REFERENCES

1. Машимов М. М. Уравнивание геодезических сетей / М.М. Машимов. – М. : Недра, 1979 – 367 с.
2. Геодезические работы в строительстве. Правила проведения: ТКП 45-1.03-26-2006 (02250) – Введ. 07.01.06. – Минск: Минстройархитектуры, 2006. – 62 с.

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PROTECTION OF FACTORY WORKERS AGAINST THE HARMFUL INFLUENCES OF THE USED LUBRICANTS

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The analysis of the impact of used lubricants on a person is carried out. The possibility of using the emulsion, based on used oil products, made by means of shock waves, generated during the operation of the pneumatic radiator as an antiadhesive coating of the moulds in the manufacturing of concrete reinforced products instead of commodity emulsols and emulsions is proved.

The global annual demand for lubricants exceeds 40 million t. and is growing by about 2% per year. [1]. Nowadays the bulk of these materials is produced on the base of petroleum oil. However, since the early 90s of the last century (mainly in Europe), there is a tendency to use a vegetable oil or its mixture with petroleum or synthetic oils acting as the dispersion medium in the production of lubricants. Key environmental advantage of the lubricants is their biodegradability. This trend should be developed in connection with the widespread tightening of legislation in the field of ecology.

In the global production and use of lubricants there have been two major lines of the solution of environmental problems. The first - the creation of environment-friendly lubricants - non-toxic, non-polluting, with high biodegradability and ease of disposal after the end of their life durability. The second trend - the improvement of the recovery means of used lubricants (UL) by eliminating their harmful impact on the environment [2-4].

The challenge in the direction of rational use of UL is to organize the collection and formulation of quality requirements for subsequent processing and use. Data collection is conducted sporadically and in most cases is associated with the environment protection. This is due to organizational data collection difficulties from small consumers, little quantities of these materials at small enterprises. In the case of large consumers of lubricants (railways, centralized lubrication systems of steel production) UL collecting can be up to 80% of the consumption of the fresh ones. Collection and disposal of UL on a wide industrial scale will give the possibility to solve the problem of environmental protection, as well as significantly expand the resources of raw materials for the production of petroleum products for various purposes.

The goal of research is to eliminate the influence of the exhaust oil products upon the health of factory workers at the expense of their conversion into emulsion, followed by their usage as antiadhesive material for the moulds in the production of concrete products.

Influence of oil exhaust products on the health of a person. Used lubricants are complex multicomponent systems formed in the operation process. UL contain a lubricant base and additives, decomposition products of the base components and those of additives wearability and impurities. UL composition determines, firstly, the degree of exposure to the environment and human, and, secondly, the methods for their recovery. The vast majority of changes in the chemical composition of the used lubricants taking place under the influence of temperature, pressure, oxygen, air, water, the catalytic action of the metals, solar and artificial light, impurities, microorganisms, lead to increased environmental hazards, so that at the end of the life durability of environment-oriented aspect prevails over the economic, taking into account the profitability and technical feasibility only of the re-use of valuable chemical raw materials.

While evaluating the environmental properties of UL it is extremely important to know the precise definition, closely related to the concept of "life durability". Both in Belarus and all over the world, this problem is far from being solved. Extended life durability, profitable from the economic (technospheric) point of view, in most cases leads to the accumulation of ecologically dangerous products in the UL, complicating the processes of utilization themselves. There are no objective and unambiguous criteria of the lubricants wearability. These problems cause considerable difficulties in determining the life of oils, lubricants and coolants, in the assessment of their environmental risks and the choice of methods of rational utilization of the UL.

Toxic and carcinogenic properties of UL are determined by the decomposition of components under operating conditions, as well as outside matters. Toxic substances can occur when there is corrosion and thermal decomposition of the lubricant: they may appear in the exhaust as a result of sharing the collection, transportation and storage. Thus there are three environmental and health problems:

– ehe occurrence of dermatitis and allergic diseases, leading to defatting of the skin, cracks, and the phenomenon of infection and in the absence of means of protection; problem is actual when there is a contact, both with fresh and with used oils and can be solved in accordance with the rules of production and personal hygiene;

– high carcinogenicity of certain lubricants, caused by a number of compounds, which are absent in the fresh product, thus making it difficult for the recovery of waste oils;

– the Pollution of UL by halogen compounds, especially chlorine.

Overseas studies showed an increase in activity of some carcinogenic exhaust petroleum oils compared with fresh due to the accumulation of bioactive polycyclic Arenes (PA) - products of incomplete combustion of fuels and thermal decomposition of the oil. [3, 4] Thus, in a crankcase engine oil resides in high temperature zone for a long time, which leads to the accumulation of PA; more than 140 of them are identified in used oils from such engines. These compounds are present in the fresh oil, but in very little quantities. Part of the PA comes out of the fuel. In general, the most carcinogenic waste oils come out of the crankcase engine. PA accumulation also takes place in industrial oils, working at much milder conditions compared to motor ones(50-70 ° C). Thus, in the delegated oil-20A which was taken out of the machinery at a motorcar construction plant there have been marked the accumulation of particularly dangerous carcinogenic structures, as well as the formation of new compounds not found in fresh oil. In addition to the PA, the carcinogenicity of waste oils is determined by some other factors,but the whole complex of which is still insufficiently studied. Used cutting fluids are less carcinogenic, although there have been noted a slight increase in the concentration of PA.

