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Geoecoprotective technologies of storage of used wooden sleepers

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Abstract

The article deals with the negative impact of organic pollution of used wooden sleepers. The research offers geoecoconstruction to protect the environment from such influence. It is shown that such a construction can be made in the form of a porous screen. Design sizes are calculated taking into account the geoecoprotective properties of porous material. Geoecological reliability coefficient is calculated for the geoecoprotective screen.

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Keywords: porous screen, geoecoprotective propesties, storage

1. Introduction

Used wooden sleepers represent a problem. The point of the problem is to extract organic nature pollutions from used wooden sleepers. Every year more than one million used wooden sleepers get waste products. Organic substances from wooden sleepers have toxicity. The papers [1-5] show a possibility to detoxicate the environment by means of binder systems. The papers [6-9] consider a possibility of geoecoprotective improvement of binder ground and transport construction; the papers [10-12] analyze lithosphere protection by means of binder systems. Now the main idea is to use porous mineral construction material for geoecoprotection of the environment from wooden

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sleeper pollution. Construction materials with big porosity, for example, foam concrete with the average density 300-600 kg/m3, may be used as absorbers of organic pollutions. If this is the case, absorptive properties of the materials with big porosity should be known.

What is more, it would be possible to construct an article for storage of used wooden sleepers. One of these constructions may be a geoecoprotective screen. In this way lithosphere will be protected and there will be a new preventive method for environmental protection.

Thus, to create a geoecoprotective screen new parameters of porous materials must be known. Absorptive properties of a construction article depend on the area of the article. Localization of organic flood by means of surface is one of the ways to prevent geosphere pollution as well.

It was studied the square of organical substances floodes, accoding to the properties of surface, for the calculation of specific square for floode localization. The papers [13-16] consider the influence of surface on material properties. Such influence is caused by the donor-acceptor nature of the centers on the surface. Wodel acid-base surface sites and milling on the surface functionality are considerated in the papers [17-20]. The papers [21-23] consider the relationship between composition functional groups and their proton conductivity. Thus, in geoecoconstruction all of the surface properties must be taken into consideration.

2. Method and experiment

Parameters of construction systems were offered for geoecoprotective properties. Such properties may be gained by blocking organic pollutions in the pores of solid mineral material. Pores and capillaries absorb organic pollutions. To calculate absorption and blocking ability of building materials we considered not only porous material density but organic solution density as well. Construction material and organic pollution have masses, kg, volumes, V, m^3, absorbing capacity according to mass, A_{am}, (kg/kg) (1) or according to volume, A_{av}, (m^3/m^3) (2) and pollution holding capacity according to mass, A_{hm}, (kg/kg) (3) or according to volume, A_{hv} (m^3/m^3) (4).

$$A_{am} = \frac{m_1 - m_0}{m_0}, \text{ kg/kg} \quad (1)$$

$$A_{av} = \frac{v_0 - v_1}{v_a}, \text{ m}^3/\text{m}^3 \quad (2)$$

m_0 –start mass of concrete article;
m_1 - mass after absorbing organic substances and 5 minutes of free flow of polluted sflood

v_0 –start volume of polluted flood, m^3;
v_1 - final volume of polluted flood, m^3
v_a - volume of article, m^3

$$A_{hm} = \frac{m_2 - m_0}{m_0}, \text{ kg/kg} \quad (3)$$

m_2 - mass after 4 hours of free flow of concrete polluted solution

$$A_{hv} = \frac{v_0 - v_2}{v_a}, \text{ m}^3/\text{m}^3 \quad (4)$$

v_2 - final volume of polluted flood after 4-hours of free flow, m^3

Formula 5 is used for a specific area calculation, S_s m^2/m^3

$$S_s = \frac{S}{V} \quad (5)$$

S - area of flood, m^2
V – volume of flood, m^3