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TECHNOLOGY FOR PRODUCING HYDROPHOB CONCRETE BASED ON SILICON ORGANIC POLYMERS

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ABSTRACT
The article presents the synthesis of organosilicon compounds based on tetraethoxylane and industrial by-products, and also studies the ratio of reagents, solvents and temperature to the reaction product. Also, hydrophobic compositions based on synthesized organosilicon polymers were developed and tests were carried out for a building material - concrete. As a result, it turned out that the water absorption of concrete is reduced by 40%.
KEYWORDS: *ethyl ethers, benzene, chloroform, tetrahydrofuran, dioxane, tetraethoxyxsislane, vinyl ethyl magnesium bromide, vinyl ethyl triethoxylane, urea, formalin, hypane, acrylic emulsion, liquid glass, hydrophobization, reaction efficiency, concrete, hydrophobiccompositions.*

INTRODUCTION

The world pays great attention to the production of moisture protection products based on modern technologies and their use to increase the moisture resistance of building materials and structures. The creation of chemical materials that increase hydrophobicity and their inclusion in the composition of building materials is an urgent problem in all respects. Therefore, it is important to create a new generation of complex chemicals based on innovative technologies in the creation of moisture-resistant hydrophobic materials and their use in various fields.

At this time, organosilicon compounds are widely used to protect building materials from aggressive environmental influences. This is due to the fact that organosilicon compounds have the property of film formation and the film, in turn, being a part of the processed material, consists of alternating silicon and oxygen atoms. In addition, organosilicon compounds, on the one hand, bind to the workpiece through an oxygen bridge, and on the other hand, they reduce the wetting of the object due to the presence of non-polar molecular alkyl or aryl radicals [1,3].

RESULTS AND THEIR DISCUSSION

In connection with the above, tetraethoxysisilane and secondary industrial raw materials were used to synthesize new types of polymer compounds, create new hydrophobic compositions, obtain hydrophobic building materials and expand the range of the most widely used organosilicon compounds.

The interaction of tetraethoxysisilane and vinyl ethynyl magnesium bromide in equimolecular ratios is accompanied by the formation of vinyl ethynyl triethoxysisilane according to the following scheme: [2,7,8]

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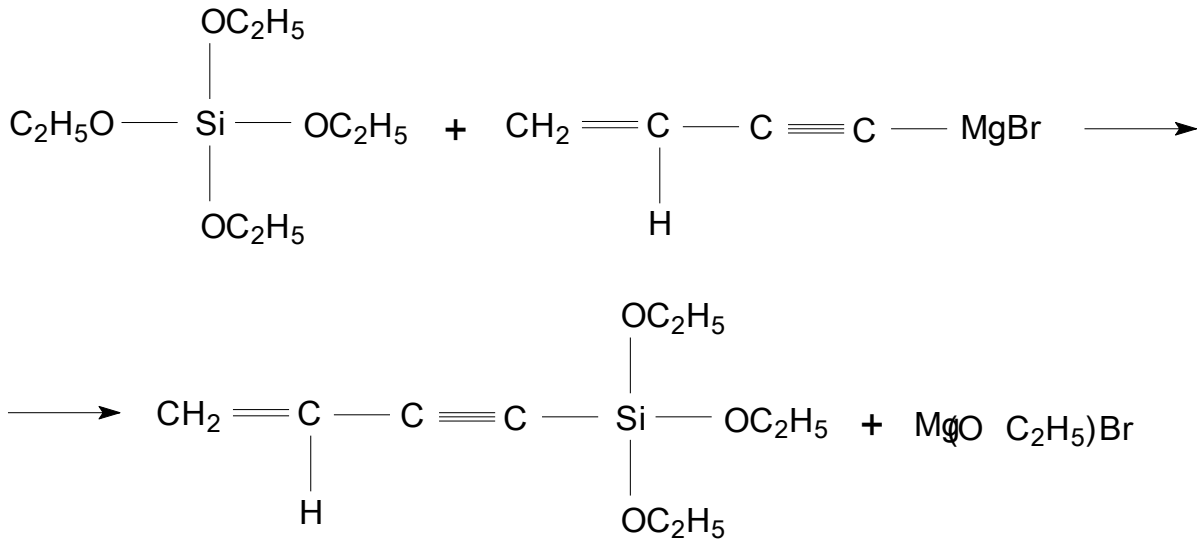
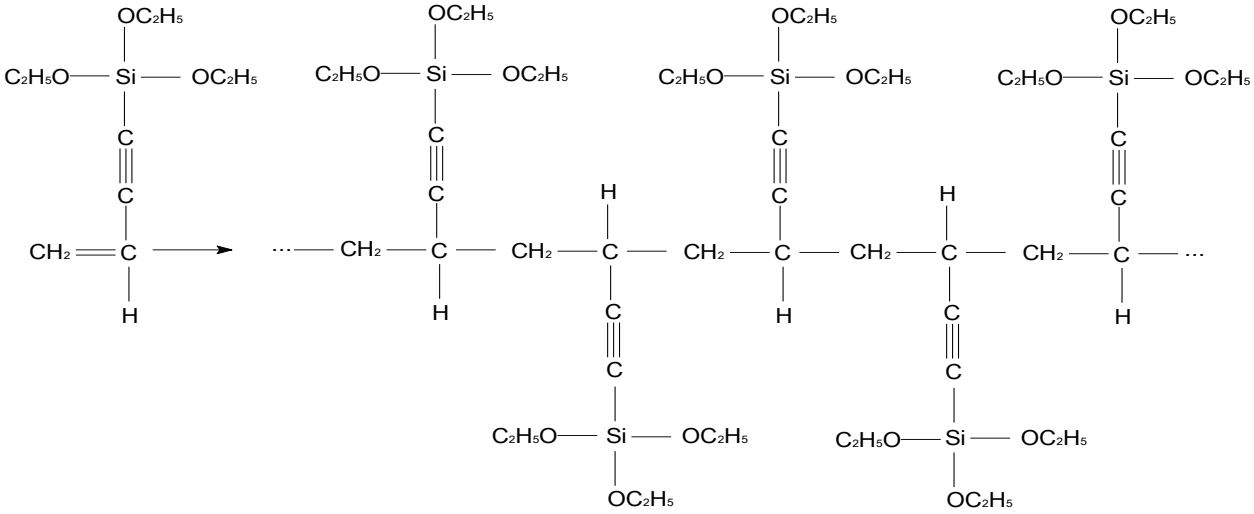


