4. Restaurant service of Kharkiv region's population in 2010 [6, c. 217]

The distribution of restaurant enterprises trade turnover levels in Kharkiv region is uneven (Fig. 4). The highest trade turnover level is in Kharkiv. This is due to **the** presence of a powerful consumer **like the** population of a city. As the purchasing power is higher in Kharkiv than in other towns of the region, the network of restaurants, cafes is wider there, and there is a large assortment of service types. Balakliyskiy, Valkivskiy, Krasnohradskiy, **Kupiansk**, Lozova, Pervomaiskiy **districts are the** transportation centers, and so there is a demand on the catering services. Hotel industry develops together with restaurant industry, that is demonstrated by Zmiyivskiy district. There are significant tourist flows in Krasnohradskiy district which requires catering services. Catering services are poorly developed in the most depressed areas (Kolomatskiy, Novovodolazkiy, Borivskiy, Blyzniukivskiy, Bohodukhivskiy, Zolochiv **districts**). A small share of trade turnover per capita is in Kharkivskiy, Chuhuyivskiy, Derhachivskiy districts which is explained, on the one hand, by the fact that district residents are catered in the regional center, and, on the other hand, the development of this sphere in district is insufficient.

Conclusions. So, we can conclude that restaurant industry is one of the main components in services ones for the population of a region, restaurant activity is unevenly distributed in Kharkiv region, the overwhelming number of establishments

is located in Kharkiv, the rest is located in small towns of the region. In the absence of real research in restaurant system development there is the need to continue social and geographical research to solve problems even in the distribution of the restaurant activity at the regional level.

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УДК 539.1 (470+571)

RUSSIAN NUCLEAR INDUSTRY

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Summary: The article deals with the problems of Nuclear Industry in Russia. Nuclear physics is researched at different periods of its development. The conclusion is made that the technologies have been tested and are being optimized in the process of design and construction.

Key words: atom, nuclear industry, nuclear physics, radioactive material, reactor, uranium fuel.

Анотація: В статті розглядаються проблеми ядерної промисловості в Росії. Ядерна фізика досліджується на різних етапах її розвитку. Було зроблено висновок, що в процесі дизайну та конструкції були протестовані та оптимізовані технології.

Ключові слова: атом, радіоактивний матеріал, реактор, уранове паливо, ядерна промисловість, ядерна фізика.

Аннотация: В статье рассматриваются проблемы ядерной промышленности в России. Ядерная физика исследуется на разных этапах ее развития. Было сделано вывод, что в процессе дизайна и строения были протестированы и оптимизированы технологии.

Ключевые слова: атом, радиоактивный материал, реактор, урановое топливо, ядерная промышленность, ядерная физика.

Russian research into nuclear physics goes back to 1918 when a special office (Department Number One) was set up with the Academy of Sciences Committee for natural and production resources. The new department was to organize exploration of

rare and radioactive materials. In 1920, the first session of atomic committee took place with the famous physicist Abram Ioffe. The next year the Radium laboratory was founded (later Radium Institute) under the Academy of Sciences. It was headed by Vitaly Khlopyn.

The first Soviet conference on nuclear physics was held in Leningrad in 1933. It gave a strong start to further investigations. A year later, Alexander Brodsky produced the first heavy water in the USSR. In 1935, Igor Kurchatov and his team discovered nuclear isomerism. Within two years, the first accelerated proton beam was produced at Radium Institute cyclotron, the only one in Europe at that time.

In 1940, the Presidium of the Soviet Academy of Sciences approved the program of the first Soviet uranium project.

In the midst of World War II, the State Defense Committee decided to resume the nuclear physics studies suspended because of the war. They decided to continue studies on the possibility of creating a uranium bomb or uranium fuel.

In 1943, Instrumentation Laboratory No. 2 (currently known as Russian Research Center Kurchatov Institute) was established with the Academy of Sciences. Professor Igor Kurchatov was appointed as the scientific leader of all uranium research. The activities performed at that time investigations into uranium fission physics and isotope separation, studies on radiochemistry and uranium metallurgy. In 1944, Igor Kurchatov obtained, for the first time, a detectable amount of plutonium at cyclotron M-1, which allowed studying chemical properties of this element.

Thanks to the effort of scientists the work was progressing fast. In 1946, the scientists led by Igor Kurchatov attained self-sustained uranium chain reaction for the first time in Eurasia. The first Soviet nuclear charge (RDS-1) was successfully tested in Semipalatinsk on August 9, 1949.

In 1953, the Ministry of Medium Machine Engineering (Minsredmash) was established. The successful development and testing of the nuclear weapons opened the door to the civil nuclear power. The world's first nuclear power plant was put into operation in Obninsk (near Moscow) in 1954. The plant – a 5 MW uranium-graphite pressure-tube reactor AM cooled by water – was built under Igor Kurchatov's leadership. The reactor got the name AM that means 'peaceful atom'. The chief designer was Academician Nikolai Dollezhal.

In June 1955, Igor Kurchatov and Anatoly Alexandrov headed the development of the Soviet nuclear power program. The program was aimed at the large-scale use of atomic energy for electricity generation, transport and other civil applications. The world's first fast neutron zero power reactor BR-1 was put in operation in 1955. The key nuclear institutions were set up at that time, including Institute of Theoretical and Experimental Physics in Moscow, Joined Institute of Nuclear Research in Dubna, Institute of Physics and Power Engineering in Obninsk, Research Institute of Inorganic Materials in Moscow.

The Kurchatov Institute provided the scientific guidance and support for construction of the first nuclear submarine (Project K-3, in 1957) and development of a new shipbuilding line – nuclear icebreakers which provided year-round navigation in the northern seas. The first nuclear-propelled icebreaker Lenin was launched in 1959.

They began the construction of the nuclear power plants. In 1964 the first 210 MW unit was put on line at Novovoronezh NPP, then the world's first fast power reactor BN-350 in Shevchenko (now Aktau in Kazakhstan) in 1973. A year later, the first 1000-MW RBMK reactor was put in operation at the Leningrad NPP. Extensive construction of large NPPs was deployed in the Eastern Europe.

A serious accident that occurred at the Chernobyl plant in April 1986 all but stopped nuclear power advancement. Soviet and global nuclear power went into deep recession in the 1990s, falling into stagnation. In 1992 the Russian part of the former Soviet Ministry of Atomic Energy and Industry was transformed into the RF Ministry for Atomic Energy. They inherited approximately 80% of the enterprises and 9 nuclear power plants. It was the time, when the industry had to restore the economic and production links broken during the recession, built new manufacturing plants. The industry survived the hard times and managed to keep its potential and human resources.

In 2004, the Atomic Energy Agency was established. The first head of the Agency was Alexander Rumyantsev and then in 2005 Sergey Kirienko.

New great tasks were set for the Federal Agency. They are the Development of Nuclear Power and Industry Complex of Russia in 2007-2010 and until 2015, according to which 26 new nuclear power units are to be commissioned in the country before 2020.

The Presidential order established State Atomic Energy Corporation "Rosatom" (shortly ROSATOM) in December of 2007 instead of the abolished Federal Atomic Energy Agency. Sergey Kirienko was appointed the Director General of the new Corporation. In 2008, Atomflot was transferred to ROSATOM.

ROSATOM provides integrated control over the use of atomic energy, ensures stable operation of civil and defense nuclear facilities, takes care of nuclear and radiation safety. It is also responsible for fulfilling the international commitments of Russia on the peaceful use of atomic energy.

Now let me say a few words about safety insurance and safety from external threats. The design of modern Russian NPP meets all the up-to-date international requirements for safety. It combines active (requiring human interference and a power source) and passive (not requiring operator's actions and a power source) safety systems. In particular, it employs four active safety system channels which are mutually redundant, as well as a core melt trap, a system for passive heat removal from under containment and a system for passive heat removal through steam generators. All engineering solutions have been well-tested and are tested in the course of design, construction and commissioning program of Leningrad II NPP (phase one). Experts believe that after commissioning the serial NPP will be in line with the safest plants in the world. Four active redundant safety trains, core-catcher, Passive systems of heat removal (from containment and steam-generators) are used in the design.

Declared safety and economic characteristics are guaranteed by reference, licensability and developed construction technology.

All the technical approaches have been tested and are being optimized in the process of design, construction and commissioning works. According to the experts, after its commissioning the ordinary Russian NPP will be one of the safest NPPs in

the world. Besides, the design provides for at least 20 automated radiation monitoring posts within a radius of more than 10 km, and the acquired information will be available to any resident of the region.

The design of modern Russian NPP are defended from flight accidents, hurricanes, waterspouts, tornados, snow and ice loads, seismic loads, outside explosions, flooding. The NPP design provides a possibility of aircraft crash. Safety related components are designed with due regard for the wind load corresponding to wind velocity 30 m/s at a height of 10 m. Design loads are those induced by the whirlwind of class 3.60 according to Fujita scale. Peak (extreme) snow load according to design equals 4.1 kPa. The NPP is designed with allowance for the earthquake which maximum horizontal acceleration at ground level equals 0.25 g.

The NPP safety-related components are designed with due account for the shock wave caused by outside explosion. The pressure at shock wave front is taken equal to 30 kPa, compression stage time – 1 s. The NPP is designed with possible flooding taken into account.

And now I want to say several words about our visit to nuclear power plant in Kursk. 17 students from our Gubkin Institute of the Moscow State Open University together with our teachers Galina Kolesnikova and Anatoly Bikov were in Kursk. We visited Kursk nuclear power plant. We had the unique opportunity to see everything by our own eyes and ask questions. We were in machinery hall, at a block control



panel, in the room of dosimeter control and in the central hall of the first power unit. We were very impressed by the system of control at the entrance to the zone of control access. We paid attention to that fact that they constantly perform dosimeter control monitoring in every work room and in 30 km zone. We also attended the center of social information of Kursk nuclear power plant where we got acquainted with exhibition and museum expositions. The knowledge which we have got there will help us in our future profession. So the excursion was very useful for us. Now we can imagine in reality how atom energy is transforming in electric power.

The Reactor Hall of Kursk NPP



The students from the Gubkin Institute in the Kursk Nuclear Power Plant

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УДК 629=111

STUDY OF THREE – WHEELED VEHICLE STABILITY AND STEERABILITY

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Summary: The article considers the most common and used arrangements of three-wheeled vehicles and analytic expressions for determine critical speeds.

Key words: three – wheeled vehicle, critical speed.

Стаття: У статті розглядаються найбільш загальноприйняті й використані формули трьохколісних транспортних засобів та аналітичні вирази для визначення критичної швидкості.

Ключові слова: трьох колісний транспортний засіб, критична швидкість

Статья: В статье рассматриваются самые общепринятые и использованные формулы, и аналитические выражения для определения критической скорости.

Ключевые слова: трехколесное транспортное средство, критическая скорость.

At this stage of development when the world faced the energy crisis, in the automobile market there is a tendency to reduce cars fuel consumption and hybridization of power plants. Also there is a tendency to reduce the dimensions of vehicles so that they could go along jammed municipal roads without problems. Therefore the world's car manufacturers are forced to seek alternative schemes of

transport vehicles. The most suitable option that satisfies these conditions is a three-wheeled vehicle (tricycle).

Due to its low fuel consumption and small sizes, tricycles are ideal for city traffic. Tricycles drivers can easily deal with traffic jams and not spend much time searching for parking. The ecological state of big cities will improve if motorists will choose small, eco-friendly vehicles but not huge, irrationally powerful cars.

There is a large number of different schemes of wheel arrangements of three-wheeled vehicles produced today. The most common and used arrangements are given below:

- with one front steering wheel;
- with two front steering wheels;
- with a single rear steering wheel;
- with a front steering wheel and a tilting body.

Let us consider the analytic expressions for determining the critical speeds V_s, V_r , for each layout drawing of tricycles separately, where: g – acceleration of gravity; R – the distance from the center of tricycle turn to its longitudinal axis; β – lateral tilt of the road; φ_y – coefficient of cross adhesion of tires with the road; a, b, h – coordinates of the center of mass C of a tricycle; L, B – tricycle base and track; θ – steering angle; δ_1, δ_2 – front wheel slipper angles and slipper angles of the axis center of tricycle rear wheels; m – tricycle weight; k_1, k_2 – resistance coefficients of the tricycle front and rear wheels slipper; V – the current speed; ψ – coefficient of the road resistance; γ – deflection angle of inertia centrifugal force from the normal to the longitudinal axis of the tricycle; ν – the tricycle body tilting angle; α, ζ – the angles shown in the diagrams; r_1, r_2 – rolling radii of the front steering wheel and rear wheels; n – arm of impressing gravity force; h_y – the arm of impressing cross to the tipping axis of inertia centrifugal force component F_{yo} (Fig.1).

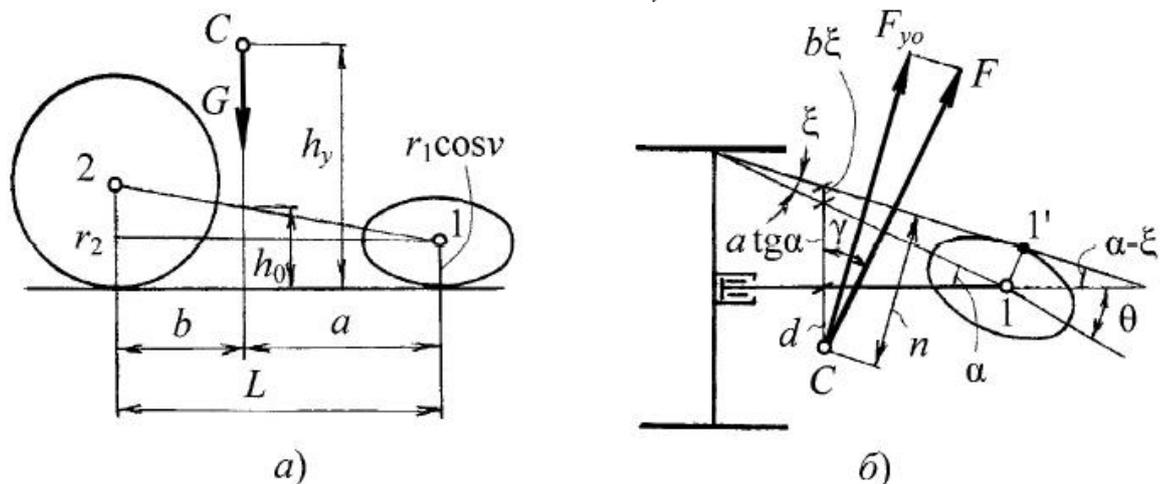


Fig.1. Scheme of determine the heights of the rotation axis of the body h and inertial forces (a), and the shoulder n of the force of gravity (b) [3].

Analytical expressions to determine critical speeds V_s, V_r for different tricycles wheel arrangements:

1. Tricycles with one front steering wheel [1]:

$$V_s = \sqrt{\frac{gR[\sin \beta + \varphi_y(a + b \cos \theta) / L]}{\cos \beta}} \quad (1)$$

$$V_r = \sqrt{\frac{gR(h \sin \beta + a \sin \alpha \cos \beta) \cos \gamma}{(h \cos \beta - a \sin \alpha \sin \beta) \cos(\alpha - \gamma)}} \quad (2)$$

where $R = L/[tg(\theta - \delta_1) + tg\delta_2]$; $\delta_1 = \frac{mb}{k_1 L} \left(\frac{V^2}{R} + \psi g \sin \theta \right)$; $\delta_2 = \frac{mV^2 a}{2k_2 LR}$;

$tg\gamma = (b - Rtg\delta_2) / R$; $tg\alpha = B / 2L$.

2. Tricycles with two front steering wheels [1]:

$$V_s = \sqrt{\frac{gR[\sin \beta + \varphi_y(a + b \cos \theta) / L]}{\cos \beta}} \quad (3)$$

$$V_r = \sqrt{\frac{gR(h \sin \beta + b \sin \alpha \cos \beta) \cos \gamma}{(h \cos \beta - b \sin \alpha \sin \beta) \cos(\alpha + \gamma)}} \quad (4)$$

where $R = L/[tg(\theta - \delta_1) + tg\delta_2]$; $\delta_1 = \frac{mb}{2k_1 L} \left(\frac{V^2}{R} + \psi g \sin \theta \right)$; $\delta_2 = \frac{mV^2 a}{k_2 LR}$;

$tg\gamma = (b - Rtg\delta_2) / R$; $tg\alpha = B / 2L$.

3. Tricycles with a single rear steering wheel [1]:

$$V_s = \sqrt{\frac{gR[\sin \beta + \varphi_y(a \cos \theta + b) / L]}{\cos \beta}} \quad (5)$$

$$V_r = \sqrt{\frac{gR(h \sin \beta + b \sin \alpha \cos \beta) \cos \gamma}{(h \cos \beta - b \sin \alpha \sin \beta) \cos(\alpha - \gamma)}} \quad (6)$$

where $R = L/[tg(\theta + \delta_2) - tg\delta_1]$; $\delta_1 = \frac{mb}{2k_1 L} \left(\frac{V^2}{R} + \psi g \sin \theta \right)$; $\delta_2 = \frac{mV^2 a}{k_2 LR}$;

$tg\gamma = (a + Rtg\delta_1) / R$; $tg\alpha = B / 2L$.

4. Tricycles with a front steering wheel and a tilting body [4]:

$$V_s = R \sqrt{\frac{g[\sin \beta + \varphi_y(a + b \cos \theta) / L]}{(R - d) \cos \beta}} \quad (7)$$

$$V_r = R \sqrt{\frac{g(h_y \sin \beta + n \cos \beta) \cos \gamma}{(h_y \cos \beta - n \sin \beta)(R - d) \cos(\gamma - \alpha + \zeta)}} \quad (8)$$

where $R = L/[tg(\theta - \delta_1) + tg\delta_2]$; $d = [h - (ar_2 + br_1 \cos \nu) / L] \sin \nu$;

$h_y = h \cos \nu + (ar_2 + br_1 \cos \nu)(1 - \cos \nu) / L$; $\delta_1 = \frac{mb}{k_1 L} \left(\frac{V^2}{R} + \psi g \sin \theta \right)$; $\delta_2 = \frac{mV^2 a}{2k_2 LR}$;

$$\operatorname{tg} \gamma = (b - R \operatorname{tg} \delta_2) / (R - d); \quad \zeta = r_1 \sin \nu / \sqrt{(B/2)^2 + L^2}; \quad \operatorname{tg} \alpha = B/2L;$$

$$n = (d + a \operatorname{tg} \alpha + \zeta b) \cos(\alpha - \zeta).$$

Having calculated the critical speeds V_s, V_r for all considered tricycles schemes, we obtained the following values of these quantities using respective input data:

$$R = 10 \text{ m}; \quad \beta = 2^\circ; \quad \varphi_y = 0,8; \quad a = 1,32 \text{ m}; \quad b = 1,08 \text{ m}; \quad h = 0,6 \text{ m}; \quad L = 2,4 \text{ m}; \quad B = 1,2 \text{ m};$$

$$\theta = 15^\circ; \quad m = 600 \text{ kg}; \quad V = 35 \text{ km / hour}; \quad \psi = 0,011; \quad \nu = 30^\circ; \quad k_1 = k_2 = 85 \cdot 10^3; \quad r_1 = r_2 = 0,21 \text{ m}.$$

1. Tricycles with one front steering wheel:

$$V_\zeta = 30,63 \text{ km / hour}; \quad V_i = 25,7 \text{ km / hour}.$$

2. Tricycles with two front steering wheels:

$$V_\zeta = 30,59 \text{ km / hour}; \quad V_i = 24,05 \text{ km / hour}.$$

3. Tricycles with a single rear steering wheel:

$$V_\zeta = 30,53 \text{ km / hour}; \quad V_i = 23,26 \text{ km / hour}.$$

4. Tricycles with a front steering wheel and a tilting body:

$$V_\zeta = 30,54 \text{ km / hour}; \quad V_i = 82,41 \text{ km / hour}.$$

Thus, having calculated all the values of critical speeds V_s and V_r , it was determined that the most stable three-wheeled vehicle scheme - is a tricycle with a front steering wheel and a tilting body.

Tricycles turnability and stability is a major problem when designing these vehicles. Tricycles stability and turnability insurance especially in the most difficult movement mode - on turns, allows not only to save life and health, to ensure safety of road constructions and the wheeled vehicle itself but also increase the average speed and thus efficiency. A tricycle with a tilting together with a steering wheel body also allows ensuring the safety of rectilinear motion along the roads with lots of turns. That is particularly important and relevant for maneuvering in small, narrow city streets.

Development of tricycles is so topical for a world automobile production that it is necessary to develop and embody this idea.

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GPS TRACKING AND ITS APPLICATIONS

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Summary: The article deals with GPS tracking and application. The location of the device is analyzed. The price of the GPS technology is considered. The combination of GPS and other technologies is studied. The conclusion is made that the principle application of GPS tracking is providing the technology in augment existing systems.

Key words: augment system, cell phone, GPS software, GPS tracking, network, satellite.

Анотація: Стаття пов'язана з GPS навігацією та її використанням. Було проаналізовано базові властивості цього приладу. Робота розглядає цінову політику GPS технологій, поєднання GPS з іншими приладами. Було зроблено висновок, що основне використання GPS навігації забезпечує розширення використання існуючих систем.

Ключові слова: мережа Інтернет, GPS навігація, GPS обладнання, система розширення, стільниковий телефон, супутник.

Аннотация: Статья рассматривает GPS навигацию и ее применение. Анализируются базовые свойства этого устройства. Работа охватывает ценовую политику GPS технологий и совместимость GPS с другими устройствами. Был сделан вывод, что основное использование GPS навигации обеспечивает расширение использования существующих систем.

Ключевые слова: мобильный телефон, GPS навигация, GPS оборудование, сеть Интернет, система расширения, спутник.

Being able to pinpoint the location of a device on the planet Earth raises some interesting ideas and applications. Primarily, GPS (Global Positioning System) was intended to be released to the consumer market as a way to aid navigation. However, since the price of the GPS technology has fallen, many companies have found new ways to apply it. It has led to many innovations, among them "GPS Tracking".

The principle behind GPS is that receivers are able to use the technique of "trilateration" to calculate their coordinates on the Earth by measuring the time taken for signals from various satellites to reach them. [1, p. 48]. The GPS software will account for any irregularities in the signal strength and clock differences between itself and the GPS satellite network by using signals from four separate satellites to improve accuracy. Usually the coordinates are then used to locate the GPS device on a map, which is either displayed to the user or used as a basis for calculating routes, navigation, or as input into mapping programs. For example, specific coordinates can be stored as waypoints allowing the user to retrace their steps by calculating the direction and distance to each waypoint that they have stored. In fact, it is this use which represents the simplest form of GPS tracking. The user is able, using a portable GPS device, to keep a track of where they have been, in order to be able to either retrace their steps, or follow the same path again in the future.

When combined with other technologies such as GPS phones, this also gives the possibility for other users of GPS to follow in the footsteps of the initial user [2]. When GPS-tracking is combined with other broadcast technologies, it becomes very useful. GPS watches, for example, can be fitted with a GPS receiver which is capable of calculating its position, while also broadcasting that using a miniature radio transmitter. The signal is relayed to a command center equipped with GPS software

systems which can track the position of the wearer, and either store it as a path or relay that information to a third party. That third party could be an anxious parent, or the police. There are a variety of GPS phones and wristbands which are sold in conjunction with a service which enables third parties to find out where their charges are at any time of the day or night.

It is particularly useful when using GPS units attached to vehicles which have distinctive identification such as numbers. The same principle applies as for a GPS tracking device designed to be worn by a human, except that the GPS is integrated within the vehicular electronics. This serves two purposes. On the one hand, it provides the driver with an integrated GPS system, without the necessity to purchase a car navigation system, or a PDA-based GPS system, whilst also offering the possibility to relay that information via a radio or cell phone transmitter.

In fact, these systems have already been tried in the field, primarily as a vehicle locator in the event that the vehicle to which the GPS vehicle tracking system is attached is stolen. The police, once informed, can find out from the control center where the vehicle is, and proceed to track it physically.

A useful consequence of being able to use GPS vehicle tracking to locate a vehicle is that the manufacturer can also use the information to alert the driver as to when they are near a service center.

If, along with the GPS coordinates, the system relays telemetry information such as the status of the engine, time since the last service, or even information not relating to defects, the receiver of this information can make a decision as to what kind of alert to pass on to the driver. [3]

GPS also opens up the possibility to allow for coordinated vehicle tracking, in which GPS tracking is used to share location information between several vehicles, all pursuing the same end goal.

The basic GPS functionality is the same however, and units can either share that information with each other, or a central point. For example, the central point can be a boat, which has on-board computer systems capable of reconciling all the locator information along with a map, thus allowing the different vessels to coordinate their actions.

GPS also has military applications, of course, where units can share, in real time, information about their location, even when line-of-sight is no longer possible. In the past, this was done by relaying often inaccurate map coordinate estimations; now the locations can be called in with high absolute accuracy.

Despite its high-tech military and commercial applications, as well as use in aviation GPS, the principal application of GPS tracking will be in providing an enabling technology to augment existing systems. These systems will include cell phones and vehicles, usually in conjunction with a central point of service designed to keep track of the location. The reason for this is to keep the cost of the actual GPS unit down as much as possible in order to supply a useful technology to consumers at an attractive price. [4, p. 94].

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УДК 62 – 588.1 = 111

DEVELOPMENT OF DUOFLOW GEARBOX

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Summary: A study of the latest designs of gearboxes. The design of duoflow gearbox, which meets modern requirements and makes the designed car competitive nowadays has been developed. The comparative analysis of the acceleration time of cars with conventional and double-flow gearboxes.

