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FORMATION AND DEVELOPMENT OF SCIENTIFIC DIRECTION OF "ECOLOGICAL SAFETY" AS A PRIORITY OF SCIENTIFIC AND PEDAGOGICAL ACTIVITY OF PROFESSOR VOLODYMYR SHMANDIY

Olena Kharlamova

Kremenchuk Mykhailo Ostrohradskyi National University,
20, Pershotravneva Str., Kremenchuk, 39600, Ukraine
kharlamovaovdoc@gmail.com

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Abstract. The milestones of scientific and pedagogical activity of Professor Volodymyr Shmandiy are described. The main results of the scientific school headed by him are presented. The hierarchical structure of ecological danger is set forth. The conceptual principle of ecological safety management is formulated. The scientific principles of research on the environmental impact of earthquakes of technogenic origin are presented. A poly-staged method for producing adsorbent of high absorption capacity based on waste from agro-industrial complex is presented. Scientific-applied and educational-methodical achievements are announced.

Key words: scientific direction, scientific and pedagogical activity, ecological danger, management of ecological safety, adsorption technology.

Volodymyr Shmandiy is a well-known Ukrainian scientist in the field of ecological safety. Since 1975, he has been working in Kremenchuk Mykhailo Ostrohradskyi National University where he has passed the path from assistant to professor. He was the head of the Departments of Physics and Chemistry, Ecology, Ecological Safety and Nature Management. Since 2004, ten years in a row, he has held a position of the dean of the Faculty of Natural Sciences.Volodymyr Shmandiy was born on June 30, 1952. He graduated from O.M.Gorky Kharkiv State University in 1975. In fact, he became the founder of a new current scientific-pedagogical direction "Ecological Safety", defended his doctoral dissertation "Management of Ecological Safety at the Regional Level (Theoretical and Practical Aspects)" in which, in particular, he established the main regularities of the functioning of ecological danger, formulated the conceptual principles of ecological safety management. Thanks to the creation of a textbook "Ecological Safety" of the educational series "Library of Ecologist" approved by the Ministry of Education and Science of Ukraine, the latest scientific developments of Professor Shmandiy have been successfully implemented in the educational process of training specialists in higher educational institutions of Ukraine. There were three editions of the textbook (2008, 2013, 2017) with changes and additions.

Given the significant contribution to the development of national science, in 1995 V. M. Shmandiy was elected an academician of the Ukrainian Academy of Ecological Sciences, and in 2005 he became an academician of the International Academy of Science and Practice of Manufacturing. In 2008 V. M. Shmandiy launched a scientific journal "Ecological Safety" which

is a part of a number of well-known science-based databases and is included in the list of professional editions of Ukraine where the results of dissertation researches are published. Since 2011 Professor Shmandiy has always been the head of a Specialized Academic Council for the defence of candidate's theses in specialty 21.06.01 – Ecological Safety. He was a member of Specialized Academic Councils for the defence of theses in specialty 21.06.01 at the National University of Shipbuilding, State Ecological Academy, V. N. Karazin Kharkiv National University, Ukrainian Scientific Research Institute of Ecological Problems, Sumy State University, and National University of Civil Protection of Ukraine.

Doctor of Technical Sciences, Professor Shmandiy proved to be an experienced teacher who is actively working in the field of training highly skilled scientific staff. Two doctoral and eleven candidate's theses have been defended under his guidance. Professor Shmandiy published more than 500 scientific works, 5 monographs, 3 manuals and 3 textbooks approved by the Ministry of Education and Science of Ukraine. An International Scientific and Technical Conference "Problems of Ecological Safety" is held annually under his scientific guidance. He is also the head of the scientific school "Management by Regional Ecological Safety".

The indicated achievements in scientific and educational activities on training and attestation of scientific and pedagogical staff contributed to his productive work on modernization of the content of higher education. In 1995 he opened one of the first Departments of Ecology in Ukraine, and in 2003 he founded the Faculty of Natural Sciences. He was awarded with the badges "Excellence in Education" and "For Scientific Achievements".

From 2004 till 2015, in accordance with the Orders of the Ministry of Education and Science of Ukraine: No. 487 dated June 15, 2004, No. 363 dated May 8, 2007 and No. 1364 dated November 25, 2011, Professor Shmandiy was a member of the Commission on Ecology, Environmental Protection and Sustainable Use of the Scientific and Methodical Council of the Ministry of Education and Science.

