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SYNTHESIS AND RESEARCH OF NEW SORBENTS BY MODIFICATION OF POLYVINYLCHLORIDE WITH MONOETHANOLAMINE

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Annotation
The reaction of polyvinyl chloride with monoethanolamine was studied in order to modify the complex-forming reaction-active compounds. Their composition and properties were studied. The composition of the obtained product was studied using IR-spectroscopy, scanning electron microscopy, element analysis method.

Keywords: polyvinyl chloride, monoethanolamine, modification, molecule, sorbent, polymer, membrane, IR-spectroscopy, scanning electron microscop, distilled water, dimethylformamide.

Introduction

The reactions of chemical transformation of PVC have been studied in both homogeneous and heterogeneous processes, in an organic medium and in aqueous solutions, in suspensions, in the swollen state, in a melt, and in solvent/nonsolvent systems [1].

When using ion exchange processes in practice, it is necessary to take into account the kinetic properties of the sorbent, which indicate its porosity. In this case, the study of the phase of termination of mass transfer is necessary to select the optimal process conditions, such as temperature, hydrodynamic parameters, and fractional

composition of the resin. In ion exchange resins, sorption is a complex and multistep process, and usually the limiting stages determine the overall rate of the process [2].
Thus, by modifying PVC by methods of polymer-analogous transformations, it is possible to obtain various ion exchangers of both cation-exchange and anion-exchange character. However, to obtain these valuable materials, it is necessary to use granular PVC with a certain particle size. This reaction is complicated due to the influence of diffusion processes on the course of the reaction of chemical transformation in heterogeneous conditions, as well as the presence in the composition of granular PVC of various additives in the form of dioctyl phthalate and destruction stabilizers.
The reactions of chemical transformation of PVC have been studied both in homogeneous and heterogeneous processes in an organic medium, in aqueous solutions, in aqueous suspensions, in a swollen state, in a melt, in solvent-not-solvent systems. In a solution, the nature of the nucleophile is not the only factor influencing the course of the process; in addition, the nature of the solvent, the temperature and duration of the reaction also affect [3-4].
Along with its advantages, PVC has a number of significant disadvantages. The most significant of these is insufficient thermal stability at the temperatures required for processing. Therefore, in the process of PVC processing, plasticizers (dialkyl phthalates) and stabilizers (compounds of lead, cadmium and barium) are introduced, which leads to a decrease in the environmental safety of PVC materials and an increase in their cost [5].
Ion exchange materials are widely used in various fields of human activity, in in particular, such as pharmaceuticals, petrochemicals and hydrometallurgy, water treatment. One of the important directions is the use of ion exchangers in the purification of natural and waste waters from ions of heavy and toxic metals, as well as biologically active substances. One way to get new polymeric materials with the desired physicochemical properties is the modification of existing polymers. In particular, it represents interest in obtaining ion exchangers from polymers widely used in the national economy by modification of materials based on polyvinyl chloride. The modification of polyvinyl chloride was studied in organic media, aqueous solutions, suspensions [6]
There are two approaches to obtaining polymers: the first with a polycondensation mechanism and the second with a polymerization mechanism. Obtaining polemics by polycondensation involves at least three steps takes: copolymer formation by condensation reaction, using functional trialcoxylanes adhesion of alkoxylan monomers to the end groups of the copolemer as a result of hydrolytic condensation

formation of sopomer. Technological production of polymers with a polymerization mechanism is somewhat simple because the production of the polymer and the introduction of its functional group are in one process combined [7-9]

With the expansion and development of industries, the need for anion-exchange and complex-forming sorbents increases. The synthesis of such sorbents can be achieved by modifying industrial sorbents containing functional groups with various chemical reagents [10-13].

Coordination properties of polymer ligands and their practice the homogeneity of the functional groups within the application is significant depending on the degree. Polyfunctional polymer ligands are mixed ligand complexes their stability has formed monofunctional resins is higher than the stability of the compounds [14]

Obtaining such sorbents on the basis of polyvinyl chloride planned for production in our country can be very effective. The presence of a highly reactive chlorine atom in PVC allows it to be modified with various reagents and to obtain sorbents with both ion-exchange and chelating properties [15-19].

