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THE PROBLEM OF DISPOSAL SLUDGE TREATMENT PLANTS

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Abstract

Consider the features of the formation and disposal of sludge. It is noted that the methods of sludge treatment in digesters or throw them in the sludge beds are not perfect. The presence of high concentrations of nitrogen and phosphorus in sewage sludge would allow its use as a fertilizer, but it is necessary to consider that may contain heavy metals that contaminate the environment. It noted a huge amount of sludge produced per year in Russia. A preferred method of disposal of sewage sludge - sludge storage in the fields. This method results in the exclusion of large areas. Sludge fields pose a threat to the environment due to the high content of dangerous viruses, bacteria, harmful gases, hazardous chemicals

In this work it was studied the composition of the sludge. It has been determined that the precipitation contained a significant amount of organic material that is fat, protein, carbohydrate, etc.

The aqueous phase of the sludge is characterized by a neutral environment.

The values obtained for BOD₅, reflecting the total content of organic substances in the water, allow to judge that this water is classified as very dirty water.

Measurements of pollution sludge with heavy metals. The measurements of the mass of content of heavy metals in the aqueous phase of the sludge (soluble form) and in dry matter (total content) showed that the concentration of heavy metals in the dry sediment is significantly higher than in the aqueous phase of the sludge.

The measurement results on the toxicity of the sludge lead to the conclusion that sludge have acute toxic effects and are 4 cash danger

The results of research on sludge oil content allow us to speak about the excesses of this indicator.

Keywords: sludge, silt card, sewage treatment, pollution, recycling.

1. Introduction

Important issue now is to protect the environment from pollution, increase in capacity of recycling and reuse of water, the development of resource-saving and non-waste technology [1].

As a result, domestic and industrial human activities generate waste in the form of waste water, which are mainly discharged into the sewer. Sewage, combining production, domestic and rain, are a source of pollution in urban areas. In the process of passing the waste water purification stages in sewage treatment plants sludge precipitate is formed, for the most part, is not amenable to any processing other than dehydration on sludge fields in natural conditions. This process is long term and occupies large areas under the sludge cards. In addition, storage of sludge leads to the spread of adverse-gas background, pollution of soil and groundwater with toxic components that are part of sludge [2].

Common methods of sludge treatment in methane tanks or throw them in the sludge beds are not perfect, low productivity and need significant alienation of land near the sources of pollution [3]. Areas provided for storing the sludge, in most cases, are overcrowded and no longer cope with the continuous flow of sludge. In addition, the storage for sludge are a threat to the environment because of the high of content dangerous viruses, bacteria, harmful gases, hazardous chemicals. Apart from this formation of unpleasant odors that delivers great inconvenience settlements.

Around the towns and large villages of Russia, except for the cities, got a huge number of sub-standard sludge - production waste after biological treatment of sewage wastewater [4]. Near the big cities such sludge (their original moisture content of 98-99%) is dried and burned in special highly energy-intensive and environmentally faulty furnaces, and then deposited. In some cities, dehydrated raw sludge is collected and dumped in municipal landfills, and without this aggravating the tense ecological situation. Self-purification processes of nature because of the large concentration of xenobiotics and their high resistance to degradation go very slowly. Therefore the actual task is to restore the ecological environment: the rational processing of industrial and agricultural waste; readjustment and restoration of soil fertility, contaminated with toxic chemicals; Disposal of sewage sludge treatment facilities; clean water sources. One of the many ecological problems of modern civilization is the disposal of production and consumption waste, including waste sewage treatment plants.

We note that for the year in Russia is formed about 2 million. tons of sludge by dry weight (at an initial humidity of 98% of their weight is in the order of 100 million. tons) [5].

2. Materials and research methods

Tests of silt rainfall of treatment facilities from slurry and silt platforms were selected by method of pointed tests. The platform is divided into 4 equal parts and select 4 tests from the center of each square layer-by-layer from depth of 0-5 cm, 5 - 20 cm and up to the final depth of the platform (but no more than 1 m), weighing not less than 200 g everyone. Pointed test has to represent the part of a deposit typical for the surveyed constructions.