By the order of the Ministry of Education, Science and the Youth No. 1543 dated 27.12.2011 he was included in the working group on the development of the branch standard of higher education of Ukraine ГСВО 6.040106-11 in the subject area "Ecology, Environmental Protection and Sustainable Use of Natural Resources". During 2013–2015 Professor Shmandiy worked as a member of the working group ГСВОУ 8.04010603-13 "Ecological Safety". He is a coauthor of the following branch standards of higher education of Ukraine:

– Bachelor's degree in the subject area 6.040106 "Ecology, Environmental Protection and Sustainable Use of Natural Resources" – 2011;

– Master's degree in specialty 8.04010602 "Applied Ecology" – 2012;

– Master's degree in specialty 8.04010603 "Ecological Safety" – 2013

He is a developer of

– programs of normative educational disciplines "Techno-ecology" and "Ecological Safety" for training Bachelors in the subject area 6.040106 "Ecology, Environmental Protection and Sustainable Use of Natural Resources" – Odessa, 2013;

– a collection of test tasks for checking the residual basic knowledge on normative disciplines of the OPP for training Bachelors in the subject area 6.040106 "Ecology, Environmental Protection and Sustainable Use of Natural Resources" – Odessa, 2011;

– program of foreign practice of full-time students in the subject area 6.040106 "Ecology, Environmental Protection and Sustainable Use of Natural Resources" (in cooperation with specialists from Slovakia) – 2009/

Professor Shmandiy is a scientist and public figure whose sphere of interests is ecological safety. He, in particular, established the basic laws of functioning of ecological danger, formulated the basic conceptual principle of the strategy of ecological safety management [1], which is determined by the hierarchical structure of the ecological danger and the dynamic interconnection and interdependence of danger and security. This principle is formulated as follows: efficient management can be carried out on the basis of the use of patterns of danger formation and through subsystems determined by its structural components. Specific regional laws of ecological safety management are established, the main of which are:

– effective management can only be achieved by providing an acceptable spatial and temporal structuring of danger;

– optimal positioning of the sources of danger significantly weakens the effects of its manifestations;

– minimization of unfavourable neighbourhood of dangers of different genesis weakens the degree of total impact on humans and the environment;

– realization of administrative decisions and appropriate decrease in danger can be dispersed both in space and in time.

Positioning and neighbourhood management causes a change in region profiling with regard to danger and it is able to cause shifting of priorities.

Professor Shmandiy proposed a hierarchical structure of ecological danger [2], which includes three main types of danger: natural, natural-anthropogenic and anthropogenic (Fig. 1).