Complex compounds of intermediate metals in the world are coordination compounds is the main subject of not only fundamental but also applied research in chemistry is calculated. Reactive active organic ligands in large quantities of intermediate metals coordination compounds formed in various industries as a result of the application of significant developments based on modern waste-free technologies opened up broad prospects for extractive processes [20].

The reaction of polyvinyl chloride with monoethanolamine was studied in order to modify the complex-forming reaction-active compounds. Their composition and properties were studied. The composition of the obtained product was studied using IR-spectroscopy, scanning electron microscopy, element analysis method.

In this study, polyvinyl chloride was dissolved in dimethylformamide and its reaction with monoethanolamine to modify it with reactive compounds was studied. Their composition and properties were determined.

These studies demonstrate the urgency of the problem of obtaining new sorption materials based on polyvinyl chloride.

Experimental Part

Modification of polyvinyl chloride with monoethanolamine

6.25 g (0.1 mol) of polyvinyl chloride solution in 30 ml of dimethylformamide was added to a three-mouth flask equipped with a refrigerant and an automatic stirrer and 6.1 ml (0.1 mol) of monoethanolamine was added dropwise while heating and stirring at 70 °C. The temperature was then raised to 100–110 °C, and after stirring for 1–1.5

h at this temperature, a solid, resinous mass was formed. The resulting solid mass was placed in a porcelain bowl and dried in an oven at 55-60 °C for 4 hours. The dried polymer was pulverized and the low-molecular-weight material was first washed with a 5% solution of KOH in water and then with distilled water until it reacted neutral to the phenolphthalein indicator and air-dried. The resulting sorbent is a gel-like yellow-brown substance. Air-dried sorbent mass 7.63 g, moisture content 12%, reaction yield 88%. The synthesized complex-forming sorbent is partially soluble in water, insoluble and insoluble in organic solvents.

Research Results and their Discussion

Samples of the synthesized sorbents, pressed into a pellet with KBr, were investigated by IR spectroscopy using a SHIMADZU IR Fourier spectrometer (Japan) (range 400-4000 cm^{-1}, resolution 4 cm^{-1}). The interpretation of the spectra was carried out using the basic software that implements the automatic measurement of spectra, has a means of graphical display of spectra and their fragments and forms the work with the library of user spectra (Fig. 1).

