

Experimental Study of the Insulating Properties of a Lightweight Material Based on Fast-Hardening Highly Resistant Foams in Relation to Vapors of Toxic Organic Fluids

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Abstract. To isolate the surface of toxic liquids, it is proposed to use fast-hardening highly resistant foams. To obtain fast-hardening, highly resistant foams, the process of gel and foaming is combined. For this, solutions of sodium polysilicate and gelation catalyst are mixed. To increase the stability of the foams, it is proposed to add water-soluble polymers to the gel-forming composition. It is shown that a fast-hardening foam of the composition $\text{Na}_2\text{O} \cdot 2.5\text{SiO}_2$ (9%)+ NaHCO_3 (9%)+6% foaming agent +0.5% carboxymethyl cellulose with thickness 5 cm reduces the mass rate of benzene evaporation by more than 5 times. It retains its insulating properties for more than 5 days. It is concluded that it is advisable to use fast-hardening highly resistant foams for the elimination of emergencies with the spill of toxic liquids.

Introduction

Currently, about 6 million toxic substances are used in the world for various industrial and household purposes, many of them belong to the group of extremely hazardous chemicals. A significant part of toxic substances are liquids. Some of them have a turnover of thousands of tons [1]. Periodically Emergencies occur, which lead to the spill of toxic liquids. At the initial stage of such accidents, the main hazard is represented by liquid vapors. They can poison people and have a negative impact on flora and fauna.

To reduce the negative consequences of such accidents, a number of methods are used: installation of liquid curtains; scattering and displacement of a vapor cloud by a gas-air flow; backfilling of the spill and absorption of liquid by bulk adsorption materials; dilution of liquid spillage with water or solutions of neutral substances; neutralization with solutions of chemically active reagents; cooling the spill with refrigerants; burning of the strait [2]. However, in most cases, the method of isolating the surface of the liquid with air-mechanical foams is used [3]. This method has several disadvantages, the main one being the rapid destruction of the foam. The durability of the foams does not exceed several tens of minutes. The process of liquidation of emergencies with the spill of toxic liquids lasts from several hours to several days. Therefore, it is relevant to develop an insulating agent with high insulating properties and a long time to maintain performance.

Main part

As an alternative to air - mechanical foams, as an insulating agent with a long lifetime, it has been proposed to use the fast hardening foams (FHF) [4]. Upon receipt of the FHF, two sequential processes are carried out. Initially, two components of the gelling system (GS) are mixed - a solution of a gelling agent and a solution of a gelation catalyst. In this case, both components of GS contain a foaming agent (FA) in an amount of 6 wt%. Subsequently, the resulting composition is foamed using one of the existing methods. Then the foam is applied to the surface of the spilled liquid. The applied foam is retained on the surface of the liquid and after a while hardens due to the

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