Key words: duoflow gearbox, switching time, the gear ratio, break of the power flux

Анотація. Проведено вивчення найновіших конструкцій коробок передач. Розроблена конструкція двопоточної коробки передач, яка відповідає сучасним вимогам і робить проєктований автомобіль конкурентоздатним в наш час. Виконано порівняльний аналіз часу розгону авомобілів з традиційною та двопоточною коробкою передач.

Ключові слова: двопоточна коробка перемикавання передач, час перемикавання, передавальне число, розрив потоку потужності.

Аннотация: Проведено изучение инновационных конструкций коробок передач. Разработана конструкция двухпоточной коробки передач, которая соответствует настоящим требованиям и делает проектированный автомобиль конкурентоспособным в настоящее время. Произведено сравнительный анализ времени разгона автомобилей с традиционной и двухпоточной коробками передач.

Ключевые слова: двухпоточная коробка переключения передач, время переключения, передающее число, разрыв потока мощности.

Car racing is a ground for testing of new units and the improvement of control systems of vehicles units. Modernization of racing car designs is a major task for the further technological progress. The development of transmission is currently experiencing a new stage associated with the introduction of robotized gearbox with electronic control systems.

Mechanical transmissions that have high driving dynamics, high efficiency but a low level of comfort are used in sports cars.

Gearboxes with automatic change having lower efficiency and higher fuel consumption provide smooth driving.

An urgent subject for racing cars is the maximum reduction of acceleration time, which can be achieved by the absolute exclusion of movement of neutral gear phase during gear changes.

So, one of the biggest tasks in this field is design of duoflow transmission conducted for the car F-1600 (Fig. 1).

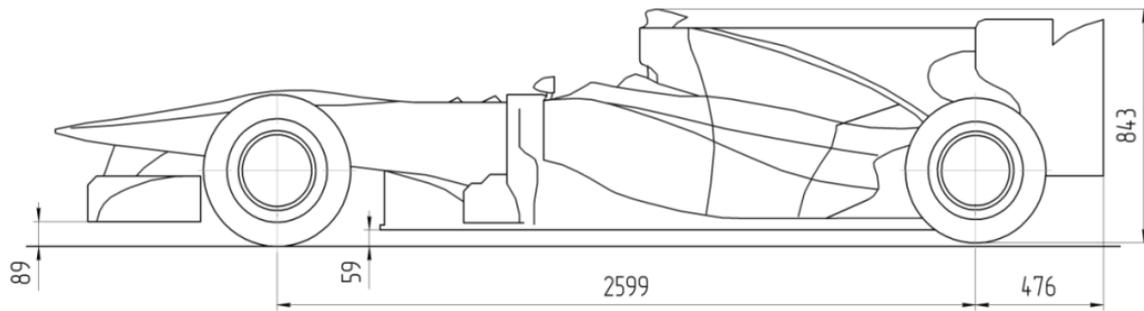


Fig 1. Scheme of bolide F-1600

There are several types of duoflow gearboxes:
 with two non-uniaxial intermediate shafts;
 without intermediate shafts;
 with two uniaxial intermediate shafts.

After the analysis of the designs the kinematic transmission scheme with synchronized pre-selective duoflow gearbox equipped with two uniaxial primary shaft was developed (Fig. 2). This option is the most compact and efficient for a given vehicle.

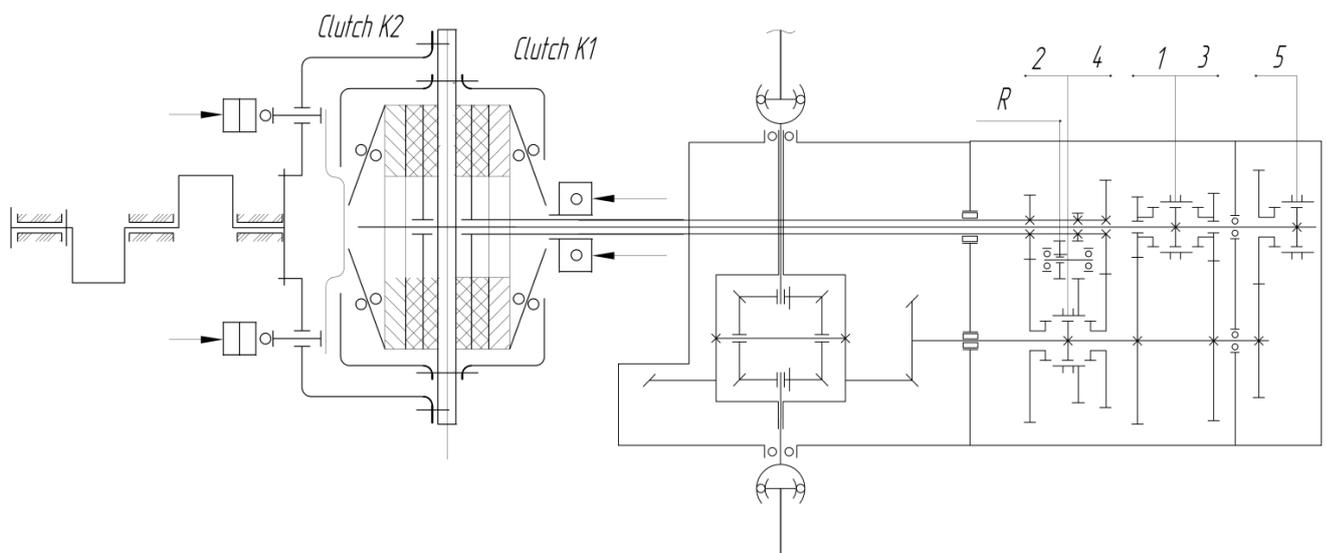


Fig 2. Kinematic scheme of transmission with duoflow gearbox

The engine of 1.6 liters car Mini Cooper S 1.6, which corresponds to the characteristics of the existing engine to analyze the traction-speed properties of the designed gearbox and to determine the advantages over a traditional gearbox, as a prototype, was adopted.

The data required for the design of the external high-speed characteristics and further analysis of traction speed parameters were obtained experimentally on the equipment of the Swedish company «Rototest» and were taken from the official site of its laboratory [2].

The engine power can develop to speed of 220 km/h, but in this case a number of transmission ratios which are commonly used by the team of the laboratory of racing cars of KhNAHU are applied. With these ratios a maximum speed of 188 km/h is provided.

The balance of power (Fig. 3) and dynamic characteristics graphs (Fig. 4), with marked dynamic factor curves for traction with the road having been designed, the parameters of stable and unstable motion depending on the coefficient of traction with the road (which in its depends on the temperature condition) was determined.

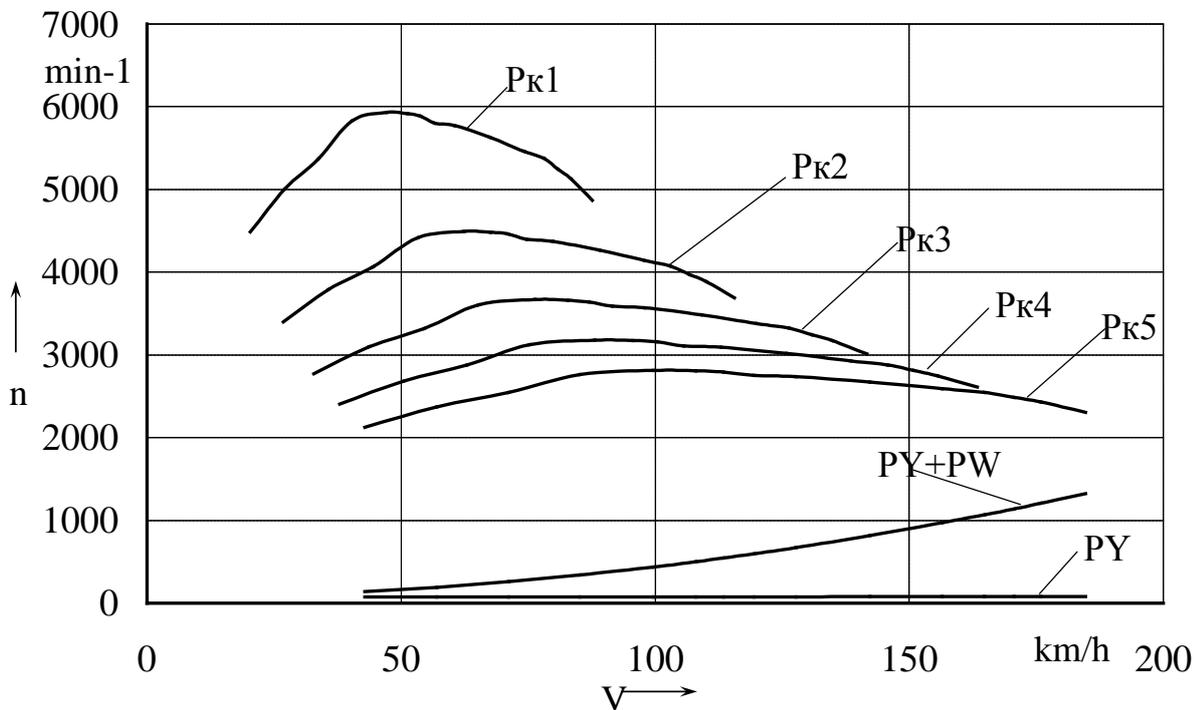


Fig 3. Balance of forces

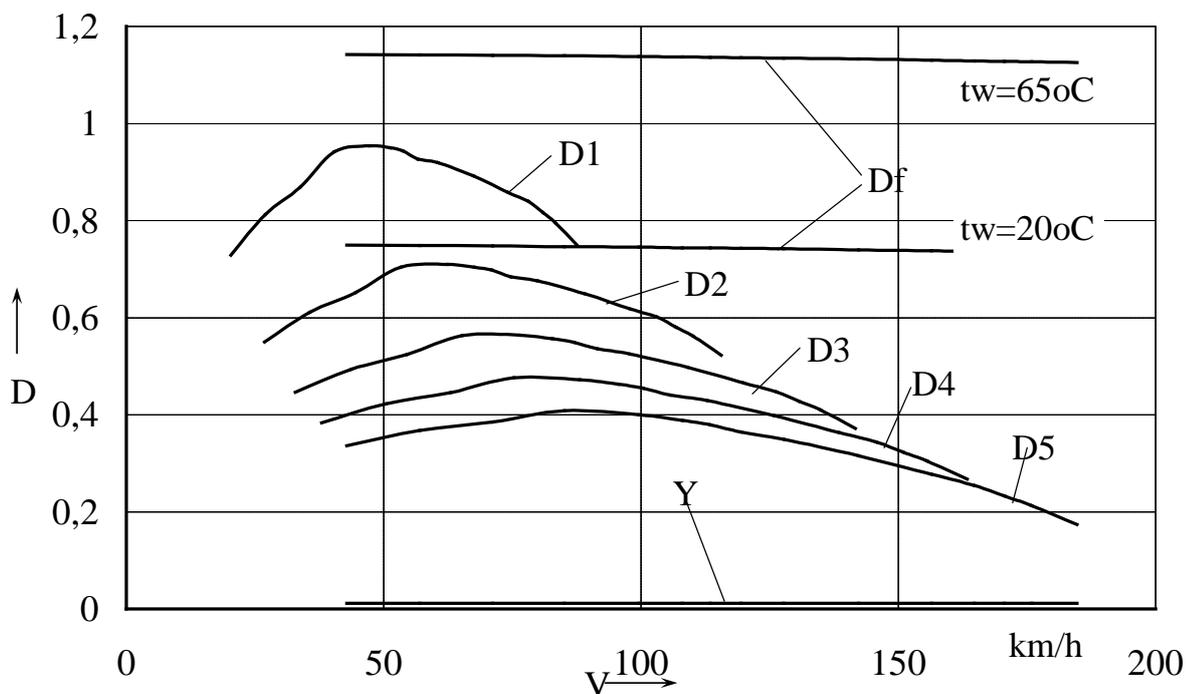


Fig 4. Dynamic characteristics

Taking into account that skidding of driving wheels does not occur with the selected number of transmission ratios to warm the wheels, it is possible to correctly compare the time of acceleration of the car with duoflow gearbox and traditional. (Fig.5)

The switching time for a classical gearbox in the mode of racing is 0.2 sec. With the drop of speed when driving in neutral gear while gears winning time in reaching the fifth gear is 1.129 sec.

At this stage of design simulation is carried out and the possibility of the usage of gear clutch instead of synchronizers in a gearbox is performed. This subject has not been considered yet.

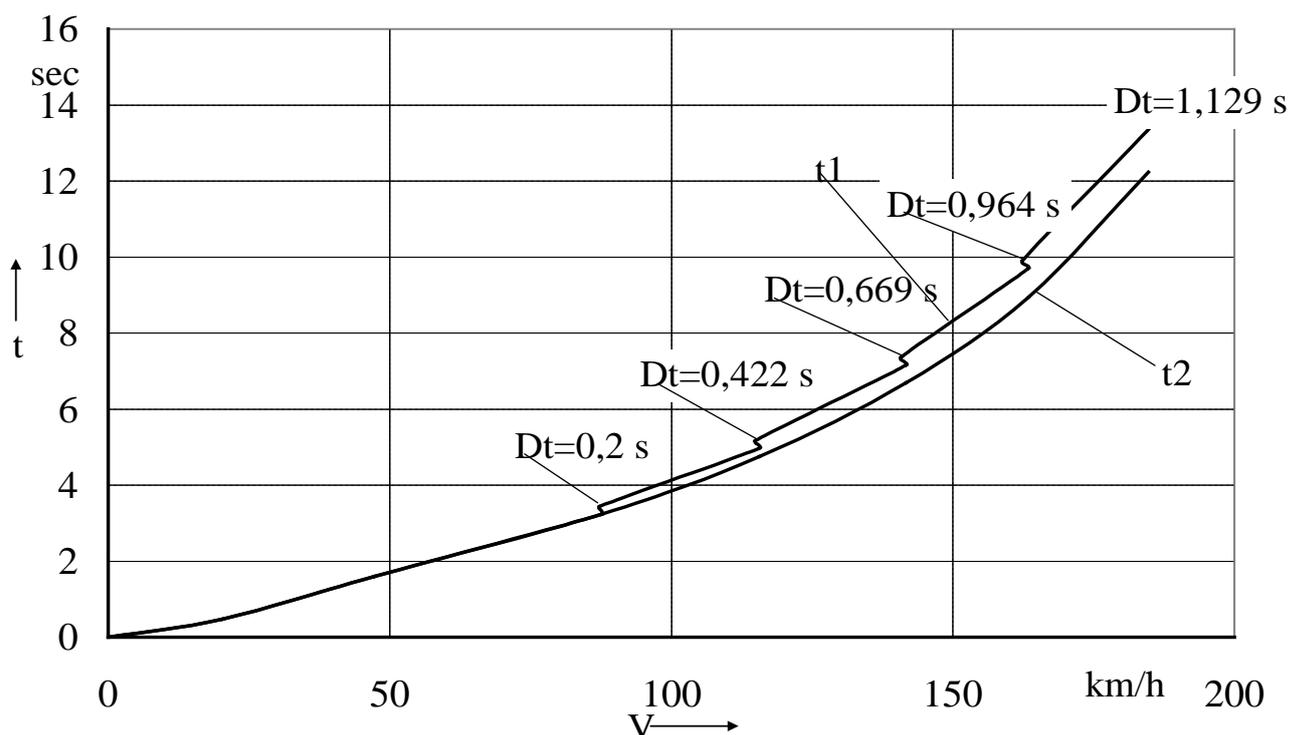


Fig 5. Comparison of acceleration time

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SOME ASPECTS OF BUILDING WEB-BASED SYSTEM OF MUTUAL EVALUATION OF THE ACHIEVEMENTS OF COMMUNITY MEMBERS

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Summary: In the work "Some aspects of building web-based system of mutual evaluation of the achievements of members of the community," revealed issues such as the problem of objective and not resource-intensive evaluation of the achievements, the automation of the evaluation process, an overview of different techniques, and discusses methods of protection against an artificial increase of the rating. The subject of the work is relevant to the field of web resources, as well as for all systems with the ability to assess materials and achievements of its members.

Key words: Break, community, evaluation, materials, rating, sabotage, system balance, web, web-based system.

Анотація: У роботі «Деякі аспекти побудови веб-зорієнтованої системи взаємного оцінювання досягнень членів спільноти» розкрито такі питання, як проблема об'єктивного і нересурсоємного оцінювання досягнень, автоматизація процесу оцінювання, огляд різних методик, а також розглянуті методи захисту від штучного збільшення рейтингу. порушені в роботі теми актуальні для області веб-ресурсів, а також для всіх систем з можливістю оцінки матеріалів та досягнень її учасників.

Ключові слова: веб-система, рейтинг, баланс системи, веб, злом, матеріали, оцінка, саботаж, спільнота.

Аннотация: В работе «Некоторые аспекты построения веб-ориентированной системы взаимного оценивания достижений членов сообщества» раскрыты такие вопросы, как проблема объективного и нересурсоемкого оценивания достижений, автоматизация процесса оценивания, обзор различных методик, а также рассмотрены методы защиты от искусственного увеличения рейтинга. Затронутые в работе темы актуальны для области веб-ресурсов, а также для всех систем с возможностью оценки материалов и достижений ее участников.

Ключевые слова: Баланс системы, веб, веб-система, взлом, материалы, оценка, рейтинг, саботаж, сообщество.

At the time, as the Internet evolves, it plays an increasingly important role in society, on the first place the subject of building balanced online communities gets. Their prime examples are forums, websites, personal and collective blogs, microblogs, news and thematic portals, social networks, chat rooms, and many others. On such platforms the exchange of information between the different visitors is usually organized, and the core community eventually formed, its permanent members, active users.

One way to stimulate the growth of the community, the accumulation of knowledge base, as well as to design the hierarchy is the system of rating points. Each member of the community is assigned a number (or reduced to numerical) parameter, which defines its importance to other community members [1, p. 19]. This parameter can characterize the level of professionalism of a user, its activity, the time elapsed since the beginning of resource use, and many other characteristics that define the authority of the user in a given social group.

Among other options we should highlight the rating points, which are exposed to a user as an estimate of their published materials. This method of introducing the rating is common for thematic communities (forums, personal and collective blogs, thematic web sites) that aim in accumulation of knowledge base, improving the quality of published material. In these more reputable, respected communities there are the users who publish popular, highly valued materials.

In the struggle for rating points, users can not only resort to the methods of honest competition, improving the quality of their submissions and publishing interesting and useful information for most of the community, but also by using various tricks. Omitting the error in the software separately consider the way in which users enter an agreement for mutual improvement rating, thus "winding" grade for their materials [1, p. 22].

This situation leads to what is submitted to the rating system and does not correspond to the reality, it does not show the relationship and the importance of the community.

Methods for assessing the achievements of members of the online community

To estimate the contribution of community members in many resources a system of rating points is used, which allows each user to put in correspondence with a number showing the level of importance among the other members of the community. Such a system is convenient because it is easy realizable, and the list of participants is amenable to simple sorting to build a hierarchy of community. There are two main methods of estimation of materials posted by users: evaluation by experts, and evaluation of all members of the community [2, p. 45]. There is a widespread mixed method in which the voices of all the users have different weights depending on their rank: voice of users with a higher ranking has more weight than the voice of customers with low rating score.

The basis of expert assessment based on the idea of attracting professionals who recognize the authority of the majority of the community and whose evaluation will be objective. Such a method is often used to evaluate materials, evaluation of which requires specialized knowledge. In cases where the opinion of the majority can break up with an objective assessment of the material, the administration resorted to the help of expert users with knowledge and the authority allows them to put the proposed assessment materials.

The positive aspects of peer review should include quality assessment, a low probability of unfair judging (a small number of judges to control the vote). But at the same time, this method requires large investments to the involvement of experts, the payment of their work. In addition the system is limited in terms of information being processed, requires constant monitoring by the administration.

Modern trends in building online communities are to provide even greater role in the creation of the material in the resource to its visitors, rather than the administration. The so-called Web 2.0-websites are playgrounds for structuring and placement of materials, whereas for the quality and quantity meet community members [2, p. 49]. Obvious examples of such resources are collective blogs, forums, wikis, etc. The administration of these sites shifts part of their duties to the community, identifying moderators, regulating the quality of materials through the ballot box. On such resources, all users can vote for it or other materials, thus

expressing their attitude towards the material to the author, publication, topic, etc. Voting on this site may be realized in various ways: from the simple (three states "yes", "no", "ignore") to the multi-level voting with different parameters of evaluation. On the positive side of this method of assessment should be its relatively low cost of maintenance (usually reduced to the maintenance of good technical platform), a natural promotion of the project through a set of users, increase visitor loyalty to the resource because of the feeling of involvement in the development of materials. However, this method has its downsides. Running such a vote requires a high level of refereeing by members of the community at the beginning of the project. The material on this site meets the evolving interests of the majority, which is unacceptable for some resources. For example, the professional forum can degenerate into a set of publications describing the most common operations for beginners as well as their votes in total votes exceed professionals calling for a rating upgrade materials with special knowledge. In addition, this method does not artificially inflate reduces the possibility of rating. Unscrupulous users can agree on a "cheat" rating to each other, so that the rating method will cease to display the actual picture of influence and importance of the community [1, p. 23].

In an attempt to combine the best aspects of all the above methods, many developers implement a mixed voting system. With this method of voice users are not identical, but depend on their ranking. This allows time to create some kinds of experts in various fields, whose opinion is more important than the view of the general public. At the same time non-professional opinion will make a smaller contribution to the vote and thus an overall assessment of the material will be more objective.

Given that the system suffered over most of positive aspects of the first two methods, it has also some drawbacks. Still there is no reliable way to deal with the artificial growth of rating, and in this case the situation is compounded: the weight of votes is equal to the fictitious experts' weight, which reduces objectivity in the evaluation of materials and reduces the overall system efficiency. At the same time, this system is self-regulating, which means that the appearance of unethical users can be corrected by the community without attracting the attention of the administration. There are several types of such mixed-mode, in which the rating and the vote is for the whole site, and for individual categories. Additionally, you can count user activity for some time eventually to reduce the effect of growth.

Analysis of the relationship between community members

To eliminate the problems associated with artificial increase rankings, you can use the special search algorithm subcommunities in the community on the basis of their interactions with each other. To do this, we should build a model society, and then analyze the relationship for the existence of isolated groups of users, within which the relationship is significantly higher than the one with users outside the group.

The other problem is user authorization. This is the other edge of the problem, which will be clearly described in our next work. The main material for the research is the problem of hidden authorization or strong methods for easy signing in. Accumulating the experience of software products such as Facebook, Twitter, we can

build the digest of common methods and different ways of communicating with users, authenticating and authorizing them. So this is the goal of our next work.

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УДК 51

MANKIND AND MATHEMATICS

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Summary: The article deals with the evolution of human thought that is reflected in mathematics and stresses the necessity of mathematics for the development of one's mental powers. The basic notions of mathematical science, such as the theory, the axiom, the function, inductive and deductive reasoning are analyzed; the areas where mathematics is applied nowadays are enumerated; new scientific tendencies that require mathematical background are specified.

Key words: theory, axiom, computer, control of vital parameters, function, inductive and deductive reasoning, logical reasoning, mathematical models of objects, orientation, stabilization.

Анотація: У статті описано еволюцію людської думки, що відображається у математиці, та наголошується на необхідності математики для розвитку розумових здібностей людини. Проаналізовано базові поняття математичної науки, такі як теорія, аксіома, функція, індуктивне та дедуктивне обґрунтування; перелічено сфери, в яких математика використовується у сучасному світі; уточнено нові наукові тенденції, що вимагають математичного підґрунтя.

Ключові слова: теорія, аксіома, комп'ютер, контроль за параметрами життєвого забезпечення, функція, індуктивне та дедуктивне обґрунтування, логічне обґрунтування, математичні моделі об'єктів, орієнтація, стабілізація.

Аннотация: В статье описана эволюция человеческой мысли, отображенная в математике, и сделан акцент на необходимость изучения математики для развития умственных способностей человека. Проанализированы базовые понятия математической науки, такие как теория, аксиома, функция, индуктивное и дедуктивное обоснование; названы сферы, в которых математика используется в современном мире; уточнены новые научные тенденции, требующие математического обоснования.

Ключевые слова: теория, аксиома, компьютер, контроль за параметрами жизнеобеспечения, функция, индуктивное и дедуктивное обоснование, логическое обоснование, математические модели объектов, ориентация, стабилизация.

Due to mathematical knowledge and skills we are able to solve not only arithmetical problems. This science allows us to develop flexibility of mind that we need to make an objective decision in any situation. To understand, to know the nature of a problem we must examine it from all sides that is possible due to imagination.

Mathematics has always been an integral and essential part of human culture, it is the key to the knowledge of the world, the basis of scientific and technological progress and an important component of personality development. Mathematics combines the features of willpower activity, speculative reasoning and the desire for

aesthetic perfection. Its basic and mutually contradictory elements are logic and intuition, analysis and design, generalization and specification [1, p. 3]. The facts prove that calculation appeared before the names of numbers. First, a man used the types of objects around him: fingers, pebbles, nodes, lines painted on the wall, notches on sticks and trees, piles of stones, etc. When the language appeared the words were associated only with the concepts that already existed and were easily recognized. The words "one", "two" and possibly "three" appeared regardless of calculation. When calculation became a widespread and common activity, verbal symbols were created for the most common or small groups of items.

The beginning of the period of elementary mathematics refers to the VIth-Vth century BC. By this time a sufficiently large amount of factual material was accumulated. Understanding of mathematics as an independent science emerged for the first time in ancient Greece. During that period, mathematical studies dealt only with a rather limited stock of basic concepts that emerged to meet the simplest requests of economic life. The development of arithmetic, the science of numbers, began.