This reaction takes place at 30 ° C for 6 hours. The reaction yield is influenced by the ratio of the starting materials and the nature of the solvents. Unlike dry ether and benzene, the reaction yield is low in reactions carried out in toluene, dioxane, and other solvents.

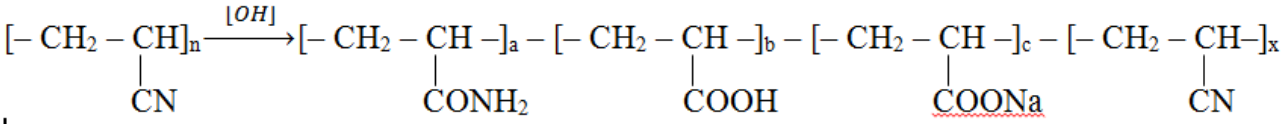
The resulting product is rectified for the presence of water, ethyl alcohol and unreacted monomer in polyvinylethynyltriethoxysilane, resulting in a product with polyvinylethynyltriethoxysilane in 150 ml (50%) or benzene in 140 ml (48%),D 1,4560; d_4^{20} 1.0183.

The scheme of thermal polymerization of vinyl ethynyltriethoxysisilane monomer at a temperature of 30-400C can be represented as follows:



Hydrolyzed polyacrylonitrile, which is a secondary industrial raw material, is obtained by hydrolysis of acrylonitrile. The number of functional groups can vary depending on the reaction conditions (temperature, type of catalyst, presence of organic solvent).

The structure of HIPAN and its functional groups is described below:



a, b, c, x depend on the conditions and duration of the hydrolysis reaction.

To synthesize the hydrophobic substance in the reactor, tetraethoxysisilane (Si $(C_2H_5O)_4$) binder and industrial secondary raw material GIPAN were used in a ratio of 1:10 and at a temperature of 40oC.

