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Minimization of negative impact from solid waste landfills with use of mineral geoantidotes

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Abstract

The relevance of the work is due not only to a large number of Solid domestic waste and the negative impact of landfills on the environment, but also to the lack of new sites for landfills. Such ground allocates drains with ions of heavy metals. Ions of heavy metals are dangerous to the environment. They are called supertoksikant. The aim of the study is to examine the sulfoaluminate nature substances and their ability to absorb heavy metal ions in order to apply at landfills. Results: sulfoaluminate nature substances ability was found to absorb heavy metal ions. Substances of the sulfoalyuminatny nature are a part of concrete. They interact with solutions of ions of heavy metals and transfer them to an insoluble state. Such process is safe for a lithosphere.

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Keywords: landfills, solid domestic waste, geoecoprotective, cleaning effect

1. Introduction

According to the report of the Government of St. Petersburg in 2014 in Saint-Petersburg appeared more than 11 mil.м3 of MSW. The results of forecasting the formation of MSW growth allows to state that by 2025 this figure will reach 13.3 mil.$м^3$. In general, in Russia it produced more than 200 mil.м3 of MSW annually.

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The main factor determining the negative impact of emplacement area of MSW is the formation of leachate within the area of burial of wastes, escaping from the landfill body in the process of warehousing, condensation and breakdown of wastes. Through the life span of MSW landfill filtrate is a constant source of groundwater and soil pollution. The filtrate consists of heterogenous types of pollutions, which includes ions of high-density metals (IHDM). Ions of heavy metals are dangerous to the environment. They are called supertoksikant. Ions of heavy metals are capable to collect in live organisms. They do harm to human health [1]. Table 1 shows the approximate content of IHDM from domestic wastes landfill.

Table 1. Impact of MSW landfill on ground water and surface water in the location area of the landfill.

Factor	The fact of excess of concentration /TAC	
	ground water	surface water
Marganese	1,5-2,8	--
Ferrum	230-340	0-2,2
Aluminium	1,3- 2,2	0-1,2
Barium	1,2-3,7	--
Plumbum	0- 3,2	0-1,2
Nickel	1,4-2,1	0-1,8
Cobalt	0-3,0	0-1,5
Cadmium	0-5,0	–

The volume of regeneration (drainage) water depending on the humidity of the waste and environmental conditions typically is 25-50% from the mass of the stored waste. A key distinction of drainage water from other types waste water is the unevenness of their accumulation during a year due to seasons fluctuations in the level of atmospheric precipitation. The largest volume of the filtrate is formed in the flood period and autumn term.

2. Method and experiment.

In works of scientists ability of substances to sorption of heavy metals has been studied [2-4]. Various classifications of sorbents have been studied [5-6] and sorption mechanisms [7-12].

For the purpose of developing the listed observations, sulfate and aluminate substances and its ability to absorb ions of high-density metals in order to use it in MSW landfills were chosen.

Among construction material it is possible to refer expanded cement (EC) to the sulfate and an aluminate substance, which ability to absorb ions of high-density metals was investigated. This property can be characterized as the index of geological and ecological protection that represents an absorbing ability of one gram of substance towards IHDM [13-18]. In works of scientists dependence of their properties on the surface of substance is shown [19-25].

The investigations were conducted under static conditions, plumbum was chosen as IHDM, being one of the most dangerous IHDM. Results by reference to the choice of conditions of the investigations are shown in Tables 2 and 3.

Table 2. Results of determination of contact time IHDM with EC (hydrated).

Time, t	Initial concentration, mg/l	Final concentration, mg/l	Cleaning effect, %
15	2025,71	1806,89	11
30	1730,45	1114,07	36
45	1941,71	347,06	82
60	2027,71	243,71	88
75	2222,71	290,42	87
90	2128,71	257,03	88

Table 3. The results of determination of the appropriate measure for the EC (hydrated) to achieve a purification level TAC (the volume of solution 100 ml).

Measure, g	Initial concentration, mg/l	Final concentration,mg/l	Cleaning effect, %