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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

for many different purposes, both by enterprises and other enterprises [4-6]. For practical application of this method it is necessary to optimize the process parameters.

Purpose – to determine the optimum water content of the emulsion during the work of the pneumatic radiator.

The techniques of experimental research

Determination of the influence of the water content in the emulsion on its stability. For all experimental studies OP and TD solutions identical in chemical composition to the original are used. Their chemical composition was determined according to the guidelines [7]. In order to improve the reliability of the experiments identical conditions have been designed in each series of experiments - the pressure in the compressed air pulse rate, temperature, percentage of substances that affect the stability of the emulsion and the mixing time.

The method of preparation of components for the experiment is as follows: a container was filled with water (the amount of which was determined by the height of the liquid column); then an emulsifier was added (the volume of which was measured by a volumetric flask), the liquid was stirred until complete dissolution of the emulsifier by means of shock waves which appeared when using a pneumatic radiator; after which the exhaust lubricant NSP was added, which was to be used as a basis for the preparation of the emulsion. The components were heated by means of a tubular electric heater.

The sequence of the experimentation was as follows: After stirring for 15 minutes (as more mixing time does not provide appreciable effect on stability) samples were taken from the top and from the bottom of the liquid; water was added to obtain a new percentage of water - OP (in which an emulsifier had already been introduced to maintain the percentage of liquid-emulsifier); then the temperature of the liquid was checked (if necessary additional heating was carried out); components were stirred again for 15 minutes, etc.

Measuring the volume of the liquid was carried out by measuring its depth in the working capacity, the diameter of which is known.

Stability of the prepared emulsion was evaluated by the number of released water for periods of time ranging from 1 to 30 days. The bundle of tubes is measured using the height of the liquid column.

Stability of emulsion (emulsion content in excess water in the emulsified state) Y in percentage terms was calculated by the formula

$$y = \frac{v_1}{v} \cdot 100 , \quad (1)$$

where v_1 – the amount of water released from the emulsion ml; v – the amount of the test emulsion ml.

Determining the optimal time of the air radiator in preparation of an emulsion with a predetermined stability. To select the optimal time of the PI it is necessary to define the relationship between the degree of stability of the emulsion and the time of the PI.

Preparations for the experimental studies were similar to the preparation of experimental studies to determine the effect of water content in the emulsion on its stability.

The scheme of experiments was as follows: After stirring for 3 minutes, samples were taken from the surface of the liquid, as well as from the bottom of the tank, and then the temperature of the liquid was measured (if necessary additional heating was carried out) and the liquid was stirred again during 3 minutes, samples were taken; the temperature was checked; it was stirred again, etc.

After a full cycle the experiment was repeated with a new batch of components.

Stability of the prepared emulsion was evaluated by the amount of released water. Layering was measured with the help of test-tubes using the height of the liquid column.

Stability of emulsion (emulsion content in excess water in the emulsified state) in percentage was calculated according to the formula (1). The emulsion was considered stable when the amount of water having released for 30 days did not exceed 2%.

The experimental results

Study of the effect of the water content of the emulsion on its stability. Studies were conducted on pilot plant for the preparation of an emulsion by means of shock waves at Polotsk plant "Prommashremont." Used oil-containing products were utilized as the basis for the preparation of the emulsion. The pulse frequency - 1.5 pulses per second at a pressure in the compressed air network 0.4 MPa has been set with the help of the control panel. There have been ten series of experimental studies. In each series experiments with the initial water content of 10% to 80% in increments of 10% were carried out. The greatest interest in terms of the use in recycling technologies is given to the results obtained at the water content of 30 and 40 percent. The experimental results (the proportion of released water during y t) are shown in Figures 1 and 2.

At the water content of 30% by volume of the emulsion stable emulsion is obtained in which the volume of the evolved water for 30 days after manufacture is 0.8-1.5% (Fig. 1), which makes it possible to prepare an emulsion, not only for the needs of the enterprise, but commercial sale to other businesses. Such an emulsion can be used as mold release agents in the manufacture of concrete products or additive to fuel for boilers.

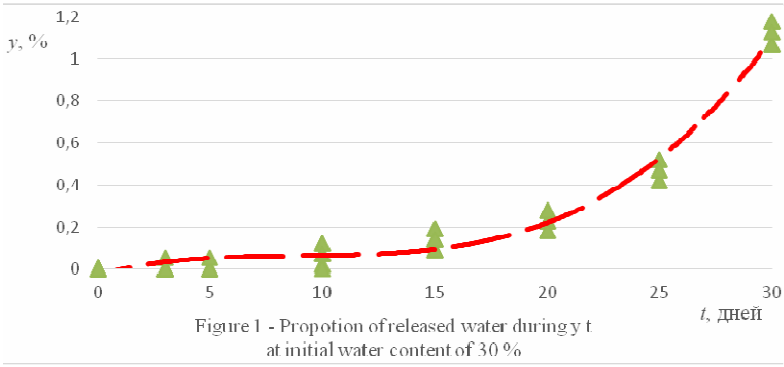

Figure 1 - Propotion of released water during y t at initial water content of 30 %