In the frame of elementary mathematics appeared number theory, which grew gradually from arithmetic. The work of a large number of mathematicians involved in the solution of geometric problems in a coherent and rigorous system of elementary geometry was summarized in Euclidean geometry, as outlined in the excellent book – *Origins* (300 BC). With the increasing complexity of trade and agriculture people had to calculate more extensive ranges of objects, which required creation of more complex calculating devices, such as different counting mechanisms (abacus, soroban, suan-pan, etc.) and later in the Middle Ages there appeared mechanical counting devices: Pascal machine, Leibniz machine, slide rulers, etc.

In the XVIIth century the demands of science and technology led to creation of methods developed with the aim to study mathematically the motion of the processes of change and transformation of geometric figures. With the use of variables in analytical geometry and the establishment of differential and integral calculus mathematics began a period of variables. A great discovery of the XVIIth century made by Newton and Leibniz was the notion of infinitely small quantities, laying the foundations of infinitesimal analysis (mathematical analysis). Function became the main subject of study. The study of function led to the basic concepts of mathematical analysis: the limit, the derivative, the differential, the integral.

By this time a brilliant idea about the method of Descartes coordinates appeared. Besides, analytic geometry, which allows us to study the methods of geometrical objects of algebra and analysis, was created. On the other hand the coordinate method opened the possibility of a geometric interpretation of algebraic and analytic facts.

In the early XIXth century further development of mathematics led to the formulation of the problem of studying the possible types of quantitative relations and spatial forms.

Communication in mathematics and science was becoming more complex. New theories emerged not only as a result of inquiries of science and technology, but also as a result of the internal needs of mathematics. A remarkable example of one of these theories was the imaginary geometry of N.I. Lobachevsky. The development of

mathematics in the XIXth and XXth centuries is referred to the period of modern mathematics. The development of mathematics itself, mathematization of different fields, the penetration of mathematical methods in many areas of practice, the progress of computer technology led to new mathematical disciplines such as operations research, game theory, mathematical economics and others.

Constructing a mathematical theory is based on the axiomatic method. The core of a scientific theory is based on some assumptions, called axioms, and the rest of the theory is obtained as logical consequences of these axioms. The main methods of mathematical research are mathematical proof, i.e. rigorous logical reasoning. Mathematical thinking is not confined to logical reasoning. For a correct formulation of the problem, one needs mathematical intuition to assess the choice of methods [3].

Mathematics studies mathematical models of objects. The same mathematical model can describe the properties of totally different real-world phenomena. Thus, the same differential equation can describe the processes of population growth and decay of a radioactive substance. It's not the nature of the objects but the relations between them that is important for mathematics.

Two types of reasoning are used in mathematics: deduction and induction. Induction is a method of study in which a general conclusion is not based on individual cases. Deduction is a reasoning method by which the total of cases should be a conclusion of private nature.

Mathematics plays an important role in the natural sciences, engineering and humanities. The reason for penetration of mathematics into various branches of knowledge is that it offers a very clear model for the study of reality as opposed to less common and more diffuse models offered by other sciences. Without modern mathematics with its advanced logic, computing machinery could not be designed for various fields of human activity.

The mathematical science is not only a powerful tool for solving applied problems and the universal language of science, but also an element of general culture. For example, a rocket and a computer are two of the greatest technological achievements of the XXth century, which became its symbols. Moreover, computers and mathematical methods play a crucial role in the creation of space-rocket systems and space exploration.

The research of the outer space scales and speeds initiated by the mankind demanded the development of new mathematical methods of navigation and flight control of spacecraft, brand new technologies with the use of computers. High speed of spacecrafts made it almost impossible to directly control them in real-time mode as a spacecraft flies a distance of hundreds of meters per second.

That is why maintaining a set of conditions for the operation of the spacecraft and its systems in the orbit (orientation, stabilization, control of vital parameters, etc.) is largely the responsibility of on-board computers. Thus, at every stage – from research, design and development to launching and monitoring satellites – computers are used [4].

Many prominent scientists today believe that the future progress of humanity is closely connected with wider and more full-fledged use of mathematical techniques

than it was before. It is impossible to disagree with the Greek scholars who said that mathematics is the key to all sciences [2].

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УДК 51

HOW TO MAKE MATHEMATICS FUN

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Summary: The issues raised in the article address young teachers of mathematics and help them create positive, aim-oriented and good-natured atmosphere in the class-room; show learners that mathematics is an interesting and logically-structured subject; teach them to learn from mistakes. In the article one can also find a number of games adapted for mathematical lessons.

Key words: discipline, effort, figures, mathematics, mistakes, numbers, penalty, theorem.

Анотація: Питання, що висвітлюються у статті, будуть корисними для молодих вчителів математики та допоможуть їм створити позитивну, цілеспрямовану та доброзичливу атмосферу в класі; показати учням, що математика є цікавим та логічно побудованим предметом; навчити їх вчитися на помилках. У статті також можна знайти ряд ігор, адаптованих для уроків математики.

Ключові слова: дисципліна, зусилля, фігури, математика, помилки, числа, покарання, теорема.

Аннотация: Вопросы, которые освещаются в статье, будут полезны для молодых учителей математики и помогут им создать позитивную, деловую и доброжелательную атмосферу в классе; показать ученикам, что математика является интересным и логически стройным предметом; научить их учиться на ошибках. В статье также можно найти игры, адаптированные для уроков математики.

Ключевые слова: дисциплина, усилия, фигуры, математика, ошибки, числа, наказание, теорема.

In this article some questions related to learning and teaching mathematics are raised.

This paper has two main purposes:

- to illustrate some ways in which mathematics teachers can help create a secure, supportive classroom environment in which the pupils learn not to fear failures and to see making mistakes as an opportunity to learn and grow;
- to show that mathematics is quite easy and interesting.

Ask this question “What is mathematics?” to your friends and as the answer you will probably hear something like: "This is a science about figures and numbers". For example, arithmetic deals with numbers, that are replaced by the letters in formulas of algebra. In geometry we are talking about plane figures and dimensional

solids. Meanwhile, there exist such branches of mathematics where neither numbers nor figures matter.

So, what is mathematics? What is the most important thing about it? What are the characteristics of its branches and its theories?

Like bricks in a wall of a house, each argument is based on the theory already proved, that is cemented with the laws of logic. Each of these "bricks", each statement of mathematical theory, previously obtained from the already proven ones, is based on the rules of logical deduction and is called a theorem.

Any theorem or a group of theorems can serve as justification for a new theorem. And just as a building is made of bricks, any mathematical theory is a set of theorems [1, p. 7-8]. Logically consistent harmony of statements – this is the most significant property of mathematics. But harmony requires hard work. That is why we recommend some advice for teachers who want to improve their lessons:

1. Try not to frown on wrong answers. It discourages students from participating. Critical thinking and honest effort are more important than correct answers.

2. There is no teaching without control of your class. It is better to fall behind by a day or two early in the year to address discipline, than to have an uphill battle all year long over behavior.

3. Avoid talking over your students. If there is too much noise in the classroom, sometimes the best thing to do is to stop talking.

4. Routine and structure are good, but too much of it can cause you and your class to fall into a rut. Try to vary activities from time to time.

5. Encourage active participation from your students. From time to time, call students to the board or allow them to work in groups. Avoid giving teacher-directed lessons all the time.

6. Try to be flexible. Mathematics can be a rigid topic, but you don't have to be.

7. Try to spell out what topics will be on the test. Telling your students to "Study Chapter 6" is not enough, especially if they have poor study skills.

8. If a student was present for all the material taught, but is absent on the day of the test, then on the day the student returns, inform him/her of the make-up day and time. Do not let it go more than a day or two. However, if the student missed part or all of the material taught, you should give him a deadline by which to make up all missed work, and a new test date. It may be helpful to contact the parent in this case. A student should not be penalized for being absent. However, they can be penalized for failing to make up the missed work.

9. A technique called "Front Loading" is recommended. Students are most motivated to learn at the beginning of the school year. Rather than reviewing material from the previous school year, why not introduce a topic they have not seen before?

10. Try to teach students good problem-solving skills. When your students enter the work place, their superiors will not give them a worksheet with 25 least common multiple (LCM) exercises. They will more likely have a scheduling problem that needs to be solved using LCM concepts.

11. To motivate students, give out awards for both good academics and for good effort.

12. Do your best to be fair to students. You will earn their respect this way.

13. The best motivator of all is connecting mathematics to the real world. For example, when teaching the metric system, make students bring in empty cartons and bottles from their kitchen [2].

14. Humor can serve as a mnemonic that leads to retention of material. There are lots of creative ways to make mathematics fun for your class. For example:

The Decimal Dance. When teaching students to multiply decimals, often they forget to account for decimal place value. To help them remember to mark the decimal point, use the decimal dance. At the chalkboard, you must work out the product of the numbers. Then you simply exaggerate the motion of counting decimal places. You make a large white arc under each digit until you have accounted for the correct number of decimal places. By calling this The Decimal Dance, students remember to account for decimal place value after multiplying decimals.

Front Loading. Most teachers start the school year by reviewing previously learned concepts. However, this is a time when students are most motivated to learn. Why not introduce a new topic they have never seen before? This technique, known as Front Loading, shows students that you intend to challenge them, and sets the tone for the year.

Fractions and Chocolate Bars. When introducing the concept of multiplying fractions, use 8 brown-colored cubes to represent one chocolate bar. We offer $\frac{1}{2}$ of the bar to a student. You ask that student to offer $\frac{1}{4}$ of his/her piece to another student. Then you ask the class "What fraction of the original chocolate bar did the second student get?" Students quickly learn that a part of a part is a smaller part. Next, you distribute cubes to each group and have students complete multiplication exercises using both the cubes and arithmetic. They soon discover that the commutative law applies to multiplication of fractions.

Geometry and Gumby. You introduce the square, rectangle, parallelogram, rhombus, and trapezoid at the chalkboard, noting the properties of each. To summarize the lesson, you hold the shoebox in front of the class and say: "If you bend a rectangle like Gumby, what quadrilateral do you get?" (parallelogram). Bending the shoe box demonstrates the change in angles, and the fact that the length of the sides has not changed. Then ask: "If you bend a square like Gumby, what quadrilateral do you get?" (rhombus).

The Homework Wave. Every once in a while, you may motivate students to do their homework with the Homework Wave. If every student has completed their assignment, they take out their assignment sheets and wave them. This is just like the wave in the bleachers at a game, except that they are waving their homework instead of their arms. Students enjoy this activity tremendously.

Repeating Decimals and The Monster That Wouldn't Die. Some students have trouble grasping the fact that a repeating decimal goes on forever. You may start with a simple fraction like one-third. At the chalkboard, you divide the numerator by the denominator several times until a pattern becomes apparent. Then ask the class what they think will happen if you continue to bring down a zero and divide. Most of them say that you will keep getting the same digit in the dividend. To emphasize the concept of repeating decimals, you make an analogy to a monster movie where the monster is relentless – it just keeps coming back and never dies, no matter how many times you try to kill it [3]!

You must understand that mathematics is no harder than other subjects, but it is different. You will succeed by taking those differences into account.

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THE MAJOR MOLECULE

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Summary: Major findings and research preceding the DNA structure discovery are considered in this article. An attempt is made to analyse the order of works carried out by various scientists in search of understanding the phenomenon of heredity and its transfer. The answer to the main point has become a key factor in the development of many sciences including biophysics.

Key words: DNA structure discovery, heredity transfer, major findings, phenomenon of heredity.

Анотація: У цій статті розглядаються найважливіші відкриття та дослідження, що передували відкриттю структури ДНК. Спроба проаналізувати порядок робіт, які вчені проводили у пошуках розуміння феномена спадковості та її передачі. Відповідь на головне питання стала вирішальним фактором у розвитку багатьох наук у тому числі біофізики.

Ключові слова: відкриття структури ДНК, найважливіші відкриття, передача спадковості, феномен спадковості.

Аннотация: В этой статье рассматриваются самые главные открытия, которые предшествовали открытию структуры ДНК. Попытка проанализировать порядок работ, которые ученые проводили в поисках понимания феномена наследственности и её передачи. Ответ на главный вопрос стал решающим фактором в развитии многих наук в том числе и биофизики.

Ключевые слова: открытие структуры ДНК, передача наследственности, самые главные открытия, феномен наследственности.

Our life is full of discoveries. The experience shows that if some natural phenomena cannot be explained at present, it would not mean that those phenomena will not be explained in the future. Our ignorance about those phenomena can be explained by the absence of the adequate tools to study their causes. The first half of the previous century science belonged to physics, with the general theory of relativity, quantum mechanics, and nuclear fission. The second half belonged to biology. In the post-war world, the secret of the gene (how hereditary characteristics pass from one generation to another) was the hottest problem in science. The post-war shift into biology was a stark exchange of the science of life. Although deoxyribonucleic acid, or DNA, was discovered in the late 1860s, the substance was largely ignored for nearly a century because it seemed too simple to serve any significant purpose. This view changed dramatically in the 1940s. At this time scientists discovered that chromosomes, which were known to carry hereditary information, consisted of DNA and proteins. Experiments conducted throughout the 1940s showed that, contrary to the prevailing

opinion that proteins carry the genetic information, DNA actually seemed to be the genetic material. However, the structure of DNA was still unknown and scientists did not realize how such a simple molecule could contain all the information needed to produce a human being or other living organisms.

To decode the human genome, high-tech methods are currently used to view the microscopic chromosomes and scientists even pluck individual genes out of a cell. But in Darwin's time, it was impossible to see any of that. No one was sure how animals or plants passed down traits. And Darwin knew that the lack of an explanation for heredity left a big gap in his theory of natural selection. In one of the great triumphs of scientific experimentation, Austrian biologist and monk Johann Gregor Mendel, Darwin's contemporary, solved this problem in the mid-nineteenth century.

Darwin, like many of his contemporaries, speculated that characteristics of the parents were blended (like mixing paint) as they passed to the offspring. But if that were true, some of Darwin's critics pointed out, then how could a single fortunate mutation be spread through a species? It would be blended out, just as a single drop of white paint would be in a gallon of black. The results of Mendel's carefully designed and meticulously executed experiments were ignored until long after both he and Darwin were dead. Mendel's principle of heredity declares that the cross-breeding of parents need not diminish the purity of their germ-cells or consequently the purity of their offspring. When in such cases individuals bearing opposite characters, A and B, are crossed, the germ-cells of the resulting cross-bred, AB, are each to be bearers either of character A or of character B, not both. Consequently when the cross-breeds breed either together or with the pure forms, individuals will result of the forms AA, AB, BA, BB. Of these the forms AA and BB, formed by the union of similar germs, are stated to be as pure as if they had had no cross in their pedigree, and henceforth their offspring will be no more likely to depart from the A type or the B type respectively, than those of any other originally pure specimens of these types.

Mendel disagreed with Darwin's views concerning the blending notion, hypothesizing instead that traits, such as eye color or height or flower hues, were carried by tiny particles that were inherited as a whole in the next generation. The scientist carefully bred and cross-bred pea plants to see how a few specific traits, e.g. height were passed down. When Mendel bred a tall plant to a short one, all of the offspring were always tall, never blending to medium size. When he then bred those offspring together, three out of four of their offspring were tall, but one was short. Height was passed down in a particle we now call a gene (though Mendel never used that term himself). A plant was short or tall depending on the random combination of genes it inherited.

The unique chemical properties of DNA had been studied long before the structure of the molecule was understood, and even before DNA was discovered to be the genetic material. 1869 was a landmark year in genetic research, because it was the year in which Swiss physiological chemist Friedrich Miescher first identified what he called "nuclein" because it had come from the nucleus of human white blood cells. (The term "nuclein" was later changed to "nucleic acid" and eventually to "deoxyribonucleic acid" or "DNA"). The man who discovered DNA did not know

that it was the hereditary material. He expected it to be present in organs such as the liver and kidney, and he also believed it to be an acid. Initially, Miescher tried to isolate the cells for his experiments from lymph nodes, but it was difficult to purify the lymphocytes and impossible to obtain sufficient quantities for analysis. On Hoppe-Seyler's suggestion, Miescher changed to examining leucocytes and obtained the cells for his experiments from the pus on fresh surgical bandages, which he collected from the nearby surgical clinic in Tübingen. In pus, he found the ideal base material for his analyses.

At first, Miescher focused on the various types of proteins that make up the leucocytes, as proteins were considered to be the most promising targets for understanding how cells function. Miescher showed that proteins (and lipids) were the main components of the cells cytoplasm, described their properties in some detail, and attempted to classify them. However, this work was hampered by the simple protocols and equipment available at that time and the diversity of proteins within the cells surpassed the scientist's analytical methods. Yet during these tests, it was noticed that a substance precipitated from the solution when acid was added and dissolved again when alkali was added. A crude precipitate of DNA was obtained for the first time [1, p. 276]. Miescher realized that he had discovered a new substance. Sensing the importance of his findings, Miescher wrote, "It seems probable to me that a whole family of such slightly varying phosphorous-containing substances will appear, as a group of nucleins, equivalent to proteins". So Miescher had shown that the material inside the nucleus was different from the material inside the cell cytoplasm, and indeed was not present there. Miescher also managed to characterise the chemical components of this 'nuclein' acid, although not with the familiar names of bases that we're used to. He identified the components as N, C, H, O and P.

In the 1920s two types of sugars were found to differ, ribose and deoxyribose in the presence or absence of one oxygen atom. DNA was shown to incorporate the bases A, C, G, and T, while RNA (ribonucleic acid) incorporates A, C, G, and U. Much of this work was carried out by the American Phoebus Aaron Levene (1869-1940). When Levene analyzed the chemical properties of nucleic acid, he discovered that DNA was abundant in three things: five-carbon sugars (pentoses), phosphate (as Miescher had previously found), and nitrogen bases. Thus, Levene correctly deduced that the DNA molecule was made of smaller molecules linked together, and these smaller molecules, which he named nucleotides, were made of three parts – a five-carbon sugar, a phosphate group (PO_4), and one of four possible nitrogen bases – adenine, cytosine, guanine, or thymine (often abbreviated A, C, G, and T). Levene proposed what he called a tetranucleotide structure, in which the nucleotides were always linked in the same order (i.e., G-C-T-A-G-C-T-A and so on). However, it has been realized that Levene's proposed tetranucleotide structure was overly simplistic and that the order of nucleotides along a stretch of DNA (or RNA) is, in fact, highly variable. Despite this realization, Levene's proposed polynucleotide structure was accurate in many regards. For example, we now know that DNA is in fact composed of a series of nucleotides and that each nucleotide has three components: a phosphate group; either a ribose (in the case of RNA) or a deoxyribose (in the case of DNA) sugar; and a single nitrogen-containing base. We also know that there are two basic categories of nitrogenous bases: the purines (adenine [A] and guanine [G]), each with

two fused rings, and the pyrimidines (cytosine [C], thymine [T], and uracil [U]), each with a single ring. Furthermore, it is now widely accepted that RNA contains only A, G, C, and U (no T), whereas DNA contains only A, G, C, and T (no U) [3, p. 289].

Levene was correct in identifying the three parts of a nucleotide, and determining that nucleotides were linked together to make DNA; but because he thought DNA was a simple circular structure, Levene rejected the notion that it could be the genetic material and sided firmly with those who believed that proteins contained the genetic code of organisms. Protein was the obvious candidate.

By the 1920s it was thought that genes were made of protein. The other main ingredient in the chromosome is deoxyribonucleic acid, or DNA. Protein was far more interesting to geneticists than DNA because there was a lot more of it and also because each protein molecule is a long chain of chemicals, of which 20 kinds occur in living things. DNA, in contrast, contains only four kinds of the repeating units called nucleotides. Hence, it seemed too simple to carry the complex instructions required to specify the distinct form of each of the infinite variety of cells that constitute living matter. In 1943, Avery made a revolutionary discovery. He found that when DNA was transferred from a dead strain of pneumococcus to a living strain, it brought with it the hereditary attributes of the donor. His discovery has been called worth two Nobel Prizes, but he never got even one. A year later, however, Avery, with two colleagues, wrote about their research. They described an intricate series of experiments using the two forms of pneumococcus, virulent and nonvirulent [7, p. 7]. When they freed a purified form of DNA from heat-killed virulent pneumococcus bacteria and injected it into a live, nonvirulent strain, they found that it produced a permanent heritable change in the DNA of the recipient cells [6, p. 15]. Thus the fact was established—at least for the readers of *The Journal of Experimental Medicine*—that the nucleic acid DNA and not the protein was the genetic message-carrier. In 1943, Erwin Schrödinger gave a series of lectures in Dublin, called "What is Life?" In his Dublin lectures, Schrödinger raised a question—why biology was treated as a subject completely separate from physics and chemistry: frogs, fruit flies, and cells on one side, atoms and molecules, electricity and magnetism, on the other. The time had come, Schrödinger declared from his Irish platform, that living organisms should be thought of in terms of their molecular and atomic structure. There was no specific division between the living and nonliving; they all obey the same laws of physics and chemistry. He put a physicist's question to biology. If entropy is (according to the second law of thermodynamics) things falling apart, the natural disintegration of order into disorder, why don't genes decay? Why are they instead passed intact from generation to generation? "*What Is Life?*"—is a small book that started a revolution. In this book, the laws of quantum mechanics to the molecules of living cells were applied. For post-war physicists, suffering from professional malaise, "When one of the inventors of quantum mechanics could ask 'What is life?', Stent declared, "they were confronted with a fundamental problem worthy of their mettle." Biological problems could now be tackled with their own language, physics [6, p. 10]. An answer was given "Life" is matter that is doing something. The technical term is metabolism – "eating, drinking, breathing, assimilating, replicating, avoiding entropy". To Schrödinger, life could be defined as "negative entropy"—something *not* falling into chaos and approaching "the dangerous

state of maximum entropy, which is death." Genes preserve their structure because the chromosome that carries them is an irregular crystal. The arrangement of units within the crystal constitutes the hereditary code. From his rigorous analysis, he deduced that genetic mutations must take place because of a change in a molecule. The chromosome fiber was described as a message written in code. Schrödinger was the first physicist to apply his field to biology, and thus was also the precursor of much more recent work in biophysics.

Two important conclusions were made by Chargaff, an Austrian biochemist. First, it should be taken into account he noted that the nucleotide composition of DNA varies among species. In other words, the same nucleotides do not repeat in the same order, as proposed by Levene. Second, Chargaff concluded that almost all DNA – no matter what organism or tissue type it comes from – maintains certain properties, even as its composition varies. In particular, the amount of adenine (A) is usually similar to the amount of thymine (T), and the amount of guanine (G) usually approximates the amount of cytosine (C). In other words, the total amount of purines (A + G) and the total amount of pyrimidines (C + T) are usually nearly equal [4, p. 88]. (This second major conclusion is now known as "Chargaff's rule.") Chargaff's research was vital to the later work of Watson and Crick, but Chargaff himself could not imagine the explanation of these relationships, specifically that A bound to T and C bound to G within the molecular structure of DNA.

Crick and Watson, together with Maurice Wilkins, won the 1962 Nobel Prize in Medicine for their discovery of the structure of DNA. This was one of the most significant scientific discoveries of the 20th century. Watson and Crick worked together on studying the structure of DNA (deoxyribonucleic acid), the molecule that contains the hereditary information for cells. By their own admission, both were more interested in the prevailing scientific problems of that day than in their own work, and the structure of DNA was definitely an interesting problem. Over the next few years, Watson and Crick would collect, by coincidence, hard work, and a little luck, key pieces of information that they would use to solve the DNA puzzle. Crick and Watson already knew the main components of DNA, phosphates, sugars, and four nitrogenous bases: adenine, thymine, cytosine, and guanine. Still, it was to be found how the above elements fit together. Maurice Wilkins and Rosalind Franklin, both working at King's College, London, were using X-ray diffraction to study DNA. X-ray photographs of DNA taken by Rosalind suggested that the structure of DNA was a helix [4, c.114]. Another impetus came from Linus Pauling, who had already built a model of a helical protein. Watson and Crick were inspired by the fact that Pauling had used his imagination along with molecular models to deduce the structure of this protein. In April 1953, Watson and Crick published the news of their discovery, a molecular structure of DNA based on all its known features - the double helix. [4, c.147] According to their findings, complementary base-pairing is the key property that allows DNA to function as the mechanism of information storage and inheritance. Firstly, the sequence of bases in DNA stores the information required to self-assemble and maintain an organism the most obvious example is the use of sequence to specify the proteins to be constructed in a cell. The specificity of DNA binding (A-T and G-C base pairs are the most favourable) means that each strand in a double helix carries a negative image of the information on the other strand [3, p.

4]. Their model served to explain how DNA replicates and how hereditary information is coded on it [6, p. 18]. These discoveries gave rise to the rapid advances in molecular biology that continue to this day.

It is essential for genetic material to be able to make exact copies of itself, otherwise growth would produce disorder, life could not originate, and favourable forms would not be perpetuated by natural selection. Base pairing provides the means of self-replication (Watson and Crick¹⁴). It also appears to be the basis of information transfer during various stages in protein synthesis. Genetic information is written in a four-letter code in the sequence of the four bases along a polynucleotide chain. This information may be transferred from one polynucleotide chain to another. A polynucleotide chain acts as a template on which nucleotides are arranged to build a new chain. Provided that the two-chain molecule is exactly regular, base-pairing ensures that the sequence in the new chain is exactly complementary to that in the parent chain. If the two chains then separate, the new chain can act as a template, and a further chain is formed; this is identical with the original chain. Most DNA molecules consist of two chains; clearly the copying process can be used to replicate such a molecule. It can also be used to transfer information from a DNA chain to an RNA chain (as is believed to be the case in the formation of messenger RNA) [5, p. 762].