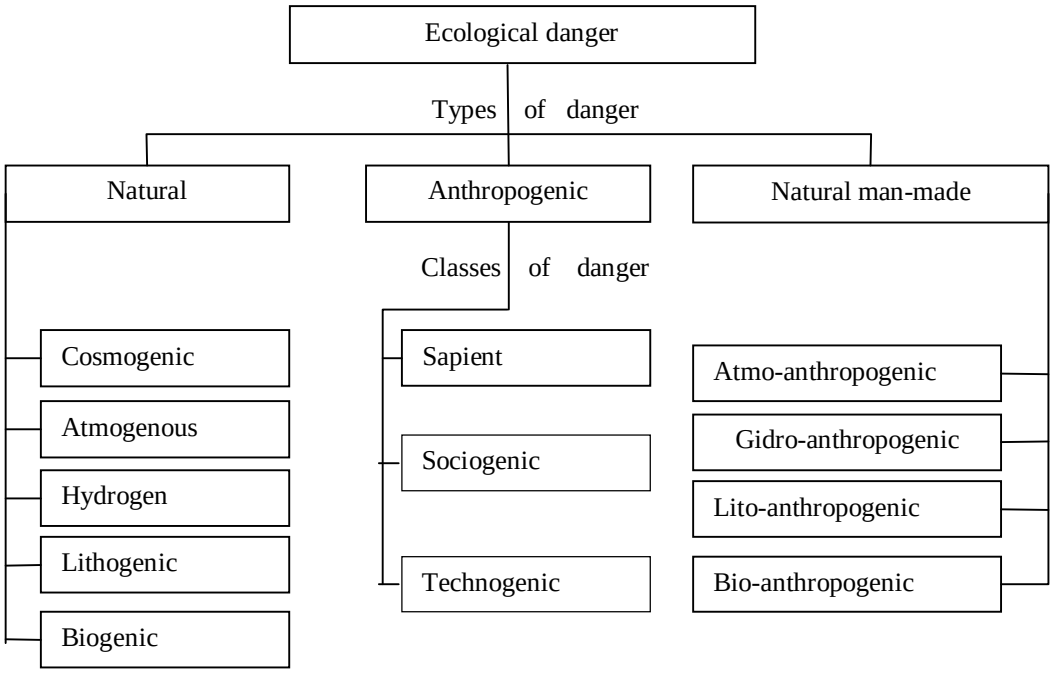


Fig. 1. The structure of ecological danger

Each type of danger is structured into classes. In particular, three classes are identified in the anthropogenic type: sapient, technogenic and sociogenic danger. The danger of the sapient class (from Homo Sapiens) is characterized by the manifestation of the factors of the biological nature of a human and corresponds to the term used by Reymers as an anthropic form of direct effect on nature. Technogenic component of ecological danger characterizes the impact on humans and the environment which is related to technical means and technologies of economic activity. Sociogenic danger is considered as related to incorrect, incomplete and inaccurate formation of the views of society on the environment and the place of a human in it. The magnitude of danger depends on the level of education, economic and cultural development of the society.

In turn, each class is structured into separate species and subspecies. In particular, anthropogenic danger includes 4 species characterized by physical, chemical, biological factors and factors of the transformation of landscapes. Each type of danger includes individual subspecies. Thus, subspecies that are associated with radiation, noise, vibration, electromagnetic pollution of the environment, etc. are characteristic for ecological danger caused by physical factors.

In works [3.4] his disciples expanded the hierarchical structure of the technogenic class and developed a detailed structure of the sociogenic class of ecological danger (Fig. 2 and 3).

In the structure of the sociogenic class of ecological danger there are six types, covering the main spheres of human life. Such systematization seems to be the most expedient, since it allows you to objectively group the factors that form the danger. Consider some species and subspecies of sociogenic danger.

We characterize the kind of danger that is formed by normative and legal factors. The imperfection of the legal framework is in the fact that there are virtually no preventive provisions in the existing documents. The punishment for violations of ecological legislation is not rigid, and the system of incentives for implementation of ecological safety management measures is imperfect. The disadvantage of the legal framework is the declarative nature of some normative documents.

On the basis of theoretical generalizations and results of field studies, the regularities of manifestations of ecological danger [5] have been established, taking into account the degree of unfavourable position of its sources in relation to the objects which it affects, the simultaneous manifestations of the dangers of different genesis, the profiling of danger according to the intensity of manifestations of its components which provides the opportunity to scientifically substantiate effective measures to improve ecological safety.

Professor Shmandiy has initiated scientific studies on the environmental impact of earthquakes of technogenic origin [6]. The structure of the monitoring system of ecological danger during technogenic earthquakes has been developed, which includes the following stages:

– identification of sources of technogenic earthquakes;

– instrumental definition of manifestations of danger by measuring the rate of displacement of soil or elements of structures in the vicinity of various objects;

– analysis of the impact of earthquakes on the health of the population by studying objective monitoring data of medical institutions and surveys;

– determination of the degree of ecological danger manifestations – establishment of experimental data correlation with the results of population surveys and visual observation of the damage to structures and buildings.