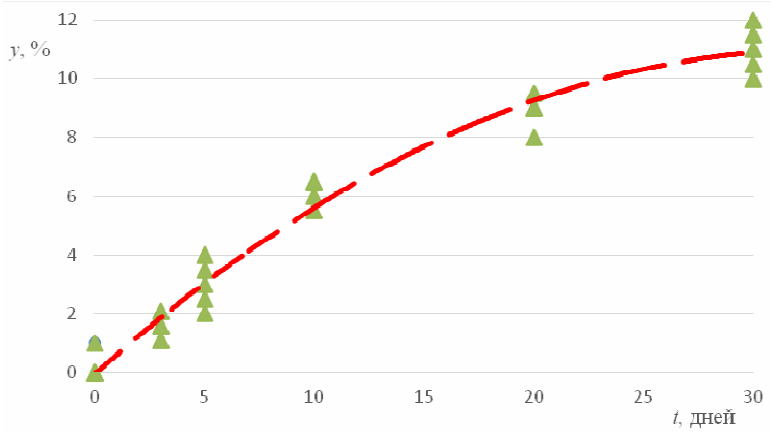

Figure 2 - Propotion of released water during *y t* at initial water content of 40 %

Studies have shown that in an emulsion with the water content of 40% during the first three days after the manufacture the amount of released water, as a rule, did not exceed more than two percent (see Fig. 2). This stability enables enterprises producing concrete products and having at their enterprise a unit for the production of emulsions with a pneumatic radiator, to prepare an emulsion for lubrication of molds in the process of manufacturing concrete products before use. As a result, enterprises can save significant amounts of raw materials for the production of emulsion-based exhaust oily product.

Determining the optimal time of the air radiator in the preparation of an emulsion with a predetermined stability. The results of the experimental studies are presented in Figure 3. It was specified that with a pneumatic radiator on duty during 3 minutes and 6 minutes a stable finely dispersed oil-water emulsion is not obtained, but the pneumatic transmitter operating during 15 minutes allows to obtain stable finely dispersed emulsion. Furthermore, we can conclude that the optimal timing of a pneumatic emitter - 15 minutes, so as a further increase in the time of the operating radiator has no appreciable effect on the stability of the emulsion.

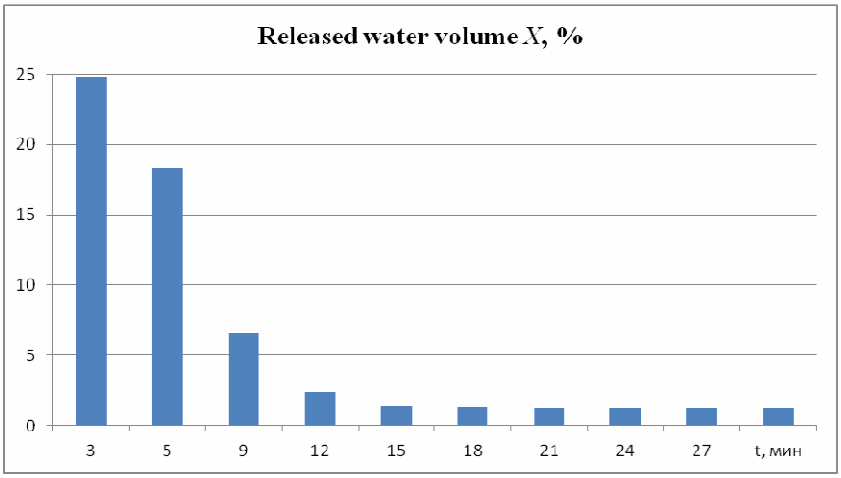

Fig. 3. Reliance of released water volume X on the operating time of a pneumatic emitter *t* at the water content in emulsion of 30%

1. The possibility of preparation of the emulsion with the required stability on the basis of spent oily products and solutions, technical detergents, using shock waves encountered when using pneumatic radiator has been proved.

2. The optimum water content in the emulsion, allowing obtaining an emulsion with sufficient stability for its industrial use has been specified.

3. It has been deduced from the experiments that the optimal time of the pneumatic transducer is 15 minutes. Further increase in the time of the radiator has no appreciable effect on the stability of the emulsion.

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USING OF THE TEXTILE VENTILATING DUCTS IN ROOMS WITH STRICT SANITARY AND HYGIENIC REQUIREMENTS

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At the present time new large-volume housebuilding gains breadth. Innovative technologies and materials are applying with the high rate of the building proposes. Such applications reduce the set-up duration of civil works and building services systems reduce capital and operating costs. Modern buildings (such as sport complexes and hypermarkets, food industry shops etc.) are made from hi-tech materials (sandwich constructions, lightweight-aggregate concrete, proflists and so on), which maintain the temperature, but have a low thermal inertia. Microclimate of those rooms demands regular monitoring and, as a result, high indicators of its parameters.

In the majority of cases temperature conditions are created by the heating systems. Air conditions in public and industrial buildings are improved thanks for using of ventilation and air conditioning systems. Also the microclimate, which satisfies technologic, sanitary and hygienic requirements, can be maintained. The main requirements put on the [1] and [2].

Besides, during the ventilation and air conditioning projecting you should follow next main principles [3]:

– Excess the air-in volume over exhaust air volume 10…15%;
– Handling air to zones with the least noxiousness exhalation and its expulsion from places with the maximal pollution;
– Absence of subcooling or overwarming;
– Pollution air outlets only in ventilated surrounding areas;
– Noise content and vibration are compliance during the work of ventilation systems;
– Installation simplicity and reliability in service; fire safety and flameproof.

The system projecting can be made in the form of traditional version and innovation version. Traditionally, hot-water heating with steel pipes and radiators/convection heaters and sheet metal ducts with louvres for ventilation proposed to be used. However, these systems not always can provide required parameters of microclimate for large-volume buildings [4].