Apparently, Watson and Crick were not the discoverers of DNA, but rather the first scientists to formulate an accurate description of this molecule's complex, double-helical structure. Moreover, Watson and Crick's work was directly dependent on the preceding research of numerous scientists, including Friedrich Miescher, Phoebus Levene, and Erwin Chargaff. Thanks to the efforts of all scientists contributing to DNA studies, we now know a great deal about genetic structure, and we can continue to work on the problems of understanding the human genome and the importance of DNA to life and health. To sum up, the problem of heredity still attracts attention of many prominent scientists as it enables them to find answers to many questions. On the basis of the DNA studies a number of cause-and-effect relations are likely to be revealed leading to new scientific discoveries.

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HYPERTHERMIA IN ONCOLOGY**Chikalova Anastasiya (Kharkiv)****Language supervisor: Leshnyova N.O.**

Summary: The article brings up a topical problem of humanity – cancer diseases and the ways of treating them. Many scientists think that the solution may be found in using ‘hyperthermia’ method, i.e. applying heat. Numerous studies prove that this method of treatment of localized and metastatic tumors is effective.

Key words: cancer disease, hyperthermia, tumour, oncology.

Анотація: У цій статті підіймається актуальна проблема людства – захворювання на рак та методи його лікування, рішення якої більшість вчених бачать у застосуванні методу «гіпертермії» – використання тепла. Багаточисленні дослідження доводять ефективність цього методу у лікуванні локалізованих та метастатичних пухлин.

Ключові слова: гіпертермія, захворювання на рак, пухлина, онкологія.

Аннотация: В этой статье поднимается актуальная проблема человечества – заболевание раком и методы его лечения, решение которой большинство ученых видят в применении метода «гипертермии» – использования тепла. Многочисленные исследования доказывают эффективность этого метода в лечении локализованных и метастатических опухолей.

Ключевые слова: заболевание раком, гипертермия, онкология, опухоль.

Every year, the American Cancer Society estimates the numbers of new cancer cases and deaths expected in the United States in the current year and compiles the most recent data on cancer incidence, mortality, and survival based on incidence data from the National Cancer Institute, the Centers for Disease Control and Prevention, and the North American Association of Central Cancer Registries and mortality data from the National Center for Health Statistics. A total of 1,596,670 new cancer cases and 571,950 deaths from cancer are supposed to occur in the United States in 2011 [1, с. 1-2].

Cancer is a major public health problem in the United States and many other parts of the world. Currently, one in 4 deaths in the United States is due to cancer.

Thermal Therapy, or the manipulation of body or tissue temperature for the treatment of disease, can be traced back to the earliest practice of medicine. Cultures from around the world can point to ancient uses of heat and cold therapy for specific medical applications, including cancer. Modern research in thermal medicine aims to understand molecular, cellular and physiological effects of temperature manipulation and the “stress” response, as well as to develop effective and safe equipment for clinical application and temperature monitoring.

The first recorded uses of localized heat for treatment of cancer appeared in the writings of Ramajama (2,000 B.C.); Hippocrates (400 B.C.) and Galen (200 A.D.) told of the palliative effects obtained when ferrum candens (red-hot irons) were applied to superficial tumors. This practice continued throughout the Renaissance until modern times. In 1898, F. Westermar placed hot-water-circulating cisterns into advanced carcinomas of the uterus and found palliative shedding of many tumors. However, in the reports from Germany of the healing effects of high-frequency currents d'Arsonval, Telsa, and others there was the potential for localized

hyperthermia realized. After intensive investigations, Nagelschmidt, in 1926, coined the term 'diathermy', meaning "to deep heat", and the widespread use of electromagnetic waves to heat tumours rapidly followed. In 1927, N. Westermark in Stockholm introduced the concepts of dose/time response and histopathologic evaluation of thermal effects. In America in 1962, Cnile reported cases of local tumour control in spontaneous dog and human tumours after combining microwave heating with low dose radiation therapy. In 1967, Cavaliere and his colleagues in Rome announced that tumour cells were apparently selectively thermosensitive as compared with normal cells at temperatures from 42°C to 45°C (108°F to 113°F) [4, c. 1].

These observations, coupled with ever increasing technical means to produce these temperatures, laid the foundation for local hyperthermia as therapy for cancer. During the late 1960s and early 1970s, the evidence continued to suggest that at 42°C to 45°C tumor cells were slightly more sensitive to heat than normal cells and might be killed at a temperature about one degree lower. Cavaliere found that these temperatures caused irreversible damage to Novikoff hepatoma cells, but not to normal or regenerating rat liver cells or minimal deviation hepatoma. Giovanella and colleagues investigated thermal effects on normal (embryonic) and neoplastic (methylcholanthreneinduced sarcoma) mesenchymal cells. They found that 95 percent of all cultures of tumour-derived and tumour-producing cells died after two hours at 42.5A°C, as compared with only 43 percent of all cultured normal and nontumour-producing cells under similar conditions [4, c. 3].

When a cell subline derived from a nontumour-producing line acquired high tumour-producing ability, it also acquired reduced thermotolerance. These and other investigations both in vitro and in vivo suggested that the acquisition of malignant potential was associated with increased thermosensitivity [5, c. 12].

Several investigators have found that a major factor in cell killing at $\geq 42^\circ\text{C}$ is the irreversible damage to cancer cell respiration. While the exact mechanisms of heat destruction remain poorly understood, coincident alterations appear to take place in nucleic acid and protein synthesis that include a reduction of activity in many vital enzyme systems. These factors, associated with an increase in cell-wall membrane permeability and the liberation of lysozymes, probably account for the autolytic cell destruction after hyperthermia.

The efficacy of thermocytotoxicity increased rapidly as temperatures were increased from 42°C to 45°C, the threshold of thermal pain in humans. At such high temperatures, the differential thermosensitivity between malignant and normal cells is reduced and replaced by a linear cell kill from progressive protein denaturation. Thus, at 45°C, host tissue tolerance becomes a prime concern in the design of clinical trials. It is well known from experiments on exposed tumours that energy concentrated within a tumour, from interstitial implants, focused ultrasound (or microwaves) potentially provides enough local heat for tumor destruction. Less well known is the fact that nonfocused microwaves and capacitive, inductive, and magnetic-loop radio frequency applicators can heat a region of the host that contains the tumour, providing "selective tumour heating", this having remarkable implications for the treatment of deep-seated tumours.

In 1927, Westermark heated rat limbs bearing Flexner-job ling carcinoma or Jensen's sarcoma with high frequency currents passed between lead electrodes. He found that tumour temperatures from 44°C to 48°C could be attained without injury to normal surrounding tissues and postulated that differences in vascularity might account for the heat variations observed: 'It is a well-known fact that these rat tumours are poorly supplied with vessels. With regard to their temperature, therefore, they cannot derive any great influence through their circulation, their thermal regulation, therefore, being apparently bad'.

In 1962, Crile observed that since the blood supply of hepatic metastases in humans was usually less than that of the liver itself, the heat generated in tumours tended to remain while the liver was cooled by portal blood flow. Since these early observations, the elegant studies by Mantyla in Finland have confirmed that ambient tumour blood flow is generally less than that of normal host tissues.

LeVeen et al subsequently heated tumours in three cancer patients with standard diathermy at 13.56 MHz and found that intra tumour temperatures were 8°C to 10°C hotter than those of adjacent normal tissues. They postulated that as a tumour grows, it does not or cannot generate an integrated ramification of vessels as do normal tissues; this results in a high resistance to blood flow and a reduced ability to exchange incident heat efficiently [4, c. 3].

After extensive temperature measurements during hyperthermia therapy in spontaneous animal and human tumours, we suggest that many tumours selectively retain more heat than normal tissues because their neovascularity is physiologically irresponsive to thermal stress and is incapable of regulating and augmenting blood flow. While these theories remain unproved, this phenomenon of "selective tumor heating" after regional or volume energy deposition suggests that potentially effective independent tumour heating might be possible deep within the body, even without the ability to focus such energy.

Hyperthermia is almost always used with other forms of cancer therapy, such as radiation therapy and chemotherapy. Hyperthermia may make some cancer cells more sensitive to radiation or harm other cancer cells that radiation cannot damage. When hyperthermia and radiation therapy are combined, they are often given within an hour of each other. Hyperthermia can also enhance the effects of certain anticancer. The effectiveness of hyperthermia treatment is related to the temperature achieved during the treatment, as well as the length of treatment and cell and tissue characteristics. To ensure that the desired temperature is reached, but not exceeded, the temperature of the tumor and surrounding tissue is monitored throughout hyperthermia treatment. Using local anesthesia, the doctor inserts small needles or tubes with tiny thermometers into the treatment area to monitor the temperature. Imaging techniques, such as CT (computed tomography), may be used to make sure the probes are properly positioned [5, c. 12].

Most normal tissues are not damaged during hyperthermia if the temperature remains under 111°F. However, due to regional differences in tissue characteristics, higher temperatures may occur in various spots. This can result in burns, blisters, discomfort, or pain. Perfusion techniques can cause tissue swelling, blood clots, bleeding, and other damage to the normal tissues in the perfuse area; however, most of these side effects are temporary. Whole-body hyperthermia can cause more serious

side effects, including cardiac and vascular disorders, but these effects are uncommon. Diarrhea, nausea, and vomiting are commonly observed after whole-body hyperthermia

Ultrasound, a well-defined and spatially manipulative source of acoustic energy at 0.5-2 MHz and wavelengths of three mm to 0.75 mm, when focused, has potential for noninvasive selective heating of a target volume at depth. The temperature rise in tissues as a result of insonation can be controlled and reproduced. However, unlike electromagnetic energy, ultrasound does not propagate effectively through air; the applicator must be coupled to the body surface with degassed saline and/or sound transmitting gel. Because of the high acoustic impedance mismatch between air and soft tissues, ultrasound is totally deflected at these interfaces and is ineffective near air-containing spaces (for example, oral-nasal cavity, and respiratory and gastrointestinal tracts). Despite continued technical advances to overcome these problems by Lele at the Massachusetts Institute of Technology and G. Hahn's group at Stanford, most clinical trials have been limited to superficial tumors at 43°C to 45°C.

Microwaves at 433 MHz, 915 MHz, and 2450 MHz have produced effective noninvasive localized hyperthermia to large areas of surface tissues and been quite useful for treatment of superficial tumors. Most investigators have employed specially constructed microwave waveguides that deposit energy into a defined area of tumour. This technique has been popular for in vivo studies because of its easy application; however, penetration in humans has been limited to only a few centimeters because of extreme absorption by high-water-content overlying muscle. Guy found that these undesirable conditions could be partially eliminated by using lower frequencies (since the depth of penetration will increase as the fat and skin thickness become proportionally smaller compared with a wavelength) and a cooling applicator plate. Recently, the University of Maryland organized multiple waveguides into a "phase array" in an attempt to focus more energy within the deeper tumours, and, while this was an encouraging project, only preliminary testing has been undertaken.

Radiofrequency (RF) at 13.56 MHz and 27.1 MHz has provided a means for both local and regional in-depth noninvasive hyperthermia. Capacitively coupled, parallel, opposed plates have provided effective high-temperature local heating in tumors. The field may be shaped by varying the size, contour, and placement of the two electrodes. However, this method has been generally reserved for surface or near-surface tumours because of the extreme energy absorption by any overlying subcutaneous tissue. To a limited degree, injurious superficial heating has been lessened with cooled-contact electrodes; intratumor temperatures as high as 57°C at a depth of 10cm have been achieved in selected patients who had minimal overlying normal tissues. Our investigations in dogs, sheep, and pigs revealed that three to four W/cm² were required to produce effective internal hyperthermia if surface tissue was cooled to 15°C; however, humans with equally thick tissues tolerated less than one W/cm² even with surface cooling to 3° C. It appears that surface cooling is only effective in humans if skin and subcutaneous tissue are less than one cm thick. 3' Multiple portals of entry and "crossfire" techniques have been studied in Wales in an effort to target RF energy to deeper tumours. This method employs at least three pairs

of sequentially activated contact capacitance electrodes placed on opposite sides of the body (Triport-222TM, Life Extension Technology, Inc., Westport, Connecticut). Using this device, Le Veen et al reported lung tumour temperatures of 45°C with minimal skin burns.

A new technique to kill tumour cells that involves loading neural stem cells with iron oxide magnetic nanoparticles and then exposing the cells to a AC magnetic field has been unveiled by a team of researchers at Kansas State University in the US. The magnetic hyperthermia method might be used to destroy internal primary and metastatic tumours as well as subcutaneous melanomas.

Localized hyperthermia involves using heat (temperatures above 43°C) to clinically treat solid tumours as it boosts the cytotoxic effects of chemotherapy or radiotherapy and also increases the permeability of tumour cells to drugs. It works because cancer cells are more sensitive to heat than healthy ones. Indeed, the technique has already been tested on many types of human cancer, including recurrent malignant melanoma, lymph node metastasis, glioblastoma, cervical carcinoma, and head and neck cancers.

Magnetic hyperthermia works by introducing magnetic particles into tumour cells, and then heating these particles using an applied magnetic field. Enough heat is generated to kill the cancer cells and the latest techniques allow heat to be applied to more precise areas than before. However, the problem is that it is difficult to transport ferrofluid or magnetic nanoparticles to deeply lying tumours. Previous experiments involved directly injecting milligram amounts of these ferromagnetic materials into cancer cells or attaching special ligands to the nanoparticles before injection – all with limited success.

Deryl Troyer and colleagues Stefan Bossmann and Viktor Chikan have shown for the first time that neural progenitor cells can act as a sort of "Trojan horse" for magnetic nanoparticles. The cells, which are precursors to neurons or glia – often also called "neural stem cells" – can be preloaded *ex vivo* with core/shell magnetic Fe/Fe₃O₄ bimagnetic nanoparticles and intravenously injected into mice with melanomas. Several days later, after the cells have had enough time to home into the tumour, the researchers apply an external AC magnetic field. The cancer cells are destroyed after several cycles of this process because the tumour proteome is denatured by the heat generated by the magnetic field [7, c. 1-8].

'Our technique allows cancer-cell targeting via an active process, since the delivery cells are attracted to the tumours by chemokine or cytokine gradients', explained Troyer. 'The technique could be a platform for combination with cancer gene therapy – for example, the delivery cells could also be engineered to express an anticancer protein and at the same time transport the magnetic nanoparticles to the tumour for subsequent magnetic hyperthermia' [2, c. 1].

Thus, taking into account the significance of the above methodology, one should be ready for further studies in this field. Currently, one in 4 deaths in the United States is due to cancer. This statistics is important when one has to deal with the problems of treating cancer patients. The subject is particularly exciting in view of the fearful statistics of the disease. National efforts are under way to determine additional safe and reliable forms of therapy. The results in laboratory models,

animals, and initial human clinical trials have been very encouraging and suggest that thermal therapy hyperthermia may have a substantial role in future cancer treatment.

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CARBON NANOTUBES: HERE COMES THE FUTURE

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Summary: Carbon nanotubes are one of the most promising materials of the 21st century. The paper deals with the main types and the physical properties of carbon nanotubes. The current and potential application of carbon nanotubes as well as some obstacles in their manufacturing and using are considered.

Key words: carbon nanotube, composite material, integrated circuits, nanoelectronics, semi-conductor.

Анотація: Вуглецеві нанотрубки є одним з найбільш багатообіцяючих матеріалів 21-го століття. Стаття присвячена основним типам та фізичним властивостям вуглецевих нанотрубок. Розглядаються поточне та потенційне використання вуглецевих нанотрубок, а також деякі перешкоди у їх виробництві та використанні.

Ключові слова: вуглецева нанотрубка, інтегровані ланцюги, композитний матеріал, наноелектроніка, напівпровідник.

Аннотация: Углеродные нанотрубки являются одним из наиболее многообещающих материалов 21-го века. Статья посвящена основным типам и физическим

свойствам углеродных нанотрубок. Рассматриваются текущее и потенциальное применение углеродных нанотрубок, а также некоторые препятствия в их производстве и использовании.

Ключевые слова: интегрированные цепи, композитный материал, наноэлектроника, полупроводник, углеродная нанотрубка.

Carbon nanotubes can be far stronger than steel, lighter than aluminum, and more conductive than copper. They were found in Damascus steel from the 17th century, possibly helping to account for the legendary strength of the swords made of it.

They are undoubtedly one of the wonder materials of the 21st century. Their list of potential applications is long and dazzling. Researchers have already built a variety of carbon-nanotube electronic and optoelectronic devices: transistors, diodes, light emitters, and detectors. Most remarkable, we can get all those different functions with a single device, merely by altering the voltages we apply to it, so nanotubes are viewed as a replacement of silicon circuits.

The discovery of nanotubes remains a contentious issue, especially because several scientists involved in the research could be likely candidates for the Nobel Prize. Many believe that Iijima's report in 1991 is of particular importance because it brought carbon nanotubes into the awareness of the scientific community as a whole [7].

To understand carbon nanotubes, first the structure of carbon should be considered. It exists in two crystalline forms: graphite and diamond. Nanotubes are structurally similar to graphite.

Much of the advantage of nanotubes turns out to lie in their electrical and physical similarities to graphite. Graphite shares important characteristics with semiconductors – its resistivity decreases with increases in temperature, preventing destructive heating feedback. Graphite does not melt and flow, but rather has a very high sublimation temperature of approximately 2500° C. Graphite is also much less chemically reactive [1].

In graphite, the carbon atoms are arranged into hexagons that form a honeycomb pattern. A nanotube can be viewed as a single layer of graphite rolled into a seamless cylinder. One of the most alluring features of nanotubes as electronic devices is that we can change the device's characteristics merely by altering the physical properties of the nanotube. Two key traits are the width of the graphite layer that is rolled to make the tube, which determines the nanotube diameter, and the orientation of the honeycomb pattern with respect to the nanotube axis. In some nanotubes, the honeycomb pattern lines up with the nanotube axis; in others it spirals around the axis like the stripes on a candy cane. The combination of diameter and twist determines whether the nanotube is metallic or semiconducting [2].

The upshot is that by changing the diameter of the nanotubes, researchers can produce devices with any band gap from 0 (a metallic nanotube) to more than 1 electronvolt – roughly the band gap of silicon – and all gap values in between. This feature allows us to make devices that turn on and off at different voltages, and may have different applications. That kind of versatility isn't possible with conventional devices, which are limited to the band gap of whatever semiconductor they are made of [2].

There are two kinds of nanotubes known: single-walled nanotubes (SWNT), and multi-walled nanotubes (MWNTs). Most SWNTs have a diameter of close to 1 nanometer, with a tube length that can be many millions of times longer. The structure of a SWNT can be conceptualized by wrapping a one-atom-thick layer of graphite called graphene into a seamless cylinder. MWNTs consist of multiple rolled layers (concentric tubes) of graphite.

Double-walled carbon nanotubes (DWNT) form a special class of nanotubes because their morphology and properties are similar to those of SWNT but their resistance to chemicals is significantly improved.

Due to their physical properties, SWNT and MWNT nanotubes can be used in a variety of scientific and practical branches. This material is strong and hard, in MWNT an inner nanotube core may slide, almost without friction, within its outer nanotube shell, thus creating an atomically perfect linear or rotational bearing [4].

The current use and application of nanotubes has mostly been limited to the use of bulk nanotubes, which are a mass of rather unorganized fragments of nanotubes. Bulk carbon nanotubes have already been used as composite fibers in polymers to improve the mechanical, thermal and electrical properties of the bulk product.

Easton-Bell Sports, Inc. in partnership with Zyvex Performance Materials, have used CNT technology in a number of their bicycle components, namely, flat and riser handlebars, cranks, forks, stems and aero bars. As a result, the frame of the BMC Pro Machine SLC 01 weighs less than a kilogram (2.2 pounds). That makes it one of the lightest frames in the race and roughly 20 percent lighter than the BMC frame ridden by the team the year before. The whole bike weighs 14.74 pounds [5].

Amroy Europe Oy manufactures Hybtonite carbon nanoepoxy resins where carbon nanotubes have been chemically activated to bond to epoxy, resulting in a composite material that is 20% to 30% stronger than other composite materials. It has been used for wind turbines and variety of sports gear such as skis, ice hockey sticks, baseball bats, hunting arrows, and surfboards [8].

The potential applications of CN can be ranged from nanoelectronic engineering to medicine.

The first nanotube integrated memory circuit was made in 2004. One of the main challenges has been regulating the conductivity of nanotubes. Depending on subtle surface features a nanotube may act as a plain conductor or as a semiconductor. However, a fully automated method has already been developed to remove non-semiconductor tubes.

Large structures of carbon nanotubes can be used for thermal management of electronic circuits. An approximately 1 mm-thick carbon nanotube layer was used as a special material to fabricate coolers, this materials has very low density, ~20 times lower weight than a similar copper structure, while the cooling properties are similar for the two materials [6].

In April 2008, at the Materials Research Society's spring meeting in San Francisco, a team of engineers from Stanford and Toshiba reported that they had used carbon nanotubes to wire logic-circuit components on a conventional silicon CMOS chip. They claim to have shown that nanotubes can shuttle data at speeds of a little

faster than 1 gigahertz, close to the range of state-of-the-art microprocessors, which run at speeds of 2 to 4 GHz [9].

In medicine, carbon nanotubes may help to treat some serious diseases. For instance, The Kanzius Cancer Research Foundation Therapy, a patented technology of ThermMed LLC, enterprise created by John Kanzius. The therapy aims to insert metallic nanotubes in or around cancerous cells and then exciting these particles using radio waves; the energy from the radio waves creates heat which burns the cancerous cell cluster. Clinical trials are expected to begin in 2012 [3].

Researchers at Rice University, Radboud University Nijmegen Medical Centre and University of California, Riverside have shown that carbon nanotubes and their polymer nanocomposites are suitable scaffold materials for bone cell proliferation and bone formation [10].

However, the toxicity of carbon nanotubes has been an important question in nanotechnology. The available data clearly show that, under certain conditions, nanotubes can cross membrane barriers, and can induce harmful effects such as inflammatory and fibrotic reactions. Thus, further research is required to overcome these obstacles.

Of course, we are to overcome many serious hurdles before we can create nanotechnologies based on carbon nanotubes, but their spectacular properties are worth trying. To use their full potential successfully, first of all we must be able to control completely the nature of the nanotubes we create. But, no doubt, carbon nanotubes are one of the vanguards of the 21st century's nanotechnology revolution.

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THE FIELD RADIATED BY HERTZ DIPOLE

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Summary: The problem of radiation of Hertz dipole with quickly decreasing dipole moment from some constant value to zero is considered.

Key words: Hertz dipole, time domain, transient fields, radiation, causal surface.

Розглядається проблема випромінювання диполя Герца, у якого значення дипольного моменту швидко зменшується від деякого постійного значення до нуля.

Ключові слова: диполь Герца, часовий простір, нестационарні поля, випромінювання, каузальна поверхня.

Рассматривается проблема излучения диполя Герца, у которого значение дипольного момента быстро уменьшается от некоторого постоянного значения до нуля.

Ключевые слова: диполь Герца, временная область, нестационарные поля, излучение, каузальная поверхность.

1. Introduction.

In spite of the fact that the problem of finding the field radiated by a transmitter excited with a given current is classical some related aspects of this problem are still of interest, despite its centennial age. It is difficult to find in general educational literature the derivation of expressions for the dipole field of the Hertz for the case of arbitrary time dependence of the excitation current. In the monograph about ultra wideband antennas the expressions for the dipole field of Hertz in the frequency domain are described and analyzed [1, p. 475]. The presented derivation of expressions for the fields is so compressed that it is not possible to understand the basic stages of the algorithm of formula derivation while key assumptions used in the process to obtain the final result disappear. The approach based on application of the inverse Fourier transform to the expressions of the fields radiated by Hertz dipole obtained by the method of complex amplitudes is not rational but leads to the necessity of unjustified usage of additional restrictions on current dependence on time [2, p. 50].

This article describes the derivation of expression for the radiation field of Hertz dipole for an arbitrary time dependence of the excitation current and gives the analysis of distribution of electromagnetic energy in its surroundings and the energy transformations [3, p. 283].

2. STATEMENT OF THE PROBLEM

Current $I(t)$ flows with an arbitrary dependence of the time on a conductor with a cross-section in the direction of axis OZ. Let us consider the field radiated by a small segment of the conductor l . Under this condition current distribution along the entire length l will be uniform. This condition will always be executed if the length l is selected infinitely small.

3. SOLUTION OF THE PROBLEM

The current through the section of conductor is connected with the change of charge as $I = \frac{\partial Q}{\partial t}$. In such a case, the complete dipole moment of the length of conductor equals to $\vec{p}_z = Q\vec{l}$, where the vector \vec{l} is directed along the axis OZ.

$$\vec{P} = \frac{\vec{P}_s}{V} = \frac{Q\vec{l}}{Sl}$$

The calculation of the field will be conducted using the vector potential.

For an infinitely small dipole we can ignore its size compared to the distance to the observation point and distribution of the density of the current in the conductor cross-section can be considered uniform.

The use of common ideas for vector operations in the spherical coordinate system leads to the expressions for the fields radiated by an electric dipole Hertz.

The expressions show that, as expected, the longitudinal component of field decreases not slower than inversely proportional to the square of the distance to the observation point. A temporary form of a radiated field in the far-field zone is the second derivative on time of full charge or the first derivative of the current. It should be noted that amplitude of the magnetic field is proportional to the amplitude of the transverse electric component without first coulomb term, as the coefficient of proportionality is the characteristic impedance of free space. Such connection transverse components of the electric and magnetic fields are usually mentioned only in the far-field zone when only the last terms decreasing inversely proportional to the distance are taken into account.

4. TRANSFORMATION OF ENERGY FIELDS IN THE SPACE AROUND THE DIPOLE

The law of conservation of energy of an electromagnetic field is known to be available if all the components of the field and all terms in expressions are considered. Only the most rapidly decreasing terms with the distance lead to the fact that the law of conservation of energy is broken and the terms are not satisfied with the divergent Maxwell's equations. Let us accept that the time dependence of the charge dipole take a smooth function, as proposed by Schantz H.G. [3, p.283].