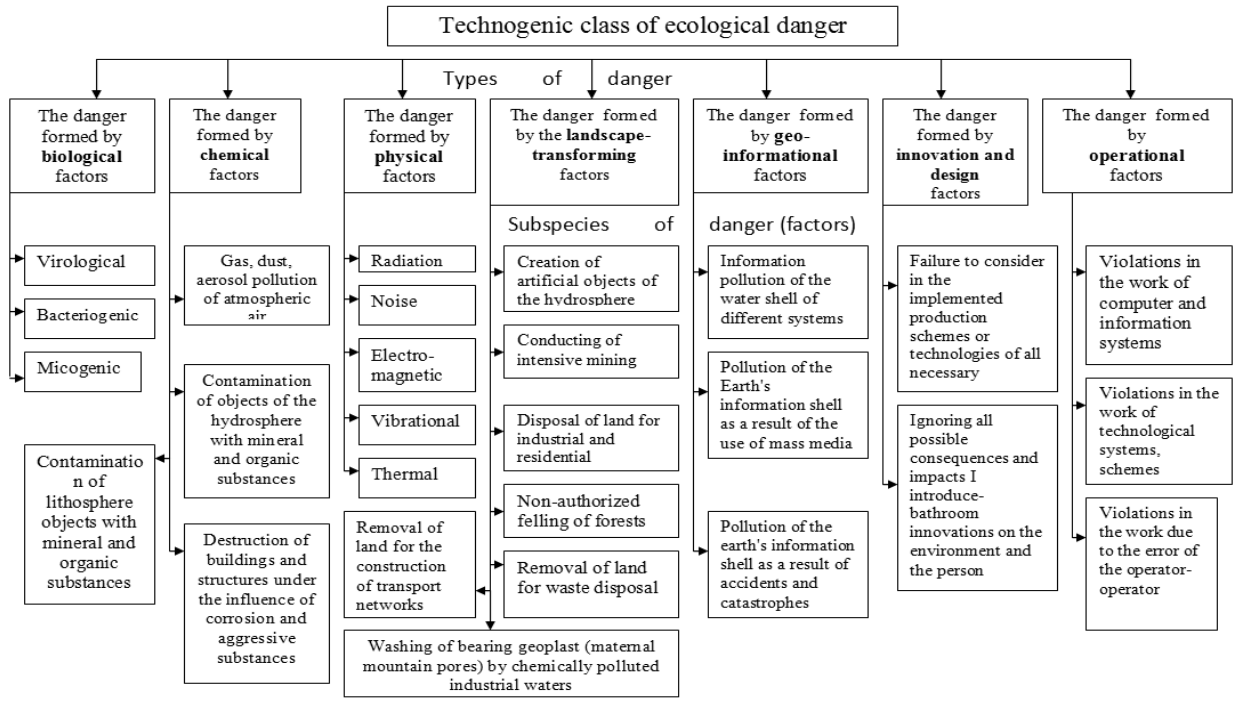


Fig. 2. The structure of the technogenic class of ecological danger

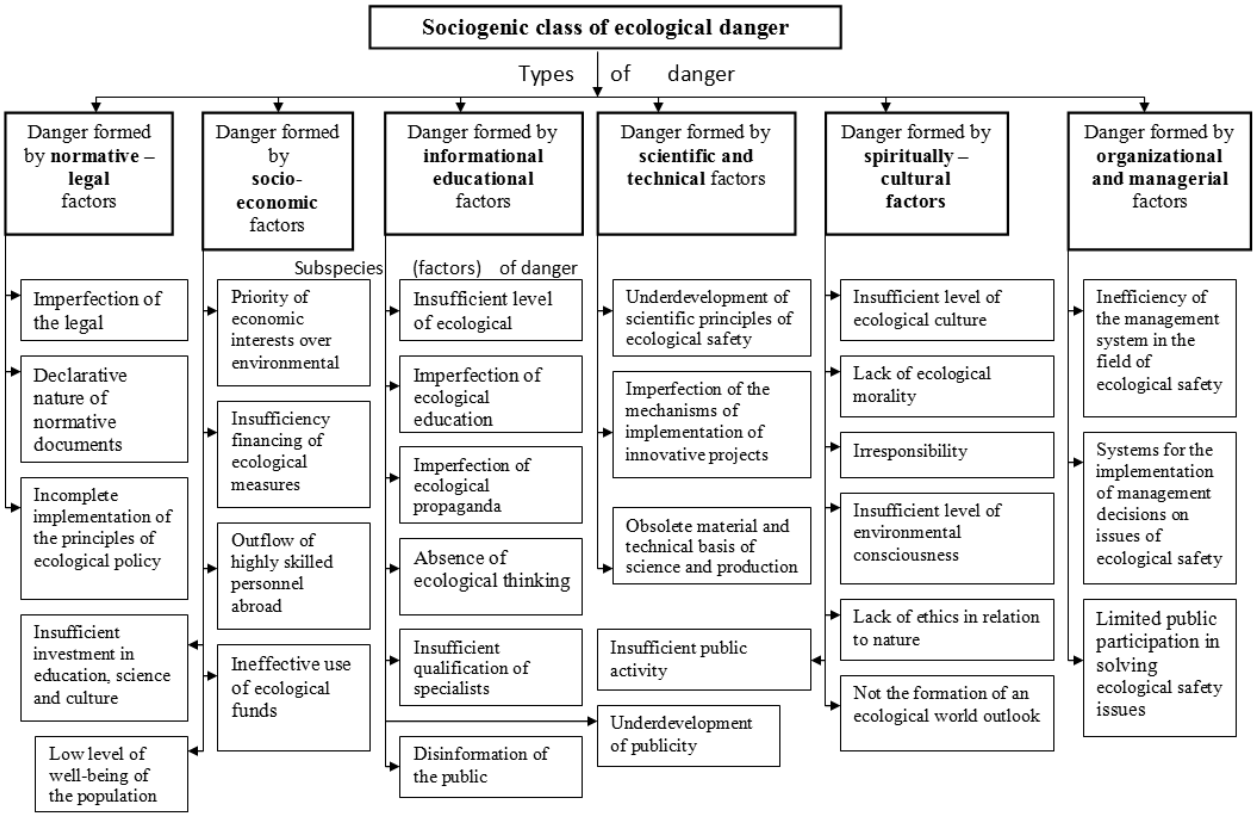


Fig. 3. Hierarchical structure of the sociogenic class of ecological danger

A poly-stage method of obtaining an adsorbent of high absorption capacity based on the waste from the agro-industrial complex is proposed [5]. Waste from the agro-industrial complex such as buckwheat and oat husks, pods of peas and beans, rapeseed and corn cobs were used as raw materials for its production.

The method includes:

– the first stage – processing of raw materials by sulfate acid;

– the second stage – modification of the obtained product during compatible grinding and mechanical activation;

– the third stage – electrostatic separation (to ensure homogeneity of granulometric composition);

– the fourth stage – cavitation treatment (to increase the degree of porosity).

Patents of Ukraine for utility model have been received for each stage. A lot of experiments have been carried out using the aforementioned types of waste from the agro-industrial complex. The results of electron microscopic study (Fig. 4) allowed to state an increase in the degree of pores.