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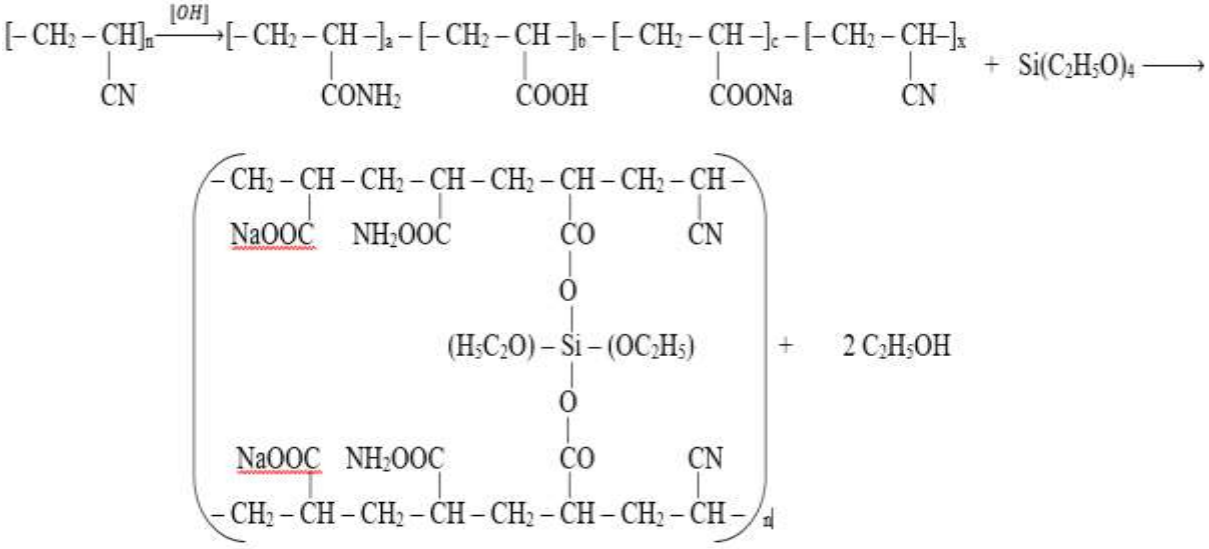
With an increase in the temperature and the amount of TEOS, the solid mass obtained as a result of large-scale crosslinking becomes insoluble in solvents, which is probably due to the complete crosslinking of the reagents. The linear form of HIPAN is explained by the fact that the solubility of the obtained polymer decreases with an increase in the degree of transition to the lattice state and the formation of a solid mass [5].

The following describes the reaction of functional groups of hydrolyzed polyacrylonitrile with tetraethoxysisilane based on experiments:



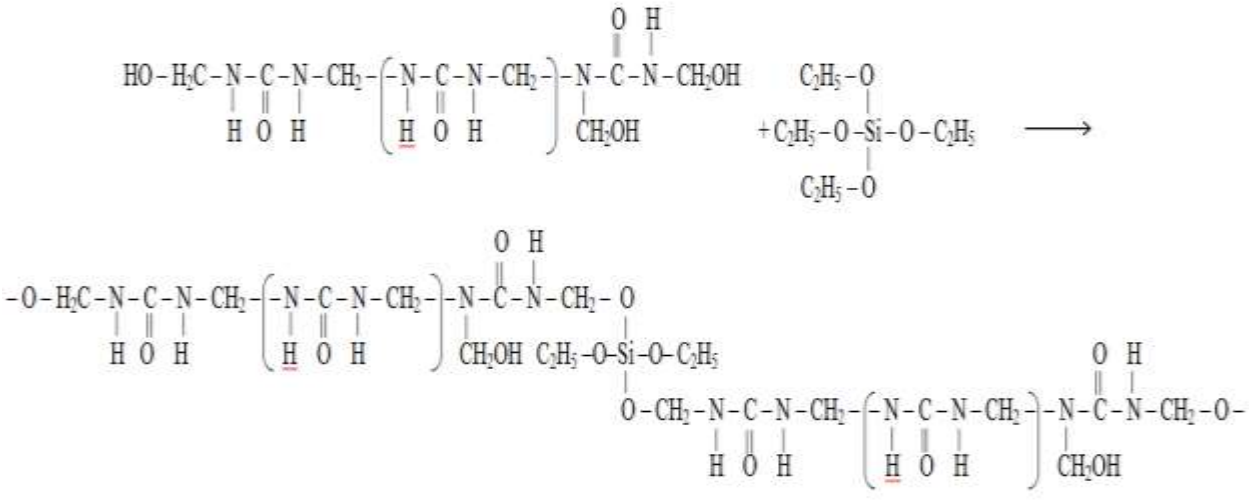
Scheme b (number of functional groups in a schematic representation of hydrolyzed polyacrylonitrile) determines the level of CH-COO crosslinking and the viscosity of the resulting polymer. Exceeding this value in a ratio of 10: 1 leads to the transformation of the polymer into a solid (rubbery) mass.

As a new component, formalin, tetraethoxysisilane binder (Si (OCH2CH3) 4), emulsifier and urea are mixed before local raw materials until they become resinous. The reaction mixture is carried out in a reactor at a temperature of 250C in various proportions.

The decisive factors for the condensation reaction between urea and formaldehyde in aqueous solution are:

- the initial ratio of reagents;
- concentration of hydrogen ions;
- reaction time and temperature.