For example, $Q(t) = Q_0 (1 - \text{th}(t/\tau)) / 2$. So normalized to the maximum function at $\tau = 1$ ns its first and second derivatives will get the form shown in Fig.1.

We find the rate of signal change defined by the parameter at which a sphere with one meter radius is the causal for the case when the transmitter is surrounded by sphere one meter radius. The energy of quasistatic field inside of the sphere does not depend on time. We build the radiated energy of quasistatic components of the field outside the sphere (Fig. 2). The scope of the selected size is causal at the time moment of 0.8 ns. It should be noted that the energy of the emitted wave grows with decreasing of time. The energy of the quasistatic component of the field is inversely proportional to the third degree and inversely proportional to a radius. The size of the causal sphere around the electric Hertz dipole is approximately equal to the spatial duration of the excitation impulse. It is stated that in electromagnetic wave there is no energy flowing through the causal sphere but there is only transformation of energy of the quasistatic component of the field outside of this sphere [4, p.280]. This statement can also be interpreted as a confirmation of existence of limitations on the applicability of expressions for the field which come from the way of obtaining data expressions.

5. CONCLUSION

All components of a radiated electromagnetic field in the time domain for an arbitrary time form of current are received. The size of the dipole is small comparing

with the spatial change of the exciting current and it has uniform distribution on the length of the dipole. The processes of transformation of energy of quasistatic component in the field of electromagnetic wave by reduction of the dipole moment are investigated. The contribution of the different components in the total flow of energy of electromagnetic field on arbitrary distance from the centre of the dipole for various temporary forms of current was shown. Due to restrictions used in the expressions it is impossible in detail to trace the process of the forming of an electromagnetic wave from the energy of the quasistatic component of the field concentrated around the dipole. The analysis of these processes is necessary to raise the efficiency of the radiation process. This analysis will help to optimize the methods of accumulation of the quasistatic component energy and the methods of converting them into an electromagnetic wave.

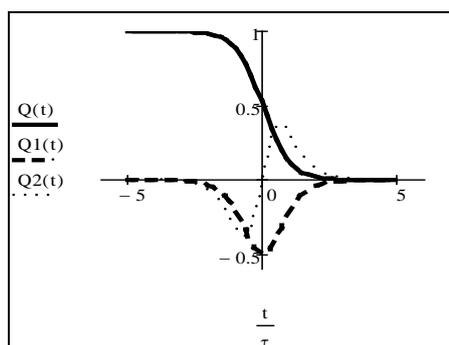


Fig. 1 The time dependence of the charge dipole with smooth change of the charge and current

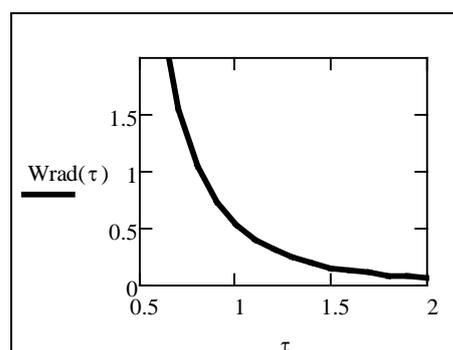


Fig. 2 The radiated energy to energy of quasistatic components of the field outside the sphere of the radius of 1m

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**INFLUENCE OF SHOCK-WAVE TREATMENT ON SURFACE OF STEEL
0.33CCr3NiMoV**

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Summary: The results of structure-phase transformations and hardening research of 0.33CCr3NiMoV steel after shock-wave influence are presented. Shock-wave treatment of the steel 0.33CCr3NiMoV leads to the augmentation of strength of the samples, caused by processes of redistribution of phases and carbon in surface layers. Steel hardening at shock treatment is conditioned by liberation in a matrix of a martensite of a cementite phase.

Key words: shock action, steels, phase transformations.

Анотація: У роботі представлені результати структурно-фазових перетворень і зміцнення сталі 38ХНЗМФА після ударно-хвильового впливу. Ударно-хвильова обробка сталі 38ХНЗМФА призводить до збільшення міцності зразків, обумовленого процесами перерозподілу фаз і вуглецю у поверхневих шарах. Зміцнення сталі при ударній обробці обумовлено виділенням у матриці мартенситу фази цементиту.

Ключові слова: ударний вплив, сталі, фазові перетворення.

Аннотация: В работе представлены результаты структурно-фазовых превращений и упрочнения стали 38ХНЗМФА после ударно-волнового воздействия. Ударно-волновая обработка стали 38ХНЗМФА приводит к увеличению прочности образцов, обусловленному процессами перераспределения фаз и углерода в поверхностных слоях. Упрочнение стали при ударной обработке обусловлено выделением в матрице мартенсита фазы цементита.

Ключевые слова: ударное влияние, стали, фазовые преобразования.

Growing world requirements for the electric power along with the deficit of organic fuel and environmental contamination demand the further perfection of the nuclear industry in the XXI century. That is why researches of new concepts, which can help to increase the safety of power stations, refine their economic indexes and upgrade structural materials are in great demand [1–3].

The objective of this article is to study and analyze the structure and phase composition of the steel 0.33CCr3NiMoV that belongs to the class of constructional refined steels and can be used in different sectors of industry after shock-wave action.

The steel 0.33CCr3NiMoV is explored by the methods of X-ray diffraction analysis and Mossbauer spectroscopy with registration of electrons of interior conversion in back scattering geometry (CEMS) on nuclei Fe57. The steel 0.33CCr3NiMoV composition is: C - 0.33–0.4 %; Cr - 1.20–1.50 %; Ni - 3.00–3.50 %; Mo - 0.25–0.50 %; Va - 0.10–0.18 %; Si - 0.17–0.37 %; Cu – ≤ 0.30 %; P – ≤ 0.025 %; S – ≤ 0.025 %. The following species of thermo mechanical treatment of the steel 0.33CCr3NiMoV are applied: 38TH – traditional hardening; 38LTT – low - temperature tooling; 38LTTH – low -temperature tooling with subsequent hardening; 38HTT – high-temperature tooling (tab. 1). For the shock-waves stressing the plates, beforehand subjected to water hardening and the abrasion, were prepared. Shock waves were created by the collision of throwing plates with a surface of the steel 0.33CCr3NiMoV. Throwing plates were accelerated by a detonation wave. It was noticed that the pressure at the front varied from 10 to 23 GPa. After the shock action

of the plate there was no change. Properties of sample treatments, mechanical characteristics (an ultimate strength σ_B , an elongation δ , contraction Ψ , impact strength aH) are presented in the table 1.

To investigate steel samples we performed X-ray diffraction on X-ray general purpose diffractometer (DRON – 3.0) in Cu-k α -radiation (the depth of the analyzed layer is ≈ 2.7 mkm), in Fe-k α and Co-k α radiation (the depth of the analyzed layer is ≈ 3 mkm). The accuracy of lattice parameter definition is ≈ 0.00005 nm. The identification of ferruginous phases was performed by means of spectrometer NGRS–4. The Co57 in a Cr matrix was used as an emitter. The spectrometer graduation was performed by means of standard ferruginous gamma-resonance absorbers. The thickness of an analyzed layer for CEMS is ≈ 0.1 mkm. The metallographic analysis of steels was performed by means of microscope MIM-8. The analysis of a samples surface was performed by means of scanning electron microscope JEOL JSM-840.

Table 1. Mechanical characteristics of the samples and parameters of thermomechanical and shock-wave treatment

Examples	Modes of thermomechanical treatment	Data of the chosen sample layer	Mechanical characteristics					
			σ_B , MPa	$\sigma_0.2$, MPa	δ , %	Ψ , %	aH , kJ m ⁻²	HR C
38S	Initial	a)Initial condition. b) rods: hardening 850 °C, oil, tempering 600 °C. HB=269	a)110 b)1180	a)105	12 12	a)49 50	784.8	a)32
38TH	Initial + standard hardening from 860 °C in oil	Initial condition +hardening	1750	167	2:5	2..34	147.15	59
38LTT	Shock-wave treatment at 350 °C, water cooling	38LTT heating up to 350 °C before shock-wave treatment	1100	101	11.5	61	637.65	35
38LTT H	Hardening from 930 °C in water	Low-temperature mechanical treatment+hardening	1900	161	6	44	981	50
38HTT 2	Shock-wave treatment at 720 °C, water cooling	Mode 38HTT2 – analog 38HTT, T	1900	155			686.7	50

		of treatment 720 °C						
38HTT	Shock-wave treatment at 930 °C, water cooling	38HTT was heated up to 930 °C before treatment	2000 : 2300		0: 44	0..1 9	98.1	61

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of the samples is presented on fig. 1. The microstructure of the initial sample 38S (fig. 1a) shows fine-grained ferritic structure with highly dispersed carbides. The X-ray diffraction analysis has not revealed highly dispersed carbides.

The microstructure of the initial sample after standard hardening (fig. 1 b.) is caused by a martensite after hardening of the usual sample in initial condition distinction in martensite morphology, arrangement, and the sizes of carbide particles.

The microstructure of the sample 38LTT (fig. 1 c.) shows reproduction of dislocations and the change of a microstructure consisting of large, almost equiaxial grains. As a result of dilatometric measurements it is established that the initial temperature of $Ac_3 = 775^\circ C$ for the sample 38LTT reaches approximately $825^\circ C$. Thus, the structure of steel samples is stabilized after the shock-wave treatment.

The microstructure of the sample 38LTTH (fig. 1 d) explains the distinction between the martensite after hardening of a usual sample in initial conditions and the martensite after hardening of a shock-wave treated sample.

The microstructure of the sample 38HTT2 which is distorted in an intercritical interval is presented on fig. 1 f. The basic phase in these samples is the martensite with various carbon content. The microstructure of the sample 38HTT (fig. 1 e) completely characterizes its structural condition after hardening in the process of shock-wave treatment

In the sample 38HTT tetragonal distortions are decreased that corresponds to carbon content $\sim 0.21\%$. In a martensite of the sample carbon content decreases to 0.21% that correlates with increasing of carbide concentration Fe_3C (tab. 2).

From the tab. 1, 2 we can see that the substantial increase of σ_B for the sample 38HTT can be connected with the presence of a phase of cementite Fe_3C . The strength improvement of the sample also should be connected with the presence of the phase of cementite.



a)



b)



c)

Table 2.
Phase composition of the treated samples.

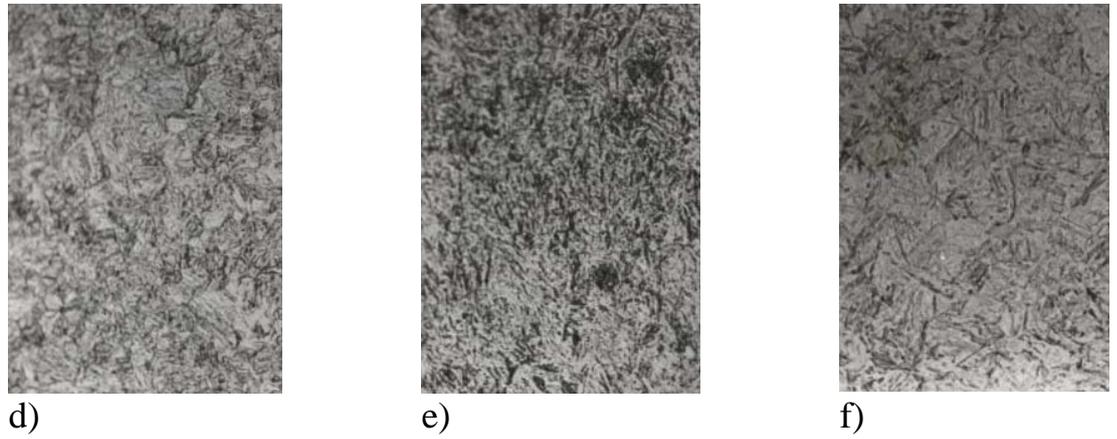


Fig.1. Microphotographs of sample surfaces after treatment: a - the initial sample; b - 38TH - initial + hardening; c - 38LTT after a cold working; d - 38LTTH after a cold working + hardening; e - 38HTT2 after a hot working; f - 38HTT after a hot working (930 °C). Magnification 200x

Sample	Martensite a, nm	Martensite c, nm	Austenite a, nm	Cementite Phases
38S	0,2864			Martensite. Carbon content in martensite is $C \approx 0.15\%$
38TH	0,2851	0,2894	0,3627	Martensite + austenite. Carbon content in martensite is $C \approx 0.33\%$. Austenite content is $\sim 7\%$.
38LTT	0,2868	0,2894		Martensite. Carbon content in martensite is $C \approx 0.1\%$
38LTTH	0,2865	0,2894	0,3604	Martensite + austenite. Carbon content in martensite is $C \approx 0.15\%$ Austenite content is $\sim 3.5\%$
38HTT	0,2866 0,28722	0,2894		a = 0,452; B = 0,509; c = 0,675 Martensite + cementite. Carbon content in martensite is $C \approx 0.21\% - 0.23\%$

In the samples 38TH and 38LTTH the austenite was found out. Thus the reduction of the a parameter corresponds to the reduction of the content C in an austenite and to the reduction of relative contents of the austenite in the sample 38LTTH. Thus, under the X-ray diffraction data, the austenite was found out only in the samples which were exposed to hardening, but after shock-wave treatment its content was lowered.

α - martensite with various carbon content was the basic phase in the samples. So in the sample 38TH the estimate of C content is 0.33 %. In the martensite of the sample 38HTT carbon content decreases to 0.21 %. Also the diffraction line disappears in the direction $\langle 100 \rangle$ that explains texture occurrence in a direction $\langle 110 \rangle$ in the sample 38HTT (fig. 2). In comparison with distortions of the

martensite lattice we can see that the most deformed martensite of the sample 38TH is the least one is in the sample 38LTT.

On messbauer data the martensite in near-surface layers was presented by a scattering spectrum with magnetic splitting close to α - iron and corresponding quantity of a hyperfine magnetic field about 33 MA m⁻¹ (fig. 3). On messbauer data the martensite in near-surface layers of the samples is presented by six linear scattering spectra with parameters, close to a ferromagnetic martensitic phase [11 – 13].

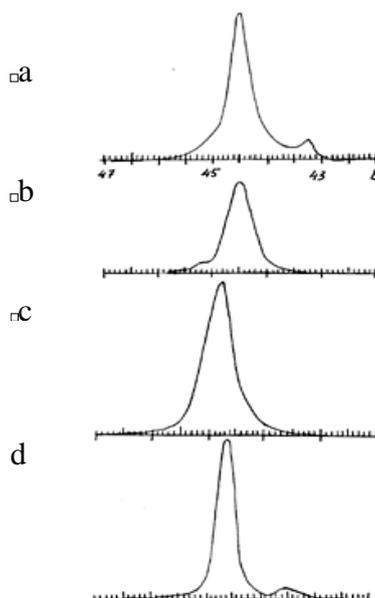


Fig. 2. X-ray lateral profiles of a line (001) of samples: 38TH - (a). 38LTT - (b). 38S - (c); 38HTT - (d)

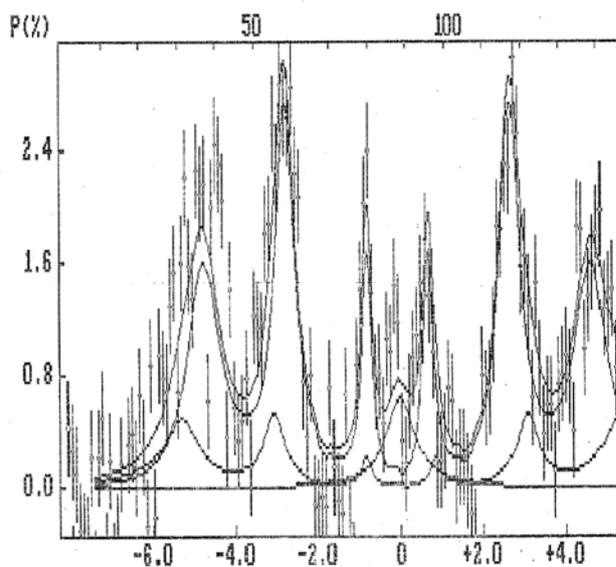


Fig. 3. CEMS spectrum of a steel surface after treatment.

On fig. 4 the dependence of standard fitting to logarithmic dependence (with reliability 0,443) values of an ultimate strength on a carbon content in a martensite is presented. This dependence qualitatively confirms the important role of the control and regulation of carbon content in separate phases (martensite, austenite, cementite).

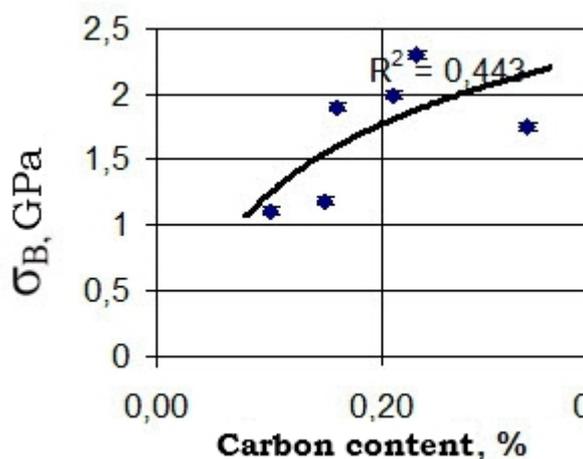


Fig. 4. Dependence of values of an ultimate

The structure formation of steel surface layers at shock-wave action occurs as follows. After an impact of plates there is a wave of a plastic loading which is spread with the velocity defined by the balance of exterior pressure and an interior stress. The progress of impact process leads to magnification of exterior pressure and occurrence of waves with great stresses [14, 15].

strength σ_B from a carbon content in a martensite.

Such shock waves lead to changes of martensite structure and austenite, phase composition of the surface in the area of shock action due to a short-duration pulsing stressing of the material.

Thus, it is possible to regulate the relative content of alpha- and gamma-phases as the result of short-duration shock action. Besides, the important application of shock-wave treatment can be the use of the processes of compaction and hardening by oxide dispersion-strengthened (ODS) ferritic and ferrite-martensitic steels [16].

The shock-wave treatment of the steel 0.33CCr3NiMoV leads to magnification of strength of the samples, caused by the processes of redistribution of phases and carbon in surface layers. On messbauer data the martensite in surface layers of the explored samples is presented by six linear scattering spectra with parameters, close to ferromagnetic martensitic phase. Lines are broadened that allows to make a conclusion about layering of phases and a segregation of impurities in surface layers. In samples with the greatest lattice distortion of the martensite small content of an austenite phase is detected. Thus reduction of lattice parameter corresponds to carbon content reduction in an austenite. Steel hardening at shock treatment is caused by deposition in the martensite matrix of the cementite phase.

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УДК: 53 (063)

ATOMIC CLOCK – A UNIQUE DEVICE

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Summary: In this research work we have viewed such achievement of mankind as atomic watch - device that allows to determine time with incredible precision and which is able to work with the same accuracy almost forever. Nowadays atomic watch is widely used in different fields of activity from GPS navigation to time synchronization in the system transport communication. Our heritage since the mankind first step towards understanding of atom essence includes not only weapons of annihilation and the source of energy but a device that is able to make life more convenient.

Key words: accuracy, achievement, atomic watch, energy, time synchronization.

Анотація: У цій роботі було розглянуто таке досягнення людства, як атомний годинник - прилад дозволяє неймовірно точно визначити час і який може працювати з однією і тією ж точністю практично вічно. Атомні годинники отримали в наш час дуже широкий спектр застосування: від GPS-навігації до синхронізації часу в системі транспортного сполучення. Наша спадщина з часів перших кроків людини в бік розуміння сутності атома – це не тільки зброя масового знищення та нове джерело енергії, але й пристрій здатний зроби життя зручніше.

Ключові слова: атомні годинники, досягнення, енергія, синхронізація часу, точність.

Аннотация: В этой работе было рассмотрено такое достижение человечества, как атомные часы – прибор, позволяющий невероятно точно определить время и который может работать с одной и той же точностью практически вечно. Атомные часы получили в наше время очень широкий спектр применения: от GPS-навигации до синхронизации времени в системе транспортного сообщения. Наше наследие со времён первых шагов человека в сторону понимания сущности атома – это не только оружие массового уничтожения и новый источник энергии, но и устройство способное сделать жизнь удобней.

Ключевые слова: атомные часы, достижение, синхронизации времени, точность, энергия.

We know a lot of kinds of clock: sand, solar, pendular, quartz, electronic. Each kind has its limit of accuracy, but there is a clock, which overtakes the competitors on this parameter in many times. An atomic clock.

During many centuries the rotating Earth was the most accuracy clock. We saw that for work of clock we need any periodic process, for example pendulum movement. For correctly clock's showing time, the period of fluctuations should be constant, how much it is possible.

As we said, time was once simply measured in astronomical terms, with the passage of the sun recording the passage of time. Surprisingly this can be a relatively accurate method of telling the time. Greater accuracy though occurred through the use of mechanical devices, and more latterly electronic devices.

Pendulum clocks though are well known for gaining and losing time, and even electronic clocks are subject to flaws in quartz crystal designs. The truly accurate measuring of time comes about through the use of atomic clocks [1].

An atomic clock is a clock that uses an electronic transition frequency in the microwave, optical, or ultraviolet region of the electromagnetic spectrum of atoms as a frequency standard for its timekeeping element.

The father of atomic clock, Louis Essen was born in 1908 in a small city in England called Nottingham. At the age of 20 his career started to take off, as he was invited to join the NPL, or National Physics Laboratory. It was during Louis's time at the NPL that he began working to develop a quartz crystal oscillator as he believed they were capable of measuring time as accurately as a pendulum based clock. Ten years after joining the NPL Louis had invented the Essen ring. This was an eponymous invention which took its name from the shape of the quartz which Louis had used in his latest clock and which was three times more accurate than the previous versions. During the early part of the 1950's Louis began to take an interest in research which was being carried out at the National Bureau of Standards (NBS) in the United States of America. He learnt that work was being carried out to invent a clock which was more accurate than any other. The American scientists were using the idea of maintaining a clock's accuracy by using the radiation emitted or absorbed by atoms. At that time the Americans were using a molecule of ammonia but Louis felt that this was not working as well as if they were using different atoms, such as hydrogen or cesium, and so he began working on his own clock using these materials instead [2].

Louis continued to work on his atomic clock and by 1964 he had managed to increase the accuracy of the atomic clock from one second in 300 years to one second every 2000 years.

The atomic clock consists of a microwave cavity. There is an electronic amplifier in the cavity. The cavity is filled up with the core elements (usually cesium-133 or rubidium-87 or Hydrogen-1). It is then heated to release atoms. The released atoms are not neutral, they carry variable electrical charges. These released atoms are made to go through a vacuum tube and then through a magnetic field. It should be

noted that only a selected few atoms which are in a low energy state can pass through this magnetic field.

After passing through a magnetic field, these atoms need to cross a microwave field, which is under the control of a crystal oscillator. The oscillator is made to vibrate the microwave field with a certain frequency. The microwave field often tends to have a variable vibration. But the variation is very small and the microwave field attains the required frequency in a cyclic order. A low-energy atom can change to a high energy state, if it can pass through the microwave field, when it is oscillating at the needed frequency. The oscillation frequency is subsequently converted to pulses of one second by a special device.

At the end of the vacuum tube, there is a device to monitor those atoms which have changed their energy state. If it is found that the number of atoms in the specified energy state are below the intended level, the crystal oscillator is adjusted in such a way that it can vibrate at a proper frequency. This adjustment process is very crucial for the working of an atomic clock. It controls certain side effects like changes in temperature and incoherence of electromagnetic waves [3].

The workings of an atomic clock have, of course, a lot to do with atomic and quantum physics, but the atomic clock is also not that far removed from a pendulum clock. Whilst the pendulum swings, or resonates, once per second, an atom may resonate many thousands of times in that period. The atomic clock works by measuring the resonating frequency of an atom, this frequency being constant. Some people erroneously believe that the atomic clock works by the decay rate of a radioactive atom, which is of course not the case [1].

In 1967 the 13th General Conference on Weights and Measures redefined the second, the unit of time in the International System of Units, in terms of the cesium standard so as to equal the second of Ephemeris Time. The conference defined the second as “the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom”.

Most atomic clocks make use of Caesium 133 atoms, these atoms having a known and constant resonance rate of 9192631770 cycles per second. Thus once that number of cycles has been counted one second has elapsed. No longer is a second simply a fraction of the time for the earth to rotate around its axis, but is defined by the number of cycles [4].

The actual workings of an atomic clock are complex, as you would expect from atomic physics. In essence caesium atoms are put into a vacuum. Lasers are then used to move the atoms through a section where microwaves are at work, and measurements are taken.

The accuracy of an atomic clock is something which many people struggle to get their head around. A caesium clock is accurate to one second every three hundred and sixteen thousand years. Developments of atomic clocks, including hydrogen clocks, should be even more accurate, perhaps to a level of one second every ten million years [1].

And this standard has been reached by the end of 20-th century. Until the 1990s the cesium beam atomic clock was the most accurate standard of atomic time and frequency. The principle underlying the cesium clock is that all atoms of cesium-

133 are identical and, when they absorb or release energy, produce radiation of exactly the same frequency, which makes the atoms perfect timepieces. Since that time, laboratories around the world have steadily improved the accuracy of cesium fountain atomic clocks. These clocks get their name from the fountainlike motion of the constituent cesium gas. The timing process begins by introducing cesium gas into a vacuum chamber and directing six infrared lasers (located at right angles to one another) to compact and cool (slow down) the cesium atoms to a temperature near absolute zero. Then two vertical lasers are used to nudge the atoms up about a metre (creating a “fountain”) through a microwave-filled cavity. The microwave frequency is tuned to maximize the observed fluorescence, which occurs at the natural resonance frequency of the cesium atom. Because the round-trip through the microwave cavity takes about a second, control of the microwave frequency has resulted in greater timekeeping accuracy. The best cesium fountain atomic clocks are now predicted to be off by less than one second in more than 50 million years [4].