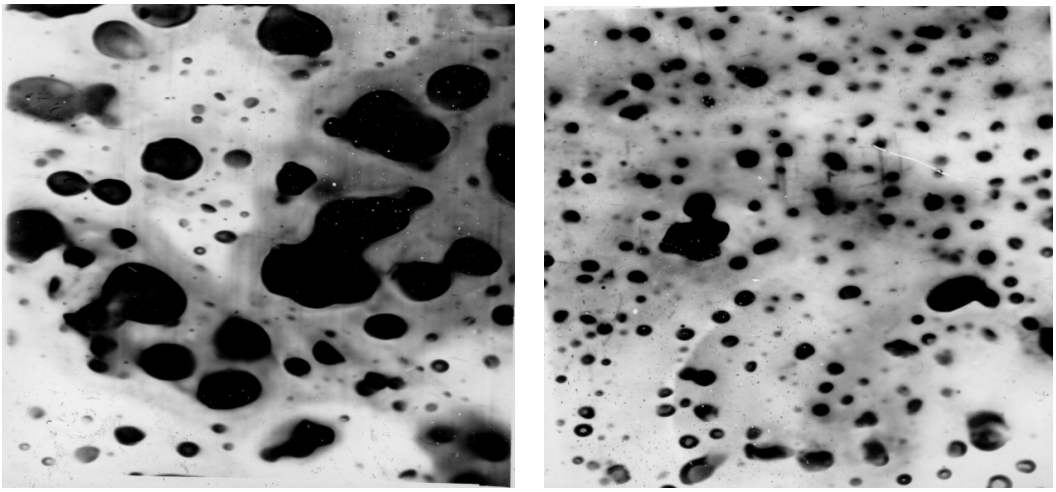
According to the results of a series of studies on the determination of the adsorption capacity of the obtained adsorbents for the removal of pollutants from aqueous media, it has been established that:

– the degree of purification from phenol monotonically increases with time, reaching saturation (98.5 %); the value of the adsorption capacity is higher than that of natural adsorbents and activated carbon (Fig. 5);

– the experiments on purification of sewage from petroleum products (Fig. 6) showed that the decrease in the granulometric composition of the adsorbent leads to the increase in purification characteristics;

– the expediency to use fraction 0/1–1 mm in real schemes of purification with an average duration of 60 minutes has been proven;

– high sorption properties of the proposed adsorbent in the purification of waste water from heavy metal ions have been experimentally established (Fig. 7).