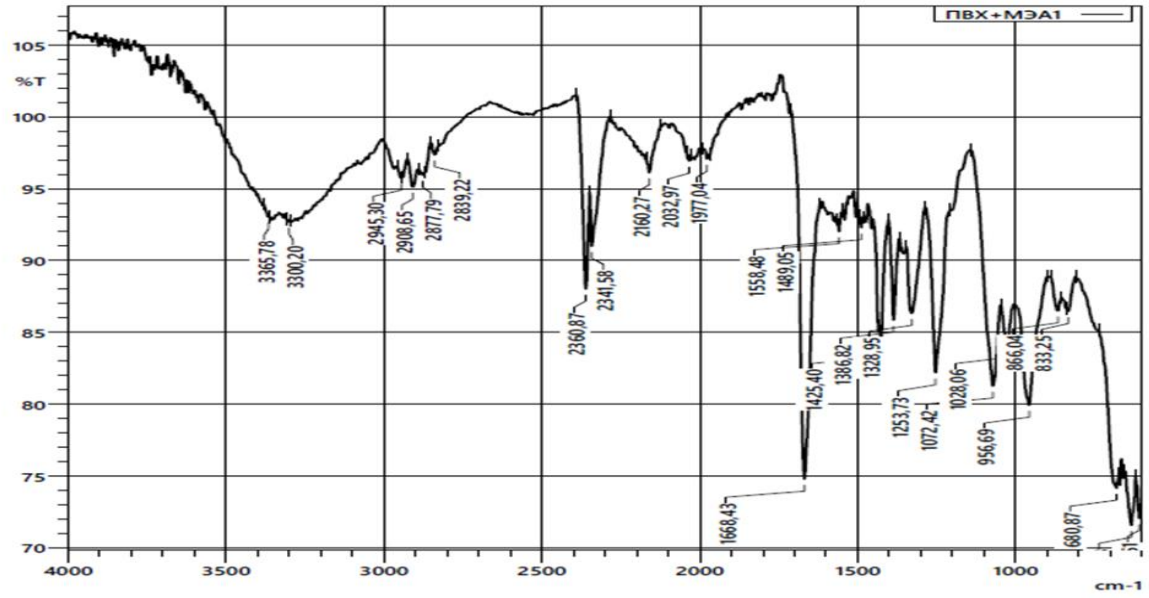

Figure 1. IR spectrum of the synthesized sorbent

In the IR spectrum of the resulting complex-forming sorbent ν (NH) + ν (OH) 3365 cm^{-1}, ν_{as} (NH) 3300 cm^{-1}, ν_{as} (CH_2) 2945 cm^{-1}, H-bound ν_{as} (OH) 2900 cm^{-1} , (CH_2) + (CN) 1668 cm^{-1}, δs (H-CH_2) 1425 cm^{-1}, ν (C-O) 1328 cm^{-1}, ν (C-OH) 1250 cm^{-1}, 956 cm^{-1} Vibration in the fields frequencies were observed.

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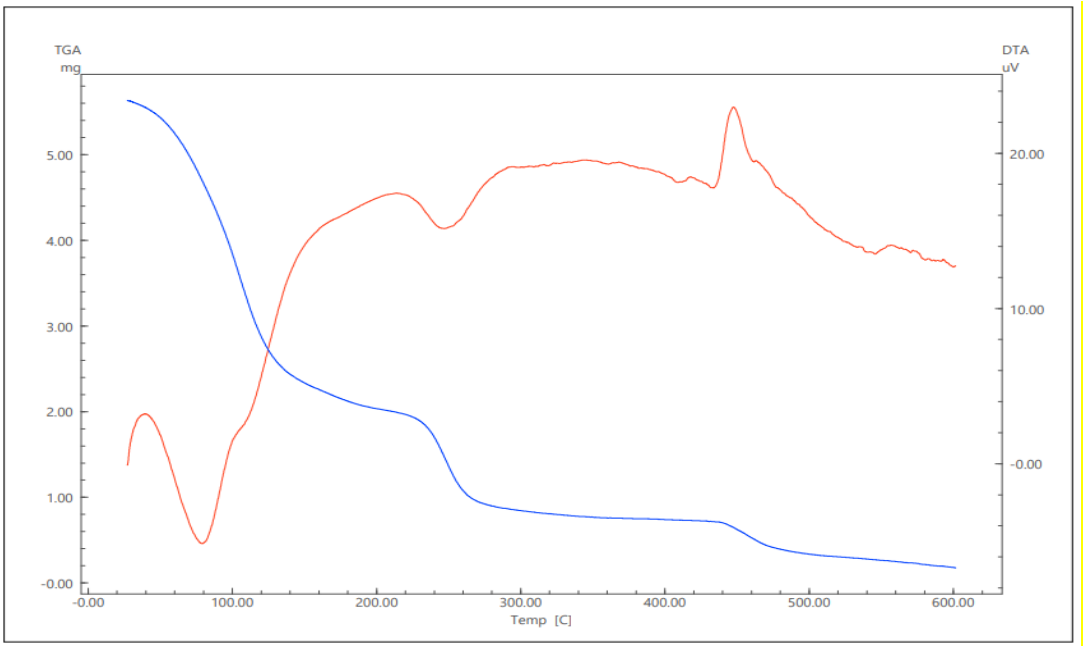

Figure 2. DTA-TGA graph of the compound formed

As a result of studying the DTA-TGA graphs of the formed compound, three endothermic peaks appear in the temperature range of 20-560 0S. The first of these indicates the liquefaction of the polymer at a temperature of 80 0S. Decomposition was initiated at 250 ° C. In the temperature range 252–560 0S, a decrease in sample mass occurred at a rate of 3% / min.