The need for such accuracy may not be immediately evident, and indeed the atomic club doesn’t help to tell the time or date, just the passage of time. This accuracy though is an important aspect of the workings of the internet and things like GPS.

The main purpose of atomic clock is Time Synchronization.

Accuracy is becoming more and more relevant as technology becomes increasingly important to the functioning of our everyday lives. And as our economies become more reliant on the global marketplace, accuracy and synchronization of time is very important. Computers seem to control much our daily lives and time is essential for the modern computer network infrastructure. Timestamps ensure actions are carried out by computers and are the only point of reference IT systems have for error checking, debugging and logging. A problem with the time on a computer network and it could lead to data getting lost, transactions failing and security issues.

Synchronization on a network and synchronization with another network that you communicate with are essential to prevent the above mentioned errors. But when it comes to communicating with networks across the globe things can be even trickier as the time on the other-side of the world is obviously different as you pass each time-zone.

To counter this, a global timescale based on atomic clock time was devised. UTC - Coordinated Universal Time - does away with time-zones enabling all networks across the globe to use the same time source - ensuring that computers, no matter where they are in the world, are synchronized together [5].

Finding a source of time to synchronize a computer network to can be a challenge as there are a myriad of online time sources, all pertaining to be accurate and reliable; however, the truth can be rather different with many online sources either in too much demand, too far away or inaccurate.

NTP (Network Time Protocol) requires a source of UTC time (Coordinated Universal Time) which is kept true by atomic clocks. Online time sources are not themselves atomic clocks but NTP server devices that receive the time from an atomic clock which is then relayed to the devices that connect to the online time server.

There are two types of online time server: stratum 1 devices - devices that receive the time directly from an atomic clock, either using GPS or a radio reference signal. Stratum 2 devices on the other hand are one step further away in that they receive their time from a stratum 1 time server.

Because of demand, finding an online stratum 1 time server is next to impossible, and those that do take request usually do so under a subscription, which leaves the only choice for most people being a stratum 2 device [6].

Getting from A to B has been a primary concern for societies ever since the first roads were built. Whether it is horseback, carriage, train, car or plane - transportation is what enables societies to grow, prosper and trade. Traffic lights, speed cameras, electronic warning signs, and railway signals and point systems have to be synchronized for safety and efficiency. Any differences in time between traffic signals, for instance, could lead to traffic queues behind certain lights, and other roads remaining empty. While on the railways, if points systems are being controlled by an inaccurate clock, when the trains arrive the system may be unprepared or not have switched the line - leading to catastrophe.

Because of the need for secure, accurate and reliable time synchronization on our transport systems, the technology that controls them is often synchronized to UTC using atomic clock time servers. Most time servers that control such systems have to be secure so they make use of NTP and receive a secure time transmission either utilising atomic clocks on the GPS satellites (Global Positioning System) or by receiving a radio transmission from a physics laboratory such as NPL (National Physical Laboratory) or NIST (National Institute of Standards and Time) [7].

So, in what time we are convinced that it is difficult to overestimate the importance of physical researches at nuclear level. Since the first experiments in this field we have made huge jumps not only in energetics but also in accuracy of measurement of our time and synchronization of different branches of our life.

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SOLVENT DROP EVAPORATION WITH PINNING ON THE SOLID SURFACE

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Summary: In this work two-component liquid drying processes are developed. We considered such parts of this process as pinning (three-phase edge fixing), non uniform evaporation of the liquid, capillary flows in the volume of drop, etc. There are some theoretical and experimental results about dependence on different properties of base, liquid, components, etc.

Key words: drop, hydrodynamic, pinning, spot, three-phase border.

Анотація: В даній роботі розглянуто процеси висихання краплини двокомпонентної рідини на твердій основі. Розглянуті такі етапи процесу як піннінг, закріплення трьохфазної границі рідини, нерівномірність випаровування рідини з країв та всередині плями, виникнення капілярних течій в об'ємі краплі. Зроблені теоретичні оцінки імовірності виникнення подібного процесу, а також експериментально досліджена залежність ефекту від властивостей основи, рідини, розчиненої компоненти, тощо.

Ключові слова: гідродинаміка, крапля, піннінг, трьохфазна границя.

Аннотация: В данной работе рассмотрены процессы высыхания капли двухкомпонентной жидкости на твёрдой подложке. Рассмотрены такие этапы процесса как пиннинг, закрепление трехфазной границы жидкости, неравномерность испарения жидкости по краям и в центре капли, возникновение капиллярных течений в объеме капли. Проведены теоретические оценки возможности такого процесса, а также экспериментально исследована зависимость наблюдаемого эффекта от основных свойств подложки, жидкости, растворённого компонента и других факторов.

Ключевые слова: гидродинамика, капля, пиннинг, трёхфазная граница.

We want to present you the solution of one physics problem.

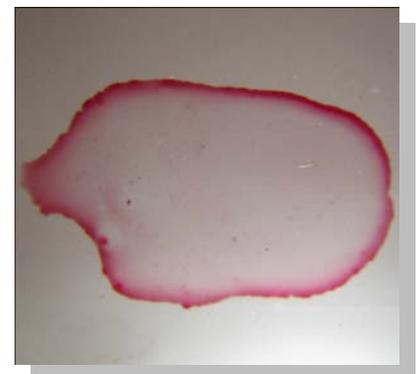
The formulation of this problem:

When drying, a drop of coffee (tea, wine, juice etc.) leaves a spot where hard particle are mainly concentrated at the edge of the drop along its rim. In this work we explained this phenomenon and studied how irregularly the hard particles can be distributed.

Common explanation

First of all let's explain why this effect exists.

There are some reasons. The first reason is caused pinning. (Pinning is the fixing of drop border due to precipitation of particles near the border.) The second reason is a non-uniform curvature of a drop: a curvature near the border is much more then the curvature in the center. That's why saturated steam is more intense than in the center. So the evaporation near the border will be stronger and the surface seems will be change. But we couldn't observe it, because the border was fixed by pinning. The surface will be remained by capillary flow which will flow from the center to the edge of the drop due to the continuity equation. Particles which pulled by the flow will precipitate on the little area near the border. That's why we



will observe this picture on the surface of the stain when the drop will evaporate [1, 2].

Theoretical part

Next, let's make our theoretical calculation of the effect.

We will count the non-uniform evaporation from the surface of the drop and will count the speed of flow. At first we want to describe our model of the solution and our assumptions.

Our assumptions:

- Height of drop is less than radius.

We consider that our drop is "flat" and we don't need to count the vertical flow of water (or other solvent).

- We obtained the surface of the drop like an ellipsoid with nearly the same semi-axis.

- The concentration and the velocity of the flow depends on the radius of the drop only.

- Viscosity of water is neglected

We want to describe:

- WHY and HOW particles come to border
- Distribution near the border

Let's make our calculation.

First of all we consider evaporation of solvent in this drop. Let's write diffusion equation for pressure of evaporated solvent:

In this equation:

- P - pressure of vapor
- D - diffusion coefficient

$$\frac{\partial p}{\partial t} = D \cdot \Delta p$$

Next, we use such border conditions, where:

- $p_{s.w}$ - pressure of saturated vapor
- y - coordinate
- φ - humidity
- t - time

$$p(0, t) = p_{s.w}$$

$$p(y, 0) = p_{s.w} \varphi$$

Using these conditions we assume that drop has little mass, that hasn't influence on humidity in laboratory.

There is solution for this system:

$$p(y, t) = p_{s.w} \left(1 - (1 - \varphi) \operatorname{erf} \left(\frac{y}{2\sqrt{Dt}} \right) \right) \quad (2)$$

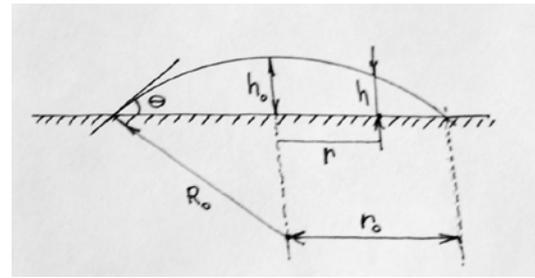
Where "erf" means "error function" [4].

If we consider that the only reason for drop to lose mass is evaporation, we can obtain how volume of drop depends on system's parameters:

$$V(t) = V_0 - \frac{16\sqrt{\pi} \mu p_{s.w.} (1 - \varphi) \sqrt{D}^3}{3R_g T \rho_w} \sqrt{t}^3$$

Designation:

- T – temperature
- ρ_w – density of water
- R_g – universal gas constant
- μ – molar mass of water



From geometry of drop we can obtain height dependence on some parameters

$$h(r,t) = h_0 \left(1 - \frac{16\sqrt{\pi}\mu p_{s.w}(1-\phi)\sqrt{D}^3}{3R_g T V_0 \rho_w} \sqrt{t}^3 \right) \left(1 - \left(\frac{r}{r_0} \right)^2 \right)$$

To move forward we tested our theory of evaporation because we need to check our assumption about “flat” drop. And to test out theory we made some experiments:

We put a drop on surface & then measured time to dry out. At the same time we measured some geometry parameters of the drop, like volume, spot radius and wetting angle. So we can put this parameters in our formulae and calculate time of full evaporation to compare it with experimental results. Some average parameters and times of evaporation state in the table below.

According to this results, our assumptions are quite realistic. So we will use them next.

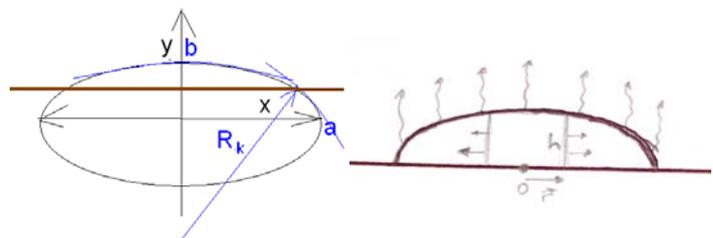
Spot radius (mm)	Time of insiccation		Volume (mkl)	Angle of wetting (rad)
	Theory	Experiment		
7	593	720	70	$\pi/12$
12	1241	1125	100	$\pi/20$
6	436	510	45	$\pi/15$
9	1556	1320	300	$\pi/6$

Non-uniform curvature & flows

Because of non-uniformity of drop shape, there are additional evaporation near the edge of our drop. For the additional evaporation, that depends on curvature which depends from the radius we obtain next dependence:

$$p = p_0 \left(1 + \alpha \left(\frac{r}{r_0} \right)^2 \right)$$

$$\text{where } \alpha = -1 + \left(\frac{R_0}{R_k} \right)$$



This non-uniformity of curvature cause non-uniform pressure distributions that cause capillary flows inside this little drop of solvent. From continuity equation we can find velocity of moving particles (it is the same that the velocity of flux of water) [2,3]

$$\int_0^r 2\pi r \frac{dh^*(r,t)}{dt} dr = -2\pi r \cdot h(r,t)v(r,t)$$

Numerical solution of this equation gives the graph below.

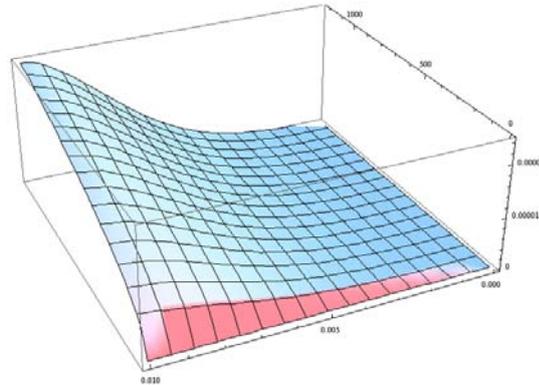
Axis:

- z (height) - velocity
- x (first plane) - radius
- y (dept) - time

Velocities:

$$v_{exp.} \approx 5 \cdot 10^{-5} m/s$$

$$v_{theor.} \approx 10^{-5} m/s$$

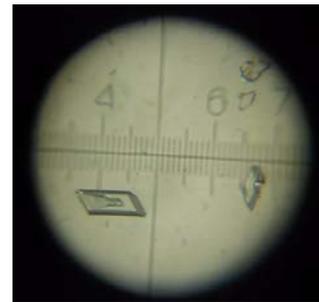


We can observe that the velocity increase when we approaches to the border. It also increase with the time of evaporation.

Experimental part

When we obtained these results we need to make experiments to compare theoretical and experiments results.

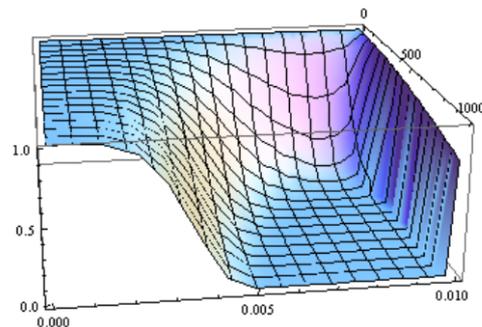
First of all we needed the corroboration of existing capillary flows. So we made quite simple setup with camera and microscope to see by our own eyes these flows. On this picture you can see little particles of salt in the salt solution. They helped to detect the velocity of the flow.



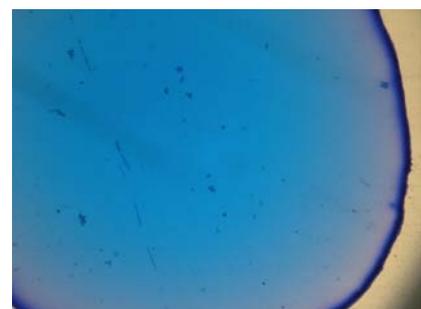
Density distribution in motion is very difficult to observe in practice because of quick character of evaporation processes. But we easily can observe result of density distribution evolution in time – as a spot.

Theoretically density distribution was obtained by continuity equation:

$$\frac{\partial \rho}{\partial t} = -\rho \frac{\partial (v_{part.}(r,t))}{\partial r}$$



And we have numerical solution of this equation on the graph above. We can conclude that when time is passing solved substances coming to the border and we



can observe (on the graph and on the photo) some “clear” zone near the edge of the drop.

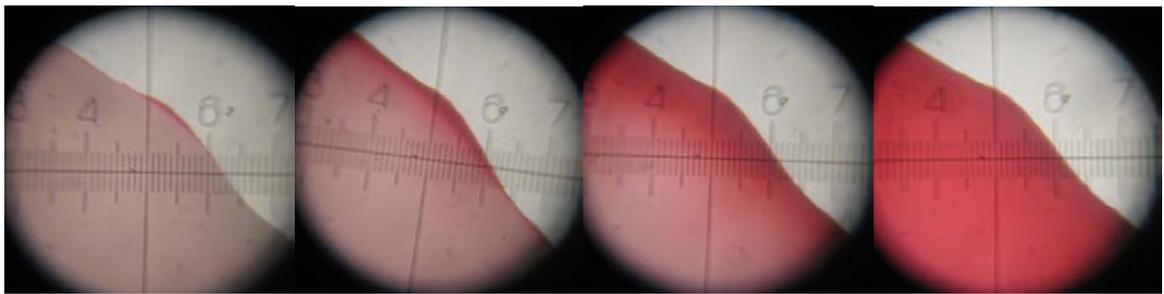
When the drop completely evaporates, almost all solved substance situated near the edge. There are different border conditions, when concentration of such substance is high. But for our solution only the fact of substance precipitation in this area is important.

Other experiments were directed on finding how dry spot color (particle) distribution depends on such parameters as:

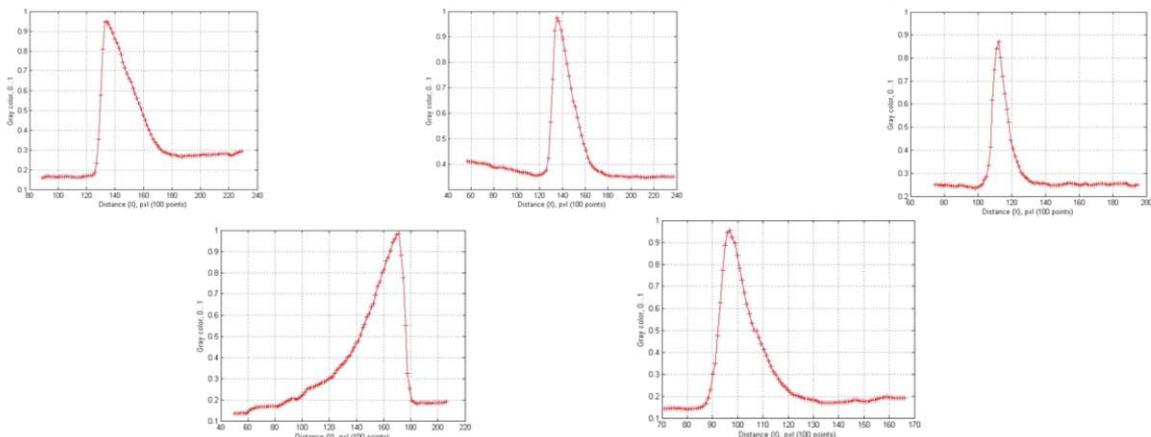
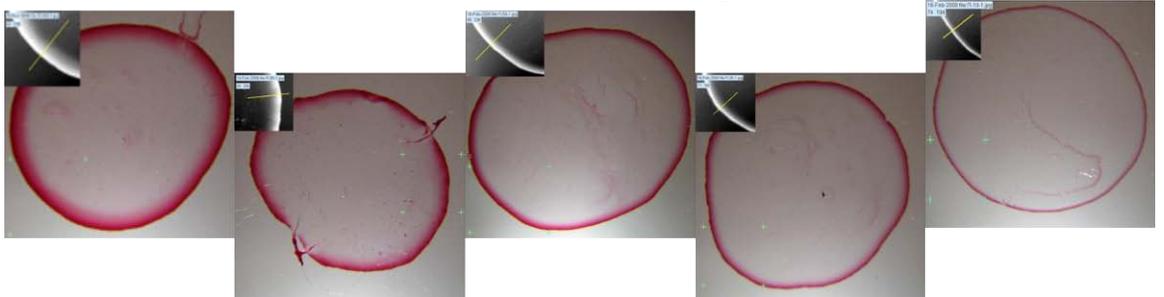
- Components of solution
- Solvent
- Wetting influence
- Gravity influence
- Concentration
- Underlying surface

There are some pictures to show the most common dependences

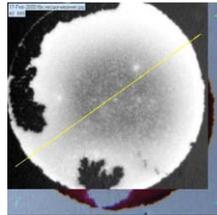
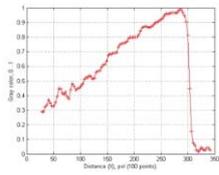
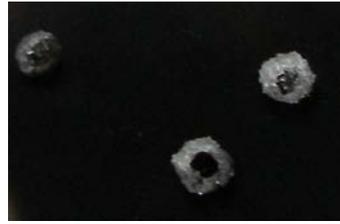
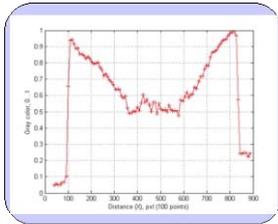
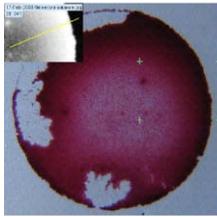
- Evolution in time (red color made by hibiscus)



- Concentration (decrease from left picture to right one)



•Wetting



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ANALYSIS OF THE CALORIFIC VALUE OF DIFFERENT GASEOUS FUELS

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Summary: The estimation of the calorific value of gaseous fuels such as pyrolysis gas, biogas, landfill gas, natural shale gas was done. The results showed that the calorific value of pyrolysis gas is comparable to the calorific value of biogas and shale gas.

Key words: calorific value, pyrolysis gas, biogas, shale gas, utilization of tyres.

Анотація: Проведена оцінка теплотвірної здатності газоподібних палив, таких як піролізний газ, біогаз, звалочний газ, природний сланцевий газ. Отримані результати показали, що теплотвірна здатність піролізного газу порівнянна з теплотвірною здатністю біогазу і сланцевого газу.

Ключові слова: теплотвірна здатність, піролізний газ, біогаз, сланцевий газ, утилізація шин.

Аннотация: Проведена оценка теплотворной способности газообразных топлив, таких как пиролизный газ, биогаз, свалочный газ, природный сланцевый газ. Полученные результаты показали, что теплотворная способность пиролизного газа сопоставим с теплотворной способностью биогаза и сланцевого газа.

Ключевые слова: теплотворная способность, пиролизный газ, биогаз, сланцевый газ, утилизация шин.

The problem of energy independence is an important one in energy policy of Ukraine and many countries.

This is directly related to the sharp rise in price obtained while crude oil and petroleum products processing.

In this regard there arises a necessity to create technologies and equipment for getting heat and electricity based on renewable and therefore cheaper and available raw materials.

Methods and technologies allowing to obtain energy from recycled materials as well as domestic and industrial wastes (waste wood, agricultural production) whose value now is around 10 times lower than the cost of petroleum products are being widespread in the world. They are used to solve environmental problems like waste utilization and maintaining clean and healthy environment and economic problems of reducing scarce energy resources exploitation [1].

The replacement of natural gas with alternative energy source, namely: pyrolysis gas, landfill gas, biogas and natural shale gas is one of the examples of rational and relevant solution of the problem of energy dependence on traditional fuels.

Technologies of waste utilization with secondary products such as flammable gases have long been used in the developed European countries and the United States of America [2].

There were done many proposals of pyrolysis installations last years in Ukraine.

Main indicators of some pyrolysis installations were analyzed by us and presented in Table 1

Table 1 - The amount of products formed by pyrolysis installations

Installation	Power, (t/day)	Productivity per day, t		
		Slag	Liquid	Gas
ECO-2006	4	0,8	2,9	0,7
Alpha	3	1,4	0,98	0,16
Biodiesel	1	0,5	0,3	0,05
Green Power	1	0,45	0,25-0,3	0,1-0,15
Pyrotex	5	1,35	2,75	0,9
Antval	3	0,9	1,8	0,3
Antval	7	2,7	4,2	1,8
Konstanta	6	1,42	1,92	1,1

As it is seen from the Table 1 and earlier researches [3, 4] the power of installation, output of goods (slag, liquid and gas), physical and chemical characteristics varied at different installations.

Installations manufacturers say that all three products are commercial goods and pyrolysis gas is similar in properties to natural gas. Pyrolysis gas is used for industrial processes at installations and its remains are burned [4].

There is no unified view of the possible use of the pyrolysis products as follows from previous studies. In the previous work I was analyzed the environmental and economic assessment of pyrolysis liquid [5].

The purpose of this paper is to give a comparative analysis of the calorific value of different types of alternative fuels including pyrolysis gas formed at various Ukrainian installations and to determine the possibility of their practical use.

Objectives of the work include:

- calculation of calorific value of pyrolysis gas;
- calculation of calorific value of alternative gaseous fuels such as landfill gas, biogas, natural shale gas, coke oven gas;
- comparative analysis of properties of different alternative gaseous fuels. And compare their calorific value to calorific value of natural gas.

The equation D.I. Mendeleeva to calculate the calorific value of gases was used [6].

This formula includes the volume of gases and heat of their combustion. Only those components emitting heat during combustion were considered, gases such as CO₂, N₂, O₂ and water vapor are the ballast, and their presence leads to decrease at combustion temperature.

$$Q = 358CH_4 + 640C_2H_6 + 915C_3H_8 + 1190C_4H_{10} + 1465 C_5H_{12} + 126,5 CO + 107,5H_2 + 234H_2S \left(\frac{KJ}{m^3} \right) \quad (1)$$

$$Q = 398CH_4 + 700C_2H_6 + 995C_3H_8 + 1285 C_4H_{10} + 1575 C_5H_{12} + 126,5 CO + 127,5H_2 + 257H_2S \left(\frac{KCal}{m^3} \right) \quad (2)$$

Where: Q – calorific value of gas, KJ/m³, KCal/m³

C_nH_m – hydrocarbon content in gas, %;

CO – content of carbon oxide in gas, %;

H₂S – content of hydrogen sulfide in gas, %

H₂ – content of hydrogen content in gas, %

The calorific value of alternative gaseous fuels such as landfill gas, biogas, pyrolysis gas and shale gas has been calculated for comparative analysis. That is why these waste utilization technologies are used in Ukraine today.

Results of calculation are presented in Table 2

Table 2 - Comparative analysis of the calorific value of various gases.

Company	Gas composition, %			Net Calorific Value, m ³
	CH ₄	H ₂	CO	
NATURAL GAS				33 080
PYROLYSIS GAS				
South-Ural Ltd.	7	25	18	7 470,5

Iron Ltd.	min	5	15	15	5 300
	max	10	20	25	8 892,5
Neroaera	min	33	12	11	14 495,5
	max	45	28	18	21 397
Energy Ltd.		24	17	4	22 734,7
A ALPHA – UKRAINE Ltd.		35	18	4	29 154,3
Energomash Ltd.		38	82	47	28 364,5
SHALE GAS					
Linde Group	min	14	25	10	8 964,5
	max	17	40	20	12 916
BIOGAS					
Mediana PM Ltd. Russia	min	50	0		17 900
	max	80	1		28 747,5
Euro diesel Ltd. Ukraine	min	40	0		14 320
	max	75	1		26 957,5
LANDFILL GAS					
Gengas OY	min	40	0		14 320
	max	70	1		25 167,5
TIS Eco	min	50	0		17 900
	max	75	1		26 957,5
Nedra Luganska Ltd.	min	40	0		14 320
	max	60	1		21 587,5

As it is seen from Table 2 the calorific value of alternative gaseous fuels is substantially (2-5 times) lower than that value of standard fuel - natural gas.