a b

Fig. 4. Results of electron microscopic study of buckwheat husk briquette adsorbent (6700 times increased) at different stages of its production: a – raw material grinding and interaction with sulphate acid; b – mechanical and chemical activation

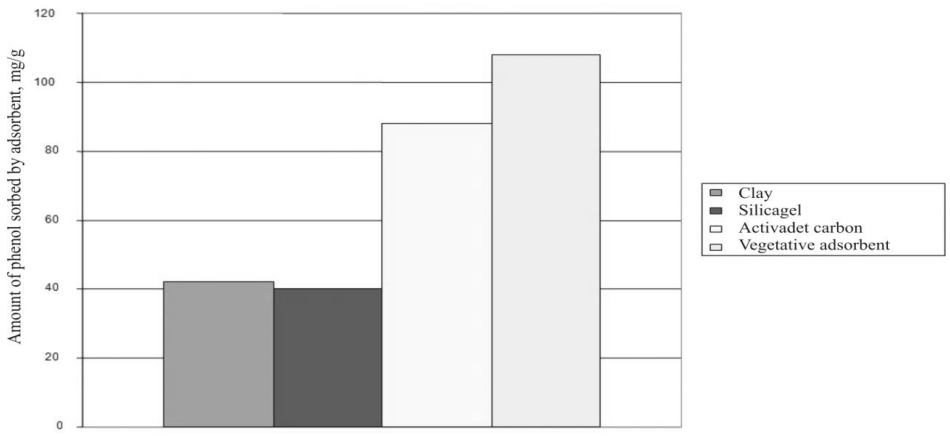


Fig. 5. Results of absorption of phenol by various adsorbents

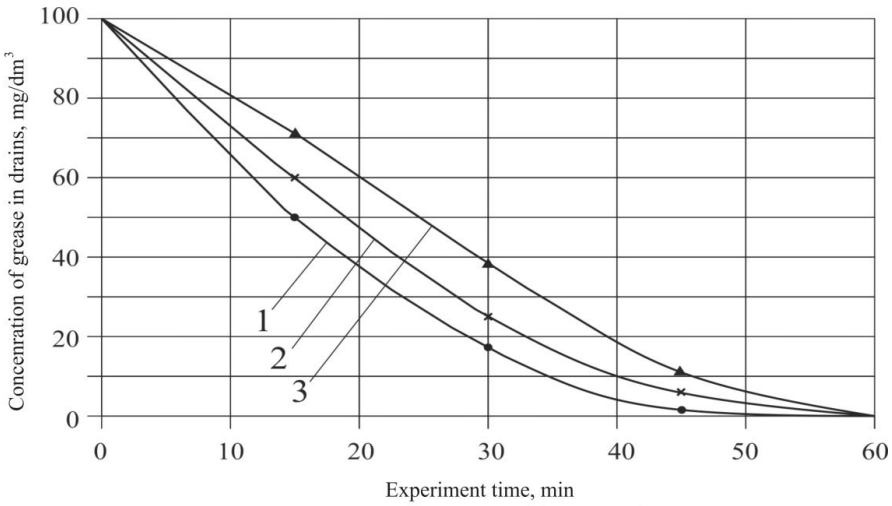


Fig. 6. Dynamics of changes in the time of concentration of technological grease in contaminated water with the use of adsorbent of different granulometric composition (mm): 1 – 0,03–0,01 mm; 2 – 0.1–1.0; 3 – 1.0–3.0

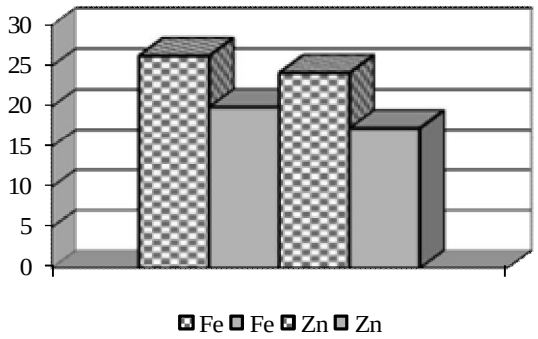


Fig. 7. Maximum values of adsorption of the developed adsorbent (xxx) and activated carbon (xxx)

Summarizing, we note that the obtained results indicate the expediency of the proposed adsorbent in the process of purification of contaminated aqueous media from fats, phenols, petroleum products and heavy metal ions. Waste adsorbents are recommended to be used as fuel in power plants.

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