The presence of chlorine in the fresh and spent lubricants and additives indicates the possible presence of hazardous organochlorines. Their sources may include petroleum oils, halogenated additives to oils and fuels and synthetic oils, in particular on the basis of polychlorinated biphenyls (PCBs). Additional pollution of UL by technical solvents such as ethylene chloride, chlorinated components SOTS occurs during their collection and transportation. PCBs are also characterized by poor biodegradability, they can be accumulated in humans and animals, mostly - in the fatty tissues. The content of PCBs in the blubber of a person can be from 107 to 455 ppb $^{-1}$. The process of their withdrawal out of a human body is very long: the half-life period of various isomers in the blood ranges from 100 to 338 days. a significant portion of PCBs is derived out of a female body in mother's milk, poisoning a child.

The combined impact of the PA and PCBs reinforces the negative effects, because the former slows down the process of deriving of the latter out of the body.

Organic phosphates obviously have the highest level of the toxicity after PCBs , due to their fire resistance and excellent tribological characteristics used in various hydraulic systems (including air systems), as well as in gas and steam turbines.

The components of cutting fluids, such as penta-chlorophenol may be sources of dioxins and furans in the UL. It is possible that chlorine compounds may contribute to the occurrence or accumulation of PCBs, dioxins and furans directly during redistillation of UL [3, 4]. The Accumulation of dioxins and furans, as well as the PCBs is observed in the fatty tissues of humans and animals, in the women's and cow's milk. The similar compounds of other halogens are equally dangerous, such as polybromobiphenyls (their sources - bromine compounds – are used as scavengers of lead in leaded petrol). However, their content is very low in the OSM.

Synthetic Oil Aging of different classes is studied much less and doesn't provide an overview of environmental hazards such UL.

Commodity based and waste lubricants Used in manufacturing are complex multi-component products. Their composition determines the impact on the biosphere and methods of waste disposal. Consideration of the environmental properties of lubricants make it possible to draw a conclusion about their ecotoxicity and the undesirability of their transferring into the environment.

The abovementioned leads to the conclusion that the findings of the environmental danger, in most cases, are difficult to interpret because of the differences in the methods of assessment of the UL impact on the biosphere as a whole. The negative effects of UL on the environment being obvious incomplete and often contradictory data on environmental hazards do not let us reveal specific and clear principles.

In general, when the environment is being polluted there are three ecological factors which are in interaction: the complexity of contaminants composition - hydrocarbons, the products of aging , synthetic materials, additives (anthropogenic factor); heterogeneity of the composition and structure of polluted ecosystem (biotic factors); the variety and variability of abiotic factors, which are the ecosystem influenced on: temperature,

pressure, humidity and others. [3]. It is possible to Evaluate the consequences of pollution in ecosystems and decide on the ways of eliminating these effects only taking into account the above factors.

The Disposal of used lubricants. we carried out the investigations at Polotsk State University [5, 6], which allowed us to develop the technology of preparation of finely divided water-oil emulsion on the basis of the used lubricants with high stability with the help of a pneumatic radiator. The diagram of the pneumatic radiator and the principle of operation is presented in [6, 7].

One way of finely divided water-oil emulsion using is its application as an antiadhesive material for the moulds while manufacturing concrete reinforced products. The economic justification of the possibility of use is shown in [8]. To assess the possibility of using the emulsion as an antiadhesive material for the moulds while manufacturing concrete reinforced products emulsions of various compositions were tested using both thermal drying oven and drying in natural conditions at room temperature. In the study two main parameters were analyzed: the nature of detachment when disassembling the moulds and extracting a concrete sample and the presence of black grease stains on the concrete, which complicates the further processing of the surface and spoils the exterior appearance of the product.

To compare the efficiency of the developed emulsions the research was carried out under the same conditions both the emulsions derived on the basis of exhaust lubricants and commodity based emulsols and emulsions used as an antiadhesive material for the moulds for the producing concrete products. The experiments were held in the laboratory of the department of building construction materials production. All samples were made in the form of the parallelepiped block (Figure 1) of the concrete of the same composition using prefabricated steel forms for laboratory work (Figure 2). The emulsion obtained on the basis of the used lubricants, was taken for testing after four weeks settling from the date of the preparation.