Calorific value of pyrolysis gas can be almost the same as the calorific value of natural gas, but may be 6 times less. The value ranges from 5 250 to 29 155 kJ/m³.

Pyrolysis gas with the lowest calorific value of 5 300 kJ/m³ (Iron Ltd.) can only be used for industrial process.

The calorific value of pyrolysis gas by the Alpha Energy and Energomash Ltd. installations is comparable and exceeds 2 times shale gas combustion in heat. This suggests that pyrolysis gas can be used in same sectors of the economy that natural shale gas.

It is known that Ukraine possesses substantial reserves of shale gas and it is intensive development being planned in coming years [7].

At present, Biogas is used both in Europe and the United States of America as a substitute for natural gas. As it is seen from Table 2 the calorific value of pyrolysis gas is close to the calorific value of biogas.

So, the practical use of pyrolysis gas prevents the small volume of its formation at pyrolysis plants with capacity from 1 to 7 tons a day. The volume of gas does not exceed 2 t/day.

It is known that Alpha Ltd. offers installations of tire with recycling capacity of 20 tons a day with the pyrolysis gas amount of 5 tons a day in Ukraine. In this case pyrolysis gas can be used for industrial purposes.

After completing this work we have got the following results:

- it has been proved that the calculated calorific value of pyrolysis gas is 2-6 times lower than the calorific value of natural gas;

- it was found that the calorific value of pyrolysis gas is comparable to the calorific value of biogas and exceeds 2 times the calorific value of shale gas;

- Ukraine releases installations which can produce 5 tons of pyrolysis gas a day. Pyrolysis gas from such installations can be used in economy fields using biogas, landfill gas and shale gas.

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IMPROVEMENT OF QUALITY CONTROL SYSTEM OF CARGO TRANSPORTATION BY MOTOR TRANSPORT (ON EXAMPLE OF OPEN JSC ATE-16363 (АТП-16363), KHARKIV)

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Summary: The article deals with the question of improvement of quality control system of cargo transportation by motor transport. The complex quality control system of cargo transportation is analysed. The conclusion is made that it is necessary to improve the quality control system of cargo transportation.

Key words: cargo transportation, enterprise, motor transport, national economy, quality control.

Анотація: У статті розглядається питання про вдосконалення системи управління якістю перевезень вантажів автомобільним транспортом. Комплексна система управління якістю вантажних перевезень аналізуються. Зроблено висновок про те, що необхідно удосконалити систему контролю якості перевезення вантажів.

Ключові слова: вантажні перевезення, підприємства автомобільного транспорту, народного господарства, контроль якості.

Анотация: В статье рассматривается вопрос о совершенствовании качества контроля системы перевозок грузов автомобильным транспортом. Анализируются комплексная система управления качеством грузовых перевозок. Делается вывод о том, что необходимо усовершенствовать систему контроля качества перевозки грузов.

Ключевые слова: автотранспорт, грузовые перевозки, контроль качества, предприятия национальной экономики.

In conditions of market relations, products upgrading is of great importance for enterprises-producers, consumers and the national economy on the whole. International experience testifies that success in economy, social and cultural development can be achieved by only those countries which can provide high quality of products and services, form on this basis competitive advantages and increase the living standards. Therefore, the theme of the research is topical due to the fact that in order to work in market conditions enterprises constantly have to solve the problems related to providing of the necessary quality of services.

The aim of the research is the development of the complex quality control system of cargo transportation by the rolling stock of the motor transport enterprise and the development of offers on the basis of its practical implementation.

The object of the research is the process of industrial and economic activity of the freight motor transport enterprise.

The subject of the research is the indexes of quality estimation and the quality control system of cargo transportation by the motor transport enterprise.

Quality is an aggregate of object's descriptions as concerns its ability to satisfy the statutory requirements and predictable demands [2, p. 35]. Quality control is the management of those factors and conditions which more essentially influence the quality of products or services [3, p. 12]. Quality control is a set of measures which are planned and systematically conducted, and which are needed for the

creation of confidence concerning the fact that products or services will meet certain requirements to quality [1, p. 12].

To substantiate the set of the indexes of cargo transportation quality estimation and to determine the transportation quality indexes, which are the most essential for clients, there was conducted a survey. The results of it and the calculated weight coefficients for customers emphasized four indexes – cost of services, timeliness, safety, reliability of delivery. These indexes are the basis for separate and integral coefficients of quality.

The integral coefficient of quality can be calculated as follows:

$$\hat{E}_{quality} = \sqrt[4]{\hat{E}_{cost} \cdot \hat{E}_{timeliness} \cdot \hat{E}_{safety} \cdot \hat{E}_{reliability}} \rightarrow \max, \quad (1)$$

where \hat{E}_{cost} – particular coefficient which takes into account the cost of services;

$\hat{E}_{timeliness}$ – particular coefficient which takes into account the timeliness of rendered services;

\hat{E}_{safety} – particular coefficient which takes into account the load safety;

$\hat{E}_{reliability}$ – particular coefficient that takes into account the reliability of delivery terms implementation.

The constituents of the integral quality coefficient are determined according to the formulas

$$\hat{E}_{cost} = \begin{cases} \frac{\dot{O}_{compet}}{\dot{O}_{\dot{A}\dot{O}E}}, & \dot{O}_{compet} < \dot{O}_{\dot{A}\dot{O}E}; \\ 1, & \dot{O}_{compet} \geq \dot{O}_{\dot{A}\dot{O}E}, \end{cases} \quad (2)$$

where \dot{O}_{compet} – average tariff of a basic ATE competitor to transport a corresponding type of cargo, UAH;

$\dot{O}_{\dot{A}\dot{O}E}$ – tariff of the ATE, UAH;

$$\hat{E}_{timeliness} = 1 - \frac{Q_{undue}}{Q_{totalreal}}, \quad (3)$$

where Q_{undue} – amount of load, transported with violation of conditioned terms, tons;

$Q_{totalreal}$ – average amount of cargo transported by the ATE, tons;

$$\hat{E}_{safety} = 1 - \frac{Q_{loses}}{Q_{totalreal}}, \quad (4)$$

where Q_{loses} – amount of cargo transported with safety violation, that's, with

losses, contamination, damage, tons;

$$\hat{E}_{reliability} = 1 - \frac{z_{drawbacked}}{z_{totalreal}}, \quad (5)$$

where $z_{drawbacked}$ – quantity of trips with violation of the transport discipline, units;

$z_{totalreal}$ – average quantity of trips, carried out by the rolling stock of the ATE, units.

The example of particular and integral quality coefficients calculation is shown in table 1.

Table 1 – Calculation of integral quality coefficient according to the clients

Customer of Automobile Transport	Values of transportation quality indexes				
	\hat{E}_{cost}	$\hat{E}_{timeliness}$	\hat{E}_{safety}	$\hat{E}_{reliability}$	$\hat{E}_{quality}$
Company "Osnova Papir"	1	0,84	0,91	0,92	0,91
Company "Prestyzh"	1	0,85	0,82	0,93	0,89
Company "Resurs"	1	0,93	0,82	0,93	0,92

It has also been suggested to regularly conduct a functional value analysis which is an effective instrument to reveal unused production reserves at the enterprises of various production industries and the spheres of activity. The given method allows to compare the quality and efficiency of a transport process. However, it is not sufficient to render high-quality services, as effective functioning of an automobile enterprise is important as well. The ultimate goal of the functional analysis is a search of the most economical, in terms of the producer and consumer, variants of production management.

A complex system to control the labour quality of administration was developed as well. The primary objective of it is the creation of the personal interest of all employees of a motor transport enterprise in conscientious performance of their duties and, as a result, rendering of high-quality services concerning cargo transportation to clients. It contributes to the creation of interrelation between the planned parameters and material motivation of each employee of enterprise.

So a complex quality control system of cargo transportation by motor transport consists of the system of the indexes of transportation quality estimation, the implementation of functional value analysis for estimation of the transport service of customers, the system of managerial staff stimulation for proper carrying out of their duties and increase of the quality of customers' service.

Thus, as a result of the implementation of the complex quality control system of cargo transportation by a motor transport enterprise, an ATE will increase general run that is related to the upgrading of transport service, and we will get an additional profit in the amount of 721,524.57 UAH.

The prospect of researches is the increase of the efficiency of the functioning of the Open JSC ATE-16363 at the expense of the improvement of forwarding service.

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УДК 629.33=111

DETERMINATION OF NORMAL REACTIONS OF CAR'S WHEELS IN TRACTION.

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Summary: The article deals with the question of the determination of normal reactions of car's wheels in traction. The distribution of the vertical reactions between the wheels is studied. The conclusion is made that it is possible to increase vehicle stability by determining the vertical dynamic responses in the front and rear wheels.

Key words: car, traction, vertical reaction, vehicle stability, wheel.

Анотація: Стаття пов'язана з питанням розподілення нормальних реакцій під час процесу зчеплення колес автомобіля. Предметом дослідження є розподілення вертикальних реакцій між колесами автомобіля. Зроблено висновок, що можливим є покращення стабільності автомобілю за допомогою визначення вертикальних динамічних реакцій попереду та позаду колес.

Ключові слова: автомобіль, вертикальна реакція, зчеплення, колесо, стабільність автомобіля.

Аннотация: Статья связана с вопросом распределения нормальных реакций во время процесса сцепления колес автомобиля. Предметом исследования есть распределение вертикальных реакций между колесами автомобиля. Сделано вывод, что возможным есть улучшение стабильности автомобиля с помощью определения вертикальных динамических реакций впереди и сзади колес.

Ключевые слова: автомобиль, вертикальная реакция, колесо, стабильность автомобиля, сцепление.

The uneven distribution of the vertical reactions between the wheels of one axle has an impact not only on the deterioration of the dynamic properties of wheeled vehicles, but also on their stability and control.

The presence of an uneven load on the wheel of steered vehicle leads to a difference of tangential reactions on these wheels. This can lead to slipping and to the need for constant adjustment of the vehicle direction by the driver.

The uneven vertical reactions on the wheels and the difference in the kinematic condition of the wheels on one axle lead to a change in the coefficient of resistance tires slip.

The purpose of my work is to increase vehicle stability performance by determining the vertical dynamic responses in the front and rear wheels, taking into account the torque on the driven wheels.

Application A

The works of EA Chudakov propose as a criterion of car stability the side force but opinion, it is not enough to consider only the limiting lateral force

A

EVALUATION OF A COURSE OF STABILITY OF THE THREE-AXLE VEHICLE AND VERTICAL REACTIONS

We offer to evaluate the stability of wheeled vehicles by the coefficient of stability

$$k_{stab} = \frac{M_{rez}}{M_{pert}} \quad (1)$$

Emerging responses to the front and rear axles wheels facing into account the dynamic load transfer during braking

$$R_{z1} = m_a g \left(\frac{b}{L} + m \varphi \frac{h}{L} \right) \quad (2)$$

$$R_{z2} = m_a g \left(\frac{a}{L} - m \varphi \frac{h}{L} \right) \quad (3)$$

then the coefficient of stability will be

$$k_{stab} = \sqrt{\frac{\left(1 - m \varphi \frac{h}{a}\right)^2 - 0,25 m^2 \frac{L^2}{a^2}}{\left(1 + m \varphi \frac{h}{b}\right)^2 - 0,25 m^2 \frac{L^2}{b^2}}} \quad (4)$$

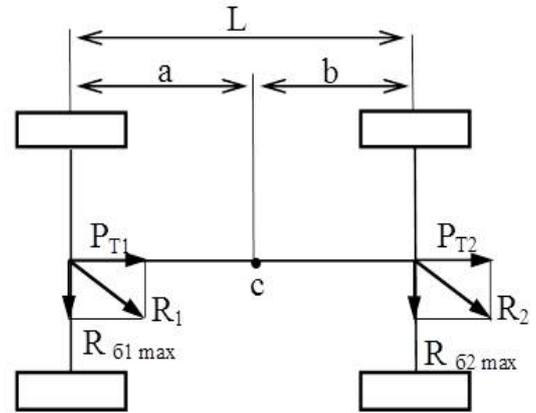


Figure 1 - Determination of stability against the two-axle vehicle during braking

against drift. Therefore, we propose to evaluate the stability of wheeled vehicles coefficient of stability. It is the ratio of moment of the drift resistance to the time of the perturbing

The maximum values of the moments are determined by the maximum possible side actions on the front and rear wheels of the car (see Fig. 1).

Application B

In certain studies, the calculation of dynamic redistribution reactions between the vertical axes of the vehicle does not take into account the effect of twisting (traction) moments on the drive wheels, because the latter were erroneously considered as sinner efforts (moments). The dynamic distribution of vertical reaction of road is defined between the wheels of front and rear axles.

This diagram (Fig. 1) doesn't indicate the torque on the driven wheels. This is due to the fact that even in the first papers on the theory of a car was mistakenly assumed torque of the wheels by internal efforts (moments), and external - to consider the tangential reaction wheels $\sum R_{x1}$ and $\sum R_{x2}$ and (1).

However, earlier, from the standpoint of classical mechanics it was also proved that the torsion (pulling) is external efforts (moments) of the vehicle chassis (Figure 2). Their size can be much larger than the moments of rolling resistance, the neglect of their action could lead to significant errors in the calculation of dynamic vertical reactions on the road wheels of the car.

Let's determine the dynamic distribution of the vertical reactions between the axes (the formula).

B

EFFECT OF THE TRACTION ON THE MOMENTS OF THE VERTICAL REACTION DISTRIBUTION OF THE DYNAMIC BETWEEN THE WHEELS CAR.

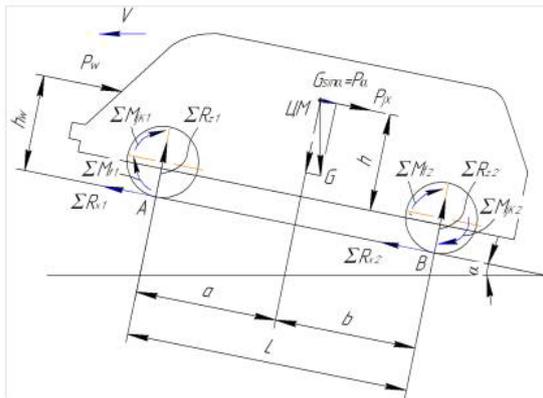


Figure 1 - Scheme of forces acting on the car in the general case of running

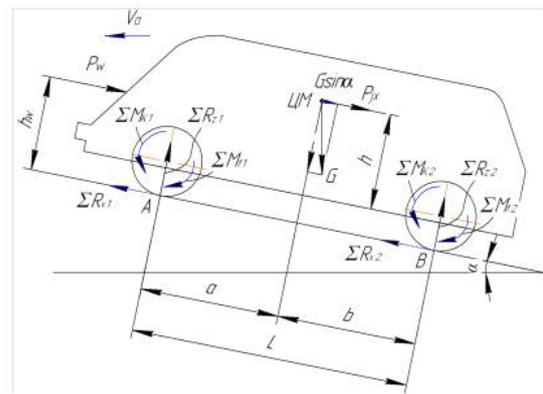


Figure 2 - strength, taking into account the external torques acting on the car in the general case running

The conditions for equilibrium of moments recorded relatively to points A and B (Figure), allowed to define

$$\sum R_{z1} = G \frac{\frac{b}{L} - \frac{kF}{G} V_a^2 \left[\frac{h_w}{L} - \frac{K_M \cdot r_{\delta 1} + (1 - K_M) r_{\delta 2}}{L} \right] + K_M \frac{r_{\delta 1} - r_{\delta 2}}{L} f}{1 + f \frac{r_{\delta 1} - r_{\delta 2}}{L}} \quad (1)$$

$$\sum R_{z2} = G \left[\frac{\frac{a}{L} + \frac{kF}{G} V_a^2 \left[\frac{h_w}{L} - \frac{K_M \cdot r_{\delta 1} + (1 - K_M) r_{\delta 2}}{L} \right]}{1 + f \frac{r_{\delta 1} - r_{\delta 2}}{L}} + \frac{(1 - K_M) \frac{r_{\delta 1} - r_{\delta 2}}{L} f}{1 + f \frac{r_{\delta 1} - r_{\delta 2}}{L}} \right] \quad (2)$$

Application C

We introduce the coefficients of the refining results of calculating of the dynamic vertical reaction. Analysis of equations (1) and (2) shows that the inclusion of the torque moment to the driving wheels increases the values of the dynamic vertical reaction at the front were and of decreases in the rear wheels.

In Fig. it is show the plots of the coefficients of the refining results of calculating the dynamic vertical reaction at the front and rear wheels of the car speed.

We have made the following main conclusions.

1. The obtained results can do the real assessment of the indicators of control of wheeled vehicles.

2. In certain studies, the calculation of dynamic redistribution reactions between the vertical axes of the vehicle does not take into account the effect of twisting (traction) moments on the driving wheels, and this is the result of the significant errors.

EVALUATION OF UPDATING OF DYNAMIC VERTICAL REACTIONS ACCURACY OF THE WHEELS TAKING INTO ACCOUNT THE TORQUE TO THE DRIVING WHEELS

Refining coefficients of the calculated results of dynamic vertical reaction

$$K_{y_{m_1}} = 1 + \frac{\frac{K_M \cdot r_{s1} + (1 - K_M) \cdot r_{s2}}{b} \left(\frac{\dot{V}_a}{g \cos \alpha} + \frac{kF}{G \cos \alpha} V_a^2 \right)}{1 - \frac{h}{b} \operatorname{tg} \alpha - \frac{\dot{V}_a}{g \cos \alpha} \cdot \frac{h}{b} - \frac{kF}{G \cos \alpha} \cdot \frac{h_w}{b} V_a^2 - f \frac{r_{s2}}{b}} + \quad (1)$$

$$+ \frac{K_M \frac{r_{s1} - r_{s2}}{b} (f - \operatorname{tg} \alpha) + \frac{r_{s2}}{b} (f + \operatorname{tg} \alpha)}{g \alpha - \frac{\dot{V}_a}{g \cos \alpha} \cdot \frac{h}{b} - \frac{kF}{G \cos \alpha} \cdot \frac{h_w}{b} V_a^2 - f \frac{r_{s2}}{b}};$$

$$K_{y_{m_2}} = 1 - \frac{\frac{K_M \cdot r_{s1} + (1 - K_M) \cdot r_{s2}}{a} \left(\frac{\dot{V}_a}{g \cos \alpha} + \frac{kF}{G \cos \alpha} V_a^2 \right)}{1 + \frac{h}{a} \operatorname{tg} \alpha + \frac{\dot{V}_a}{g \cos \alpha} \cdot \frac{h}{a} + \frac{kF}{G \cos \alpha} \cdot \frac{h_w}{a} V_a^2 + f \frac{r_{s1}}{a}} + \quad (2)$$

$$+ \frac{\frac{r_{s1} - r_{s2}}{a} [f(1 - K_M) + K_M \operatorname{tg} \alpha] - \frac{f r_{s1} + r_{s2} \operatorname{tg} \alpha}{a}}{1 + \frac{h}{a} \operatorname{tg} \alpha + \frac{\dot{V}_a}{g \cos \alpha} \cdot \frac{h}{a} + \frac{kF}{G \cos \alpha} \cdot \frac{h_w}{a} V_a^2 + f \frac{r_{s1}}{a}}.$$

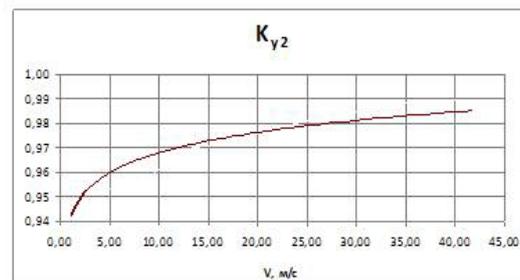
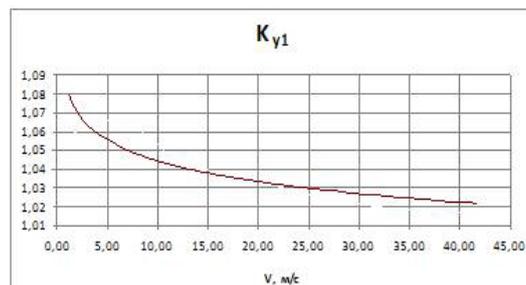


Figure - The dependence of the refined coefficients of the results of dynamic vertical reactions on the wheels $K_{y_{m1}}$ and $K_{y_{m2}}$ the rear and the front axle.

3. The results obtained for the determination of the vertical dynamic reaction to the front and rear wheels of the car differ from the known and it is possible to refine the calculation, taking into account the torque on the driving wheels.

4. In the calculations, taking into account the torque as an external force, the accuracy of the dynamic vertical reactions on the wheels of the car has been increased by 6% for the front axle and by 4% for the rear axle.

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Summary: The article deals with warm mix asphalt production technologies. They are studied from the point of view of temperature and classified according to their quality. The conclusion is made that the production technologies have the potential to reduce temperature of asphalt.

Key words: asphalt, production technology, foaming technology, organic technology.

Анотація: Стаття має справу з технологіями виробництва теплового асфальту. Ці технології розглядаються з точки зору температури та класифікуються згідно їх якості. Зроблено висновок, що технології виробництва мають потенціал зниження температури асфальту.

Ключові слова: асфальт, органічна технологія, технологія виробництва, технологія виробництва піни.

Аннотация: Статья имеет дело с технологиями производства теплового асфальта. Эти технологи рассматриваются с точки зрения температуры и классифицируются согласно их качествам. Сделан вывод, что технологи производства имеют потенциал снижения температуры асфальта.

Ключевые слова: асфальт, органическая технология, технология производства, технология производства пены.

Warm mix asphalt (WMA) production technologies have the potential to significant reduction of asphalt production temperature's without compromising its performance. The existing WMA production technologies can be categorized in three groups:

- 1) foaming technologies;
- 2) organic or wax technologies;
- 3) chemical additives.

The classification of asphalt by the production temperature is presented in Fig. 1.

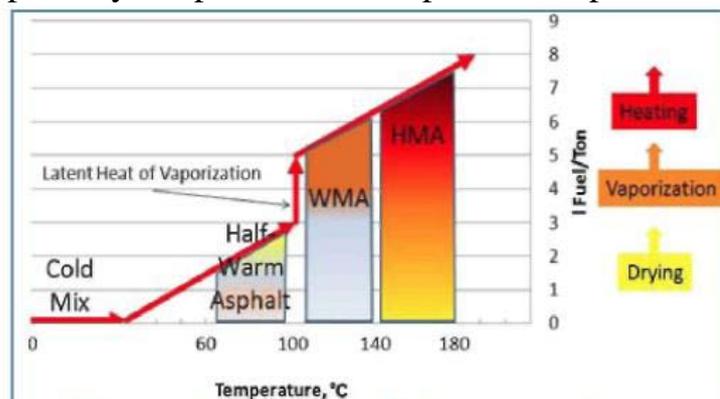


Fig. 1. Asphalt Classification by Production Temperature

Our research has been conducted to assess two different WMA production technologies – Sasobit and Rediset WMX.

Sasobit is a Fischer-Tropsch process wax that reduces the viscosity of bitumen above the melting point of wax, thus improving the coating of aggregates and workability of the mix.

Rediset WMX is a chemical additive – a combination of cationic surfactants and rheology modifier based on organic additives. It chemically modifies the bitumen

and encourages active adhesion that improves the coating of the aggregates by binder. Other additive components reduce the viscosity of the binder at the temperature's production.

The aim of the research was to investigate the changes in bitumen consistency after modifying it with WMA additives, to determine the mechanical properties of asphalt after reduction of compaction temperature and to compare the characteristics of WMA with those of conventional hot mastic asphalt (HMA). To achieve this aim, the following tasks have been set:

1. Analysis of changes in bitumen consistency at intermediate and high temperatures after modifying it with WMA additives.
2. Determining necessary adjustments in the process of mixture preparation, testing conditions and compaction method for assessment of WMA properties and their adequate comparison with HMA.
3. Determining physical and mechanical properties, including stiffness, resistance to deformations and compactibility of the asphalt modified with WMA additives and comparing the results with conventional HMA.

BITUMEN TESTING WITH TRADITIONAL METHODS

The test results (Table 1) for the binder containing Sasobit show the consistency reduction at temperatures above the melting point of the additive and increase after the crystallization of the wax. As expected, the degree of viscosity changes depends on the amount of the additive in the bitumen. The addition of Rediset WMX, however, has only a minor effect on the bitumen characteristics. Modification of the bitumen viscosity is only one of the properties of this chemical additive, as it mostly affects interaction of bitumen and aggregates. Therefore, the assessment of Rediset WMX requires testing the asphalt mixture.

Table 1

Traditional Bitumen Test Results

Bitumen type	Pen. at 25°C, 1/10mm	Soft. point, °C	Dyn. visc. 60°C, Pas	Pen. Index, I _p
	EN 1426	EN 1427	EN 12596	EN 12591
Ref.40/60	48.0	50.4	440.0	-1.2
3% Sas	32.6	78.8	2416.6	3.1
2% Sas	33.3	64.0	1147.7	0.8
2% Red	37.3	52.2	551.5	-1.3
1% Red	43.0	51.4	445.5	-1.2

1.1 ASPHALT TESTING

The densification data from gyratory compactor, expressed as a function of a number of gyrations and the ageing time show significant changes in densification at different times of ageing. The compactibility data for specimens with no ageing confirm that the compaction requires less energy for both WMA compared to HMA. However, after hardening for two and four hours, the compaction characteristics level out and are very similar to both WMA and HMA. This suggests that initial ageing has

a significant effect on compactibility properties of asphalt, therefore should be performed each time.

The stiffness modulus and the number of air voids at different ageing times are presented in Fig. 2. The results show an increase of the stiffness with the longer ageing time for all specimens, except for Sasobit at four hours, which is considered to be related to the excessive density and not to the mechanical properties of the product.