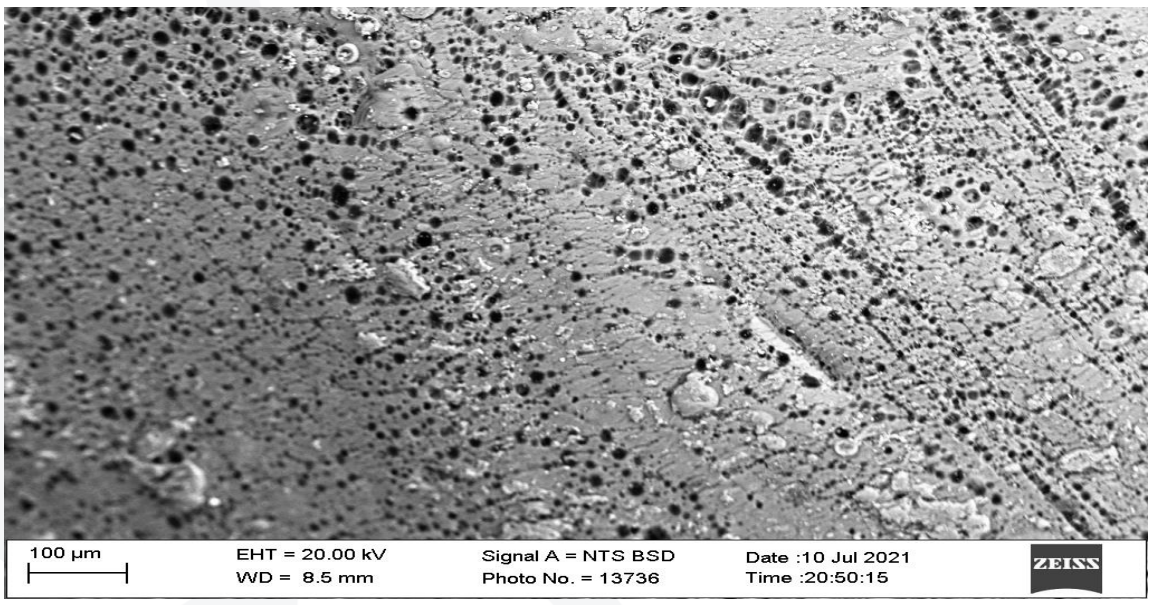

Figure 3. Appearance of the formed compound under an electron microscope

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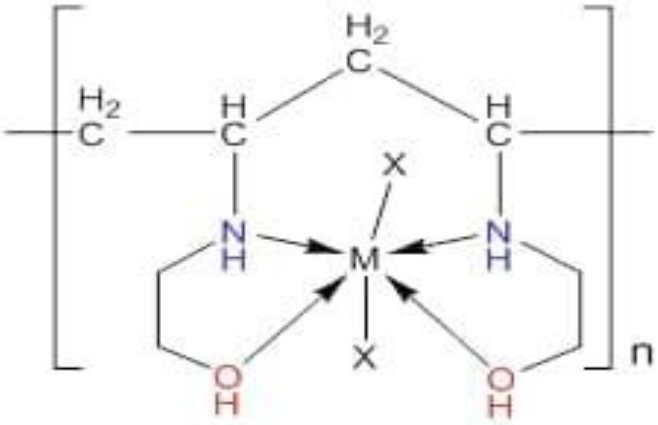
Figure 3 shows the view of PVC monoethanolamine under an electron microscope. As can be seen from the picture, PVC is mainly sewn into monoethanolamine, and a small amount of metals remain among the polymer matrix as fillers in the form of oxides. Due to this, important properties of copolymers, such as elasticity, relative elongation, deteriorate.

As follows from the table, the polyvinyl chloride matrix was modified with monoethanolamine and a complexing sorbent was obtained. The proposed structure of modified polyvinyl chloride with monoethanolamine can be summarized as follows:



Conclusion

As a result of the studies carried out, a technique for obtaining a sorption material by modifying polyvinyl chloride with monoethanolamine has been worked out. The composition of the obtained product was studied using IR-spectroscopy, scanning electron microscopy, element analysis method.

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