Single tests carefully mix and quarter 3 - 4 times. The deposit which has remained after quartering is divided into 6 - 9 squares, from the center of everyone select approximately identical quantities of a deposit, providing capture of all thickness of a layer. A lot of the joint test has to be not less than 1 kg (0,5 kg for the analysis and 0,5 kg for storage of the duplicate) [6].

Liquid rainfall of sewage selects from pipelines or technological devices and other capacities taking into account their design:

1. the deposit after settlers, sludge compactor, digester is selected from the pipeline when pumping a deposit in the receiver not earlier than in 10 minutes of operation of the pumping-over pump;
2. active silt is selected a scooping from a distributive tray.

Pointed tests of liquid rainfall select from three horizons (a surface, the middle, a platform bottom) with an interval of 10 minutes in number of four-five, not less than 500 cm³ everyone. Then merge in separate capacity and carefully mix. For the analysis select the joint test of liquid rainfall in number of not less than 1 dm³ (0,5 dm³ for the analysis and 0,5 dm³ for storage of the duplicate).

Tests store in the refrigerator in a glass jar with the ground-in or densely screwed up cover. Tests of liquid rainfall of sewage don't preserve.

The selected pointed test of soils, rainfall, slimes, ground deposits or active silt transfer from a sampler to specially prepared hermetically closed capacity not less than 500 cm³ on which paste a label with the indication of date, time, the place of selection, number and temperature of test, and also a surname of performers.

In technological process built city and production systems of sewage treatment the most important stage is processing of rainfall. Rainfall allocated in the course of sewage treatment belongs to the hardly filtered suspensions of colloidal type. Large volumes, bacterial contamination and availability of the organic substances capable to rot quickly with allocation of unpleasant smells, and also heterogeneity of structure of rainfall complicate their processing [7].

Tests of rainfall from silt cards were selected in the fall and in the summer.

Research of silt rainfall on the content of organic and mineral substance was carried out by a dry combustion in the muffle furnace. The water phase of silt rainfall was investigated with the help the conductometric and electrometric methods of the analysis.

Applied the method of infrared photometry realized in the analyzer of AH-2 oil products to definition of oil products.

The analysis of ions of heavy metals was carried out by method of atomic-absorbing spectroscopy (AAS) on a spectrometer KBAHT.Z-ЭТА.

3. Results

As part of this work to study sludge it was determined that the deposit contains a significant amount of organic matter, i.e. fat, protein, carbohydrate, etc. Organic mass decays very slowly, which leads to the spread of fecal odor.

Table 1 - The average content of organic and mineral matter in the sludge.

| № | Mineral part, percent | The content of organic matter, percent |
|---|-----------------------|--|
| 1 | 34,5 | 65,5 |

Table 2 - Indicators aqueous phase sludge.

| №п/п | Conductivity, mSm/sm | Mineralization, mg/l | pH | BOD ₅ , mg/l | C, mg/l | | |
|------|----------------------|----------------------|---------|-------------------------|----------------|------------------------------|------------------|
| | | | | | F ⁻ | NO ₃ ⁻ | Ca ²⁺ |
| 1 | 4,84 | 2541 | 6,92 | 685 | 0,36 | 558 | 485 |
| 2 | 4,32 | 2229 | 6,87 | 681 | 0,31 | 785 | 371 |
| 3 | 3,33 | 1705 | 6,61 | 698 | 1,22 | 75,9 | 41,7 |
| MPC | not rated | not rated | 6,5-8,5 | 3 | 0,05 | 40 | 180 |

The measurements of the mass of content of heavy metals in the aqueous phase of the sludge (soluble form) and in dry matter (total content) showed that the concentration of heavy metals in the dry sediment is significantly higher than in the aqueous phase of the sludge.

Table 3 - The content of heavy metals in sludge.

| № | C (water-soluble form), mg/l | | | | C (dry residue), mg/kg | | | |
|-----|------------------------------|------|-------|------|------------------------|-----|----|-----|
| | Fe | Zn | Pb | Cr | Fe | Zn | Pb | Cr |
| 1 | 0,26 | 2,6 | 0,001 | 0,01 | 0,66 | 101 | 49 | 12 |
| 2 | 0,17 | 0,3 | 0,002 | 0,01 | 0,67 | 59 | 20 | 7,3 |
| 3 | 0,16 | 2,2 | 0,001 | 0,01 | - | - | - | - |
| MPC | 0,1 | 0,01 | 0,01 | 0,07 | not rated | 23 | 30 | 6 |