The results demonstrate that the strength gain is different for WMA products, compared to the reference HMA.

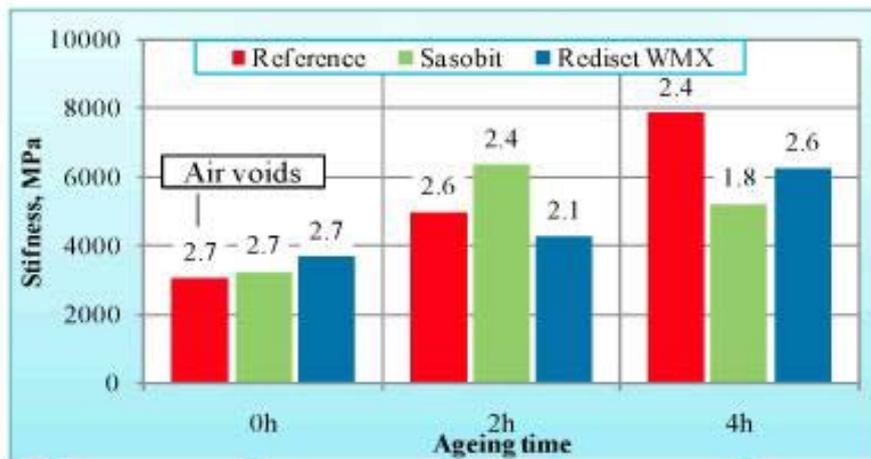


Fig. 2. Stiffness modulus after different ageing times

1.2 ASPHALT STIFFNES

The stiffness has been measured in accordance with the EN 12697-26 at 20°C.

The results show that the stiffness of Sasobit is higher than of Rediset WMX at all compaction temperatures (Fig. 3). It is also clear that the difference between stiffness of both WMA at 135°C and 125°C is not significant, which allows assuming that the temperature can be lowered to at least 125°C while maintaining the relatively highest possible stiffness modulus for both WMA products. Further lowering of the temperature is considered to reduce stiffness of the mixture.

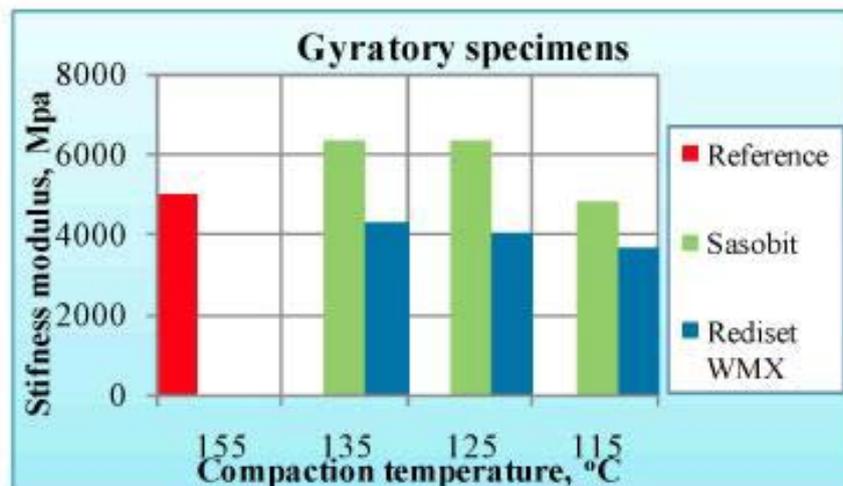


Fig. 3. Stiffness modulus test results for gyratory specimens

1.3 CONCLUSIONS

1. Addition of Sasobit reduces viscosity of bitumen at high temperatures and increases it at intermediate temperatures. At in-service temperatures, Sasobit provides higher resistance to deformations and improved elasticity of bitumen. Addition of Rediset WMX has minor effect on bitumen properties.

2. Oxidative hardening has different effects on WMA and HMA. Therefore, for the laboratory mixed samples, mix preparation method should be changed considering asphalt ageing before carrying out the compaction. Two hour ageing was found satisfactory to provide objective test results for comparison of WMA and HMA.

3. Use of both tested WMA products allows reducing the compaction temperature to at least 125°C, with the density remaining similar to HMA.

4. The analysis of mechanical properties of asphalt shows that reduction of the compaction temperature to at least 125°C for both WMA products is possible while maintaining similar stiffness and without having an increased susceptibility to permanent deformations.

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УДК 681.785.5

THE STREAK CAMERA CONCEPTION

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Summary: In this article a streak camera device is considered. The physical and electronic details of this complex instrument are not deeply analyzed. But, though different physical phenomena are involved in the work of streak cameras, their optical part is mostly discussed. The streak camera consists of several components, the principles of work of each component being outlined. Finally, the view of the camera as an optoelectronic recording device with best temporal resolution is developed. On the other hand, it is highlighted how many possibilities can scientists get, using streak cameras. Besides, many applications of this device are described.

Key words: experimental methods, high-speed optical sensors, optoelectronics, streak camera, time-resolved spectroscopy.

Стаття: В цій статті розглядається будова стрік-камери. Тонкощі фізики та електроніки, що стосуються цієї теми, не висвітлені. Оскільки в роботі стрік-камери беруть участь багато різних фізичних явищ, в основному обговорюється оптичний бік питання. Стрік-камери утворюються із декількох складових, і принципи влаштування кожного

компонента описано в загальних рисах. Нарешті, одержано уявлення про неї як про оптоелектронний записуючий прилад з найкращим часовим дозволом. З іншого боку, висвітлено багато можливостей, які отримують вчені, використовуючи стрік-камери. Представлено багато додатків цього пристрою.

Ключові слова: високошвидкісні оптичні датчики, експериментальні методи, оптоелектроніка, спектроскопія, стрік-камера.

Статья: В этой статье рассматривается устройство стрик-камеры. Тонкости физики и электроники, относящиеся к этой теме, остаются в стороне. Но, поскольку в работе стрик-камеры участвуют многие различные физические явления, в основном обсуждается оптическая сторона вопроса. Стрик-камеры образуются несколькими составляющими приборами, и в общих чертах рассмотрены принципы работы каждого. Наконец, получено представление о ней как об оптоэлектронном записывающем приборе с наилучшим временным разрешением. С другой стороны подчёркнуто, как много возможностей получают учёные, используя стрик-камеры. Представлены многие приложения этого устройства.

Ключевые слова: высокоскоростные оптические датчики, оптоэлектроника, спектроскопия, стрик-камера, экспериментальные методы.

A streak camera is an instrument for measuring the variation in a pulse of light intensity with time. It is also used to estimate the pulse duration of some ultrafast laser systems and has many other applications. Although we call it a "camera", a streak camera is quite different from video cameras and still cameras that we load with a film to take pictures of people and objects around us. In other words the streak camera is a device that measures ultra-fast light phenomena and gives us intensity vs. time vs. position (or wavelength) information [1].

Now streak-cameras are in a spotlight and receive a huge interest. They allow scientists to study processes that last less than a billionth part of a second. Talking simply, streak-cameras are optical devices with best time resolution that record information about most complex and short processes in the world. By means of this technology there are many new horizons opened now. The fields of science using them will be discussed a little later. Many laboratories all over the world apply them in their research and many scientists work in this area to develop the idea of the streak-camera.

Its name dates back to the early days of high speed rotating drum cameras. These cameras would "streak" reflected light onto film. No other instruments which directly detect ultra-fast light phenomena have better temporal resolution than the streak camera.

The streak camera can be used to detect several tens of different light channels simultaneously. For example, it can be used in combination with a spectroscope and this allows time variation of the incident light intensity with respect to the wavelength to be measured (time resolved spectroscopy). Used in combination with proper optics, it is capable of measuring time variation of the incident light with respect to its position (time and space-resolved measurement). The light being measured passes through a slit and is transformed into a slit image on the photo-cathode of the streak tube by the optics. At this point, four optical pulses, which vary slightly in terms of both time and space, and which have different optical intensities, are input through the slit and arrive at the photo-cathode [2].

The input optics of a streak-camera is an optics which is placed in front of the photo-cathode of the streak tube. Its function is to make the light measured pass into a fine slit ray with a focus on the photo-cathode. It consists of a slit section and a lens section. Various models are available, classified by the spectral transmittance and brightness of the lens system.

Between the phosphor screen on the output side of the streak tube the output optics is positioned. It is used to form an image on the sensitive surface of the camera which reads the streak image formed on the phosphor screen.

The incident light on the photo-cathode is converted into a number of electrons proportional to the intensity of the light, so that these four optical pulses are converted sequentially into electrons. They then pass through a pair of accelerating electrodes, where they are accelerated and bombarded against the phosphor screen [3]. The photo-cathode is configured of numerous layers of various types of a metallic film layered on the surface of the window material so that when light strikes this surface, the light energy is absorbed and electrons called photoelectrons are emitted. The wavelength range of the incident light from which these photoelectrons are generated and the conversion differs depending on the material making up the photo-cathode.

Material of windows is a substrate formed by either the photo-cathode or the phosphor screen, and is made of the material with a superb light transmission characteristic. Various materials such as MgF₂, UV transmitting glass and fiber plate are used as window materials. The window material varies depending on the boundary transmittance wavelength of the UV region.

As the electrons produced from the four optical pulses pass between a pair of sweep electrodes, high voltage is applied to the sweep electrodes at a timing synchronized to the incident light. This initiates a high-speed sweep (the electrons are swept from top to bottom). During the high-speed sweep, the electrons, which arrive at slightly different times, are deflected in slightly different angles in the vertical direction, and enter the MCP. MCP is an abbreviation for Micro Channel Plate. The MCP is an electron multiplier consisting of many thin glass capillaries (channels) with internal diameters ranging from 10 μm to 20 μm , bundled together to form a disk-shaped plate with a thickness of 0.5 mm to 1 mm. The internal walls of each individual channel are coated with a secondary electron emitting material, so that as the electrons come flying through the channels, they bump against the walls, and the repeated impact causes them to multiply in number. A single electron can be multiplied into as many as 10⁴ using this process [2]. As the electrons pass the MCP, they are multiplied several thousands of times then they impact against the phosphor screen, where they are converted again into light.

The phosphor screen is a screen which produces light when electrons bump against it. This is where the electron image is optically converted into a streak image. The phosphor screen consists of a glass plate and layers of fluorescent material on the surface of the plate. The amount of light generated by the fluorescent material is proportional to the kinetic energy of the electrons. The peak and attenuation time of the spectrum vary depending on the type of the phosphor screen used. Phosphor screens are classified by P numbers, such as P-11, P-20 or P-43 [2].

On the phosphorous screen, the phosphor image corresponding to the optical pulse which was the earliest to arrive is placed in the uppermost position, with the other images being arranged in sequential order from top to bottom, in other words, the vertical direction on the phosphor screen serves as the time axis. Also, the brightness of the various phosphor images is proportional to the intensity of the respective incident optical pulses. The position in the horizontal direction of the phosphor image corresponds to the horizontal location of the incident light.

In this way, the streak camera can be used to convert changes in the temporal and spatial light intensity of the light being measured into an image showing the brightness distribution on the phosphor screen. We can thus find the optical intensity from the phosphor image, and the time and incident light position from the location of the phosphor image.

The trigger section controls the timing of the streak sweep. This section has to be adjusted so that a streak sweep is initiated when the light being measured arrives at the streak camera. For this purpose, we use a delay unit, which controls how long the trigger signal which initiates the streak sweep is delayed, and a frequency divider, which divides the frequency of the external trigger signal if the repetition frequency of the trigger signal is too high. Also, in cases where the trigger signal cannot be produced from the devices such as a laser, it has to be produced from the light being measured itself, and this requires a PIN photodiode.

Streak Trigger Unit (Frequency Divider) divides signals which have a repetition frequency too high to be handled by a single sweep unit, and supplies gate trigger signals and streak trigger signals to the single sweep unit. Delay Unit This unit can be used to specify the delay time in steps as short as 30 ps.

PIN Photodiode is a device to convert the incident light pulse into the streak trigger signal for a single sweep unit or a synchroscan unit. For a single sweep unit, a slow repetition pulse laser is used as the applicable light source. For a synchroscan unit, a mode-locked laser is used as the applicable light source.

The readout section reads and analyzes streak images produced on the phosphor screen, which is on the output side of the streak camera. As the streak image is faint and disappears in an instant, a high-sensitivity camera is used. Analysis of streak images is done by transferring the images through a frame grabber board to a computer.

In addition to the units which make up this basic configuration, there are spectrometers, optics, and other peripheral equipments which can be used depending on each application.

At present there are such applications of streak-cameras: measurement of electron bunch for synchrotron and LINAC applications; research involving X-ray lasers, free electron lasers and various other types of pulsed lasers; plasma light emission, radiation, laser combustion and explosions; fluorescence lifetime measurement; time-resolved spectroscopy ; optical soliton communications, response measurement with quantum devices; lidar Thomson scattering, laser distance measurement and many others [4].

Time and space-resolved measurement is a type of measurement in which temporal fluctuation of the light intensity is measured at the position of the light being measured. This is done by using a lens system appropriate to optical images

in the target range and forming an image on the input slit surface of the streak camera.

Now an imaging solution that allows us to visualize the propagation of light exists. The device has been developed by the MIT Media Lab's Camera Culture group in collaboration with Bawendi Lab in the Department of Chemistry at MIT [1]. It turns out to be a developed streak-camera that is capturing light in two dimensions. A laser pulse that lasts less than one trillionth of a second is used as a flash and the light returning from the scene is collected by a camera at a rate equivalent to roughly half a trillion frames per second. However, due to very short exposure times (roughly two trillionth of a second) and a narrow field of view of the camera, the video is captured over several minutes by repeated and periodic sampling. The idea is that the effective exposure time of each frame is two trillionths of a second and the resultant visualization depicts the movement of light at roughly half a trillion frames per second. Direct recording of reflected or scattered light at such a frame rate with sufficient brightness is nearly impossible. We use an indirect 'stroboscopic' method that records millions of repeated measurements by careful scanning in time and viewpoints [1].

Beyond the potential in artistic and educational visualization, the camera's applications include industrial imaging to analyze faults and material properties, scientific imaging for understanding ultrafast processes and medical imaging to reconstruct sub-surface elements, i.e., 'ultrasound with light'. In addition, the photon path analysis will allow new forms of computational photography, e.g., to render and re-light photos using computer graphics techniques [4].

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УДК 556.388

PROTECTION METHODS OF GROUND WATER POLLUTION

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Summary: The article «Protection methods of groundwater pollution.» is devoted to the methods of groundwater protection, because groundwater is a valuable natural resource used in

drinking and industry. These means include land-use planning and everybody's interest in rational way of using. A great deal of attention is paid to the geological and hydrogeological characteristics, which are mapped and let to determine potential contamination sources.

Key words: ground water, methods of protection, natural resource, pollution.

Анотація: Стаття «Методи захисту підземних вод від забруднення» присвячена методам захисту підземних вод, тому що підземні води – цінне природне джерело, яке використовують для пиття і промисловості. До цих методів належать моделювання та інтерес кожного в раціональному використанні. Багато уваги було приділено геологічним та гідрогеологічним властивостям, які наносяться на карту і дають визначити можливі джерела забруднення.

Ключові слова: забруднення, методи захисту, підземні води, природне джерело.

Аннотация: Статья «Методы защиты подземных вод от загрязнения» посвящена методам защиты подземных вод, потому что подземные воды – ценный природный источник, который используется для питья и промышленности. К этим методам относятся моделирование и интерес каждого в рациональном использовании. Много внимания было уделено геологическим и гидрогеологическим характеристикам, которые наносятся на карту и дают определить возможные источники загрязнения.

Ключевые слова: загрязнение, методы защиты, подземные воды, природный источник.

Groundwater is an important natural resource for industry, agriculture and drinking. Groundwater is protected. in European countries. A practical and effective means of protecting groundwater and preventing pollution is through the use of a Groundwater Protection Scheme.

It provides guidelines for the planning and licensing authorities in carrying out their functions. The primary responsibility for groundwater protection rests on any person who is carrying out an activity that poses a threat to groundwater. The protection of groundwater quality from the impact of human activities is a high priority, because groundwater moves slowly through the ground and so the impact of human activities lasts for a relatively long time.

Groundwater may be difficult to clean up, even when the source of pollution is removed, unlike surface water, where flow is in defined channels, groundwater is present everywhere. Agricultural, industrial and other human activities are posing increasing risks to groundwater quality.

How Extensive is Groundwater Contamination? Assessment of the extent of groundwater contamination is difficult due to such factors as limited and inconsistent access to the water (usually dependent on wells and springs), the potential for bias in existing data (if originally collected to explore a particular water quality problem), incomplete information about the well, and inconsistent methods of sampling and analysis.

It is also important to keep in mind that the trend of increasing reports on detections of contaminants in groundwater is largely due to the intensive search for contaminants now under way by many state agencies, as well as continued improvements in the sensitivity of analytical methods used to measure the concentration of contaminants.

The volume of groundwater within 2500 feet of the surface has been estimated at 100 quadrillion gallons, or about 16 times the volume of the Great Lakes of the USA. Of this amount, at least half is too saline from natural causes to use for

drinking water, although some of it may be suitable for other uses. The total amount of the remaining groundwater that is contaminated is unknown, although EPA estimates the amount contaminated by point sources to be 2-3 percent.

Perhaps the best-known sources of groundwater contamination are associated with the storage or disposal of liquid and solid wastes. The organic substances most frequently reportedly found in groundwater, as resulting from waste disposal in decreasing order of occurrence, are: trichloroethylene (TCE), chloroform, benzene, pentachlorophenol, tetrachloroethylene (PCE), creosote, phenolic compounds, 1,1,1-trichloroethane, toluene, xylene.

Dissolved Solids and Chloride. One of the most common water quality concerns is the presence of dissolved solids and chloride in concentrations that exceed the recommended maximum limits in federal secondary drinking water standards: 500 mg/L (milligrams per liter or approximately equivalent to parts per million) for dissolved solids and 250 mg/L for chloride. Such concentrations are found at the seaward ends of all coastal aquifers and are quite common in aquifers at depths greater than a few hundred feet below the land surface in many parts of the United States.

Although not particularly toxic, iron and manganese in concentrations greater than the limits for federal secondary drinking water standards (0.3 mg/L for iron and 0.05 mg/L for manganese) can impair the taste of water; stain plumbing fixtures, glassware and laundry; and form encrustations on well screens, thereby reducing well-pumping efficiency.

Contaminants can enter groundwater from more than 30 different generic sources related to human activities. These sources are commonly referred to as either point or nonpoint sources. Point sources are localized in areas of an acre or less, whereas nonpoint sources are dispersed over broad areas.

The most common sources of human-induced groundwater contamination can be grouped into four categories: waste disposal practices, storage and handling of materials and wastes, agricultural activities, and saline water intrusion.

About 150 million tons of municipal solid waste and 240 million tons of industrial solid waste are deposited in 16,400 landfills each year. Some hazardous waste material may be deposited in municipal landfills and underlying groundwater may become contaminated. Wastes deposited at industrial landfills include a large assortment of trace metals, acids, volatile organic compounds and pesticides, which may cause significant local contamination.

Possibly as many as 7 million steel tanks are used to store petroleum products, acids, chemicals, industrial solvents and other types of waste underground. The potential of these tanks to leak increases with age. About 20 percent of existing steel tanks are more than 16 years old, and estimates of the total number that presently leak petroleum products range from 25 to 30 percent. Underground storage tanks appear to be a leading source of benzene, toluene and xylene contaminants, all of which are organic compounds in diesel and gasoline fuels.

Mining of coal, uranium and other substances and the related mine spoil can lead to groundwater contamination in several ways: shafts and tunnels can intersect aquifers, exposing coal to oxygen can form sulfuric acid, which can degrade water quality, contaminants from tailings can leach into groundwater, oil-well brines.

Since the 1800s, hundreds of thousands of exploratory and production wells have been drilled for oil and gas in the United States. During production, oil wells produce brines that are separated from the oil and stored in surface impoundments. EPA estimates that 125,100 brine-disposal impoundments exist, which might affect local groundwater supplies.

Agriculture is one of the most widespread human activities that affects the quality of groundwater. In 1987, about 330 million acres were used for growing crops in the United States, of which 45 million acres were irrigated. Pesticides have been used since the 1940s to combat a variety of agricultural pests. Between 1964 and 1982, the amount of active ingredients applied to croplands increased by 170 percent. Herbicide usage peaked in 1982, and since then has declined from about 500 million pounds of active ingredients per year to about 430 million pounds in 1987. In addition to crop applications, infiltration of spilled pesticides can cause contamination in locations where pesticides are stored, and where sprayers and other equipment used to apply pesticides are loaded and washed. Pesticides most frequently detected in groundwater are the fumigants ethylene dibromide (EDB) and 1,2-dichloropropane; the insecticides aldicarb, carbofuran and chlordane; and the herbicides alachlor and atrazine.

Percolation of irrigation water into soils dissolves soil salts and transports them downward. Evapotranspiration of applied water from the root zone concentrates salts in the soil and increases the salt load to the groundwater. Chemigation, the practice of mixing and distributing pesticides and fertilizers with irrigation water, may cause contamination if more chemicals are applied than crops can use. It may also cause local contamination if chemicals back-siphon from the holding tank directly into the aquifer through an irrigation well.

The encroachment of saline water into the freshwater part of an aquifer is an ever-present threat when water supplies are developed from the highly productive coastal plain aquifers of the United States, or from aquifers underlain by saline water in the interior of the country. Local incidents of saline water intrusion have occurred on all coasts of all continents.

Now more comprehensive methods using a greater geological and hydrogeological input are required to enable better and more defensible decision-making in land-use planning and environmental protection.

The level of available geological and hydrogeological information on which to base a groundwater protection scheme varies from area to area at present. Where the information is adequate, a comprehensive scheme based on hydrogeological concepts, is achievable. As adequate geological information, particularly on subsoils, is not available for a significant proportion of the country at present, it will not be possible to produce comprehensive groundwater protection schemes for every local authority area in the short term. Interim groundwater protection measures are recommended pending a comprehensive scheme, reflecting the precautionary principle for environmental protection.

The groundwater protection zone maps have their limitations because they generalise variable and complex geological and hydrogeological conditions. Therefore, a scheme provides a technical framework to assist in decision-making on

the location and nature of developments and activities ensuring the protection of groundwater.

Many industries, especially food processing industries such as creameries and meat factories, have their own water supply, often from groundwater. There are large available groundwater resources unused for water supply at present. Groundwater is a resource which is under increasing risk from human activities, for the following reasons:

- groundwater flow and contaminant transport are neither readily observed nor easily measured, and both processes are generally slow;
- wells and springs are contaminated;
- domestic, agricultural and industrial effluents get into the ground;
- chemicals of increasing diversity and often high toxicity are being manufactured, distributed and used for a wide range of purposes.

The right way is prevention. No doubt, it is better to prevent than to cure. Once groundwater contamination occurs, the consequences of it can be felt longer because of slow movement of groundwater. Due to interrelation with surface water systems, if groundwater becomes contaminated, surface water quality can also be affected. Thus the protection of groundwater resources is an important aspect of sustaining surface water quality. One more cause concerns benefit. Contaminated drinking water is a health hazard: once contamination has occurred, drilling of new wells is expensive and in some cases are not practical.

There are a number of ways to prevent contamination, such as to improve well siting, design and construction and better design and management of potential contamination sources. In other words, the best way is planning.

Land-use planning is a dynamic process with social, economic and environmental interests and impacts influencing, to certain degrees, the use of land and water. Farming, housing, industry, tourism, conservation, and waste disposal are potentially interactive and conflicting. Groundwater protection schemes enable planning and other regulatory authorities to take account of both geological and hydrogeological factors in locating developments. So they are an essential means of preventing groundwater pollution.

Special attention is paid to groundwater protection by European Union Policy. In its declaration the «groundwater is a natural resource with both ecological and economic value, which is of vital importance for sustaining life, health, agriculture and the integrity of ecosystems», « groundwater resources are limited and should be protected on a sustainable basis», «... to protect groundwater resources from overexploitation, adverse changes in hydrological systems resulting from human activities, and pollution, many forms of which can produce irreversible damage»[6]. So it is understood from the declaration that it means that surface water and groundwater should be managed as a whole, phenomenon paying rival attention to both quality and quantity aspects;

The risk of contamination depends on 3 elements: the hazard afforded by a potentially polluting activity, the vulnerability of groundwater to contamination, the potential consequences of a contamination event. It involves geological and hydrogeological factors and factors relating to the potentially polluting activity. The

geological and hydrogeological factors are the vulnerability to contamination and relative importance or value of the groundwater resource.

The geological and hydrogeological characteristics can be examined and mapped, providing a groundwater vulnerability map for any area. They are an important part of groundwater protection schemes and are an essential element in the decision-making on the location of potentially polluting activities.

Additional reports of groundwater contamination may be expected in the coming years, as federal, state and local agencies expand their groundwater quality monitoring programs using sophisticated analytical methods that can measure very small concentrations of contaminants. Groundwater moves very slowly, and it may be years after remedial actions are taken before improvements in water quality can be observed. For this reason, the enhancement of the quality of the nation's groundwater requires a long-term commitment.

More definitive assessments of groundwater quality will have to await the expansion of data-collection programs, the use of standard sampling and analytical procedures, research on the health risks associated with long-term exposure to very small concentrations of contaminants, and improvements in the computer models used to predict contaminant behavior.

Although current assessments of groundwater quality are far from definitive, they do suggest the widespread presence of shallow groundwater contamination. While we have much yet to learn about the sources and extent of contamination, the general principles and steps needed to protect groundwater from future contamination are well understood. Reductions of wastes, control of contamination sources and improved land management practices can significantly reduce the risk of contamination in the future.

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