Improvement of Cleaning Technology in Motor Transport Enterprises Through the Use of Natural Materials

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Abstract. The paper outlines the main problems of the ecological use of wastewater treatment technologies in motor transport and construction enterprises. The main technologies used in these production facilities in the city of Volgograd and their main shortcomings are indicated in connection with the inefficient degree of purification. An efficient technology for wastewater treatment on the production data is proposed with the use of a building material as a sorption material.

1. Introduction

Nowadays importance of environmental health of the water resources and waste disposal plant technology is growing strongly because of the increase of quantity vehicles, car washes, building and road enterprises [1-4].

Water is used widely in process of industrial facilities and it is caused the water pollution. That’s means we can’t use this water for reutilization in process of industrial facilities and it’s strongly forbidden to release waste water directly to a water body without primary purification (according to normative document [5-8]).

2. Main part

According to materials of Roswater resource department [9] the release waste water directly to a water body is 40.9 million m³ per year on average, [10] including water without primary purification. So this is the reason of poor environmental conditions and impossibility for repeatedly application of water in process of industrial facilities.

Researchers [11-17] had shown mostly water is polluted by building, road enterprises and car washes. For example, nowadays at Volgograd city the quantity of this water users is 71 that 37 more than 10 years ago. Part of this water users is shown in fig. 1.
Figure 1. Locations of car washes, building and road enterprises in Volgograd city where:

- АП - road enterprises.
- АМ - car washes.
- СП - building enterprises.
In that way we can identify the amount of waste water is released directly to a water body by multiplying the quantity of water users by the amount of pollutants.

The substances are located into the pollution water in different concentrations and phase states strongly influence on the quality of water. So research [18] had shown that pollution water is released directly to a water body includes about 350 thousand tons of organic substances about 18 thousand tons of oil products about 100 thousand tons of ammonium-nitrogen about 90 thousand tons of phenol about 1 thousand tons of zinc and so on.

3. Research part

There is a large number of operating road transport enterprises, construction industries, many new facilities for the maintenance of vehicles, including car washes, forming a large number of sewage.

The main pollutants of sewage generated of motor transport enterprises are mechanical impurities and petroleum products. In addition, waste water contains surface-active substances (surfactants), which are part of detergents and metal salts.

Based on the datas have been obtained as a result of the research, a plot of the dependence of the amount of oil products into the waste water on the size of the fraction was constructed. \( Q = f(d) \), the integral curve whose peak corresponds to the average radius of the oil product particles in the effluent.

![Figure 2](image_url)

**Figure 2.** The integral distribution curve of the dispersion composition of petroleum products in the effluent.

This graph allows you to quickly determine in a given disperse system the weight content of particles of any fraction of oil products.

From Graph No. 2 it follows that the bulk of the oil contamination of the plants in question falls on particles with a particle size from 0.001 to 0.1 mm, the smaller part falls on dropping oil products with a size of more than 0.4 mm. Along with fine fractions of oil and solid mechanical impurities, aggregates consisting of emulsified particles of petroleum products and solid particles were found in wastewater, the sizes of these aggregates fluctuate from 0.012 to 0.05 mm.

As stated earlier, in wastewater in addition to petroleum products, suspended substances are also contained, which is why the authors of this work carried out research on their content in the sewage waters of motor transport enterprises. To determine the dispersion composition of mechanical impurities, sedimentation analysis was used, the results of which are shown graphically in the form of an integral curve of particle size distribution in Fig. 3.
As Chart No. 3 shows, the nature of the distribution of suspended solids as a function of the particle diameter is as follows: a large part, namely 85%, is found in fine sand and clay particles, which is typical for the composition of waste water, taking into account the soils of the Volgograd Region.

Nowadays there are large quantity of building and road enterprises in Russian Federation and considering the huge amount of vehicles, car washes and so on the concentration of pollutants into the water increases.

There are two main waste disposal plant technologies applying in building and road enterprises in Volgograd city. The first is mechanical purification of pollution water or settling of particles which shown in fig. 4. The second is floatation method which shown in fig. 5. However the both methods don’t purify from emulsify oil products. Besides the floatation method is more expensive because of cost of the reagent.
As a result of the imperfection of waste disposal plant technologies which used in road and building enterprises, car washes there is necessity to reconstruct the existing building construction of water treatment and improve the technology of water treatment by using ecological natural materials. Also it is important [19, 20] to introduce recycling and reused water supply systems for ecological and economic efficiency.

4. Conclusion
Authors offer application of the new technology of water treatment based on the new silica-alumina adsorption material such as the flask - microporous siliceous sedimentary rock (fig. 6).

![Figure 6. Reduced to fragments flask.](image)

The flask is used as the adsorption material has the following advantages:
great oil capacity;  
hydrophobicity:  
easy to extraction;  
wide diffusion and huge resources;  
economic efficiency because of cheap cost.

The author offer the technological flow block of local water treatment (fig. 7) which lets us get cleaning water contains of oil products about 0.5 mg/l that satisfies completely demands of the reuse of water. It has to say that according to [21] water may contain about 15 mg/l of oil products and about 40 mg/l of the suspended solids.

![Figure 7. The technological flow block of water treatment based on the offering technology and adsorption material.](image)

That technology has the following advantages:
the offering technology lets us reuse of cleaned water;
modern waste disposal plant technology;
reduction of production spaces are necessary to locate the waste disposal plants (in case of using the flotation and coagulation plants with subsequent passing through series of filters);
natural building materials are used;
ecological and economic efficiency;
reduction of the man's impact.
Presented waste disposal plant technology to clean water from emulsified oil products had been tested on the road enterprises at Volgograd city (municipal motor company number 7) and shown it’s effectiveness.

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