Taking into account the above, an oligomer of urea-formaldehyde resin modified with tetraethylorthosilicate was synthesized [4, 6].



Based on these obtained organosilicon poly (oligo) mers, a hydrophobic composition was prepared in the presence of an acrylic emulsion and water glass. A composition has been created for the production of

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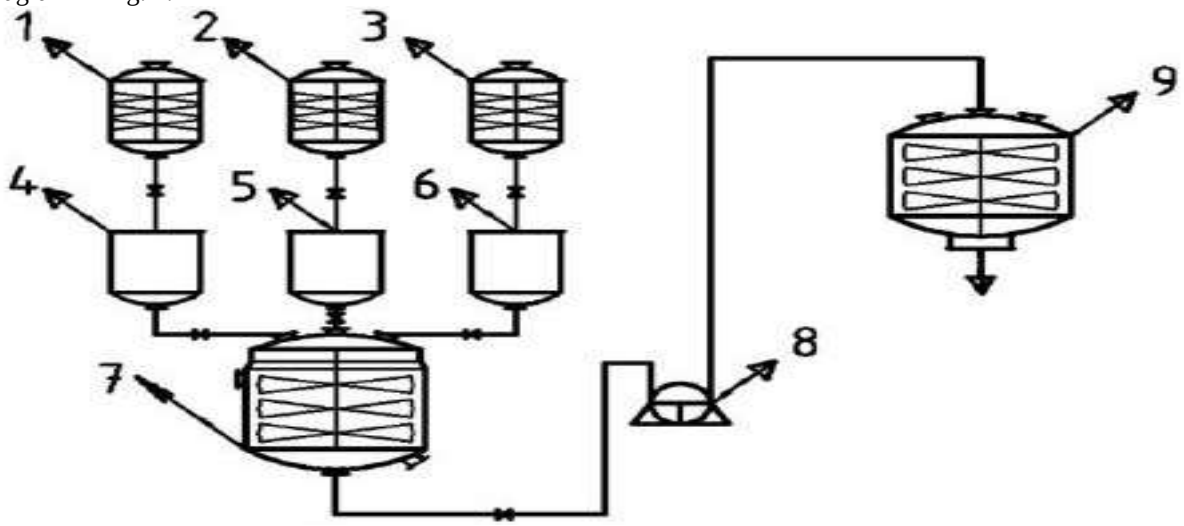
building materials with the participation of polymers obtained by this technology. Table 1 shows the ratio of the mass of the polymers synthesized in the hydrophobic composition and the substances included in the composition.

Table 1
The ratio of synthesized polymers and the created composition in production

T / p	Optimal ratio 3% of the total mass	Acrylic emulsion	Liquid glass
1	Hypan + TEOS	90	7
2		80	17
3		70	27
4	MFS + TEOS	90	7
5		80	17
6		70	27
7	PVETEOS	90	7
8		80	17
9		70	27

The hydrophobic composition obtained in the above ratio was tested in a concrete mixture. It was found that an increase in the mass content of water glass in the composition complicates the processing of the mortar and accelerates the curing time. Therefore, the optimal ratio by weight in the composition was 3% of the synthesized polymer, 90% of the acrylic emulsion, 7% of water glass. It has also been found that the hydrophobic properties of the concrete mix increase with an increase in the amount of hydrophobic composition in relation to weight. As this amount increased, the optimum ratio to total weight was set at 1% due to the reduction in the mechanical strength of the concrete.

The created compositions were used for hydrophobization of building materials as shown in the diagram in Fig. 1.



Rice. 1. Technological scheme for obtaining hydrophobic building materials.

1,2,3-tanks for storage of reagents, 4,5,6-measuring tanks-dispensers, 7- reactor forming a hydrophobic composition, 8-pump, 9- construction mixer.

According to the proposed technology, the composition is stored in storage tanks 1, 2, 3 based on the ratios shown in Table 1. The required amount is measured through the vessels of the measuring measuring vessels 4,5,6. The process is carried out in a mixing reactor 7 and is directed by a pump 8 to a construction mixer 9, where the building material is stored. There, the process of hydrophobization of the building material is carried out and a ready-made hydrophobic material is obtained. The advantage of this technology is that water repellents are synthesized and used in the process of preparing the composition.

Conclusions. Thus, organosilicon compounds based on industrial secondary raw materials and tetraethoxysisilane have been synthesized. Compositions of hydrophobic compositions based on synthesized poly(oligo)mers have been developed and tested in concrete mixtures. As a result of experiments, it was found

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that the water permeability of concrete formed when mixing in an amount of 25 kg of hydrophobic compositions created to obtain 1 m^3 of concrete is reduced by 40%.

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