Table 4 - The content of oil in the sludge

| Number of samples | The concentration of of petroleum products, g / kg |
|-------------------|--|
| 1 | 11,65 |
| 2 | 27,95 |
| 3 | 67,33 |
| 4 | 11,035 |

4. Results and discussion

Sludge municipal wastewater treatment plants are organic (80%) and minerals (about 20%) the impurities extracted from the water by mechanical, biological and physico-chemical treatment [8]. It is composed of a substance having general toxic, toxic genetic, embryotoxic, carcinogenic and other negative qualities. They may contain heavy metals, pathogens, an excessive amount of nitrates, toxic substances, pesticides, polychlorinated biphenyls, aliphatic compounds, esters of mono- and polycyclic aromatics, phenols, nitrosamines. Allocated sewage sludge harmful gases may exceed the maximum allowable concentrations several times, bad smell.

Due to the presence of high concentrations of nitrogen and phosphorus sludge is a good fertilizer[9,10]. But at the same time it can be a source of contamination as in addition to a variety of organic substances, which may contain heavy metals that pollute the environment. This is one reason why, in recent years become more common sludge incineration. Incineration also allows to obtain a positive energy balance and effectively use the calorific value of sludge.

The main factor motivating the use of this method is the fact that the quantity forms on urban wastewater treatment plant sludge disproportionately large compared with the free area on which sludge can be disposed of or otherwise treated (for example composting) [5].

Water phase the sludge is characterized by a neutral medium, with the high content of dissolved salts is determined by the mineralization within $1.7 \div 2,5 \text{ g / dm}^3$.

All cards of sludge observed excess MPC fluorides by more than 7 times, nitrates - more than 13 times, calcium ions (in the two sludge maps 2 times). Evaluation of the concentration factor is calculated relative to the MPC for fishery waters, as there is a risk of silt entering water into surface and ground water bodies, which are in the Republic of Tatarstan attributed to objects fish economic importance.

The values obtained for BOD₅ reflect the total content of organic substances in the water, allow to judge that these waters belong to the category of very dirty water.

In modern conditions, soil protection against pollution is an important task, because any harmful compounds in the soil, sooner or later fall into the human organism.

Sludge cards are one of the most important and ambitious in terms of environmental pollutants harmful and hazardous substances in particular heavy metals.

Operation silt card includes the following features:

1. Leaching of pollutants in surface waters and groundwater;
2. Introduction of contamination of the food chain in the human organism;
3. Many of the compounds have the ability to accumulate in tissues, and especially in bones.

Among environmental contaminants heavy metals and their compounds form a significant group of toxicants.

Of particular interest are those metals which are most widely and in large volumes are used in the production of human activity as a result of accumulation in the environment pose a serious threat in terms of their biological activity and toxic properties.

These include lead, mercury, cadmium, zinc, bismuth, cobalt, nickel, copper, tin, antimony, vanadium, manganese, chromium, molybdenum and arsenic. The measurement results on the toxicity of the sludge lead to the conclusion that sludge have acute toxic effects and refer to the danger of cash 4 [7]. Sludge were examined for the content of petroleum products. Given that the maximum permissible concentration of petroleum products in the soil in Tatarstan is 1.5 g / kg, we can conclude that there is excess sludge on the indicator. The bulk of the sludge stored in the sludge beds and landfills, creating operational problems in wastewater treatment. Terms and conditions of storage, tend to lead to pollution of surface and ground water, soil, vegetation. Entering the underground and ground water, aqueous extract of sewage sludge gives them color, flavors, which negatively affects the quality of such waters. This problem is exacerbated every year and requires an urgent solution. In Russia, the sludge is almost completely stored in the territories of sewage treatment plants, making them into a hotbed of bacteriological and toxicological hazard. Management of sewage sludge is currently one of the most pressing environmental problems. At the same time, the use of sewage sludge allows to solve the currently existing need to find alternative energy sources that can be sewage sludge. There are many methods of recovery and recycling of deposits of biological wastewater treatment. In particular it is suggested to use the past as a source for the preparation of activated carbons for the production of complex sorption materials intended for the removal of heavy metal ions. The choice of recovery is determined, as a rule, the availability of appropriate equipment.

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