Fig. 1. A sample obtained when tested

Fig. 2. Steel molds for test

In the result of the experiments it has been discovered that the nature of detachment in the process of disassembling and withdrawal of concrete samples out of the mould does not differ when using the commodity products as an antiadhesive material for the moulds and the final emulsion made on the basis of used lubricants. After the experiment, there were no concrete chips and dark greasy stains in all samples.

Conclusions.

1. The research has shown that UL pose a serious risk to human health and the environment.
2. The possibility of using the water-oil emulsion based on UL with the help of shock waves occuring while using pneumatic radiator as an antiadhesive material for the moulds in the production of concrete reinforced products.

REFERENCES

1. Hant's Lubricans Wold. – 1997. – V. 7, № 4. – P. 14–20.
2. Oil recovery by flotation from waste water as a source of lubricating grease / M.M. Soliman [et al.] // Triblogy and Lubrication Engineering : 14 International Colloquium Tribology, Ostfildern, Jan. 13–15, 2004. Vol. 3. – Ostfildern : Techn. Akad. Esslingen, 2004. – P. 1533–1543.
3. Евдокимов, А.Ю. Экологические проблемы утилизации отработанных смазочных материалов / А.Ю. Евдокимов, И.Г. Фукс. – М. : ЦНИИТЭнефтехим, 1989. – 64 с.
4. Белов, П.С. Экология производства химических продуктов из углеводородов нефти и газа / П.С. Белов, И.А. Голубева, С.А. Низова. – М: Химия, 1991. – 254 с.
5. Иванов, В.П. Разрушение поверхности раздела двух несмешивающихся жидкостей при эмульгировании / В.П. Иванов, В.А. Дронченко // Вестн. БрГТУ. – 2014. – № 4 (88) : Машиностроение. – С. 38–42.
6. Иванов, В.П. Утилизация сточных вод с нефтесодержащими отходами эмульгированием и сжиганием / В.П. Иванов, В.А. Дронченко // Вестн. Белорус. гос. с.-х. акад. – 2015. – № 4. – С. 141–146.
7. Дронченко, В.А. Утилизация отработавших пластичных смазок / В.А. Дронченко // Горная механика и машиностроение. – 2015. – № 4. – С. 85–89.
8. Kuzmich, R. Emulsol on the basis of used oil product / R. Kuzmich, A. Maksimchuk, V. Dronchenko // National and European dimension in research : materials of III junior researches conf. : in 3 parts. – Part 1. Tecnology. – Novopolotsk, PSU, 2011. – P. 40–41.

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UPGRADING OF THE UTILIZATION METHOD OF THE USED OIL-CONTAINING PRODUCTS

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Methods and results of the experiments to determine the effect of water content in the emulsion and its stability and the determination of the optimal time of the pneumatic radiator in the preparation of emulsions with a predetermined stability have been presented. The possibility of preparation of the emulsion with the required stability on the basis of spent oily products and solutions, technical detergents with the help of arising shock waves when using a pneumatic radiator has been proved.

Introduction. Various oily wastes having a negative impact on the environment and human health are being accumulated at enterprises. Toxicity and carcinogenicity of oil products (OP) and the technical solutions of detergents (TD) result from the decomposition of components during operation, as well as from outside contamination. Research [1] showed that in a number of technical detergents (TD) in comparison with the new ones there was an increase in fresh bioactive polycyclic arenes. The biological activity of these compounds was shown in their carcinogenicity (when exposed to the organism it causes cancerous tumors), weak mutagenicity (effect on the genetic code), teratogenicity (damage to the fetus, leading to anomalies of its development, malformations), embryo toxicity (effects on the fetus, resulting in its death before birth) and a number of other disorders of the body [1].

Spent OP and TD solutions are among the most harmful chemical pollutants [2], which are subjected to mandatory collection and recycling, and in some cases - destruction. Unfortunately, the collection, recovery and disposal of used oil-containing products (OP) and technical detergents are neglected. As a result, at present time on the territory of engineering, maintenance and refining enterprises of the republic there are significant reserves of exhaust OP. This is largely explained by the requirements which are applied to waste oil intended for regeneration, purification, and use in exchange for or along with other petroleum products. Thus, according to [3], a mixture of waste oil designated for use as a fuel oil component should have a mass fraction of solids of not more than 1 percent, the weight fraction of water should be not more than 2 percent, and moreover they should be contaminated. To meet the requirements [3] it is necessary to have expensive specialized equipment at the enterprise. This, in its turn, combined with relatively small amounts of exhaust OP and high costs of transportation to the centralized take-over for the majority of small and medium enterprises makes the collection, recovery and recycling economically inadvisable.

For such enterprises finding ways to use the exhaust OP directly at the enterprise or enterprises in the region, preferably with a minimum of cleaning and recycling is rather perspective. One possible application is to obtain such emulsions based on exhaust OP and TD solutions. At Polotsk State University investigations which allowed to develop the technology of preparation of fine water-oil emulsion-based exhaust OP and TD solutions with high stability with a pneumatic transducer have been carried out [4, 5]. The resulting emulsion can be used