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RESEARCH OF THE PHYSICOCHEMICAL PROPERTIES OF A COPOLYMER SYNTHESIZED ON THE BASIS OF AN ACRYLIC MONOMER AND A URETHANE OLIGOMER

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ANNOTATION

In the practical experiments of this study, research in the field of synthesis of the acrylic (acrylate)-urethane copolymer based on local raw materials and the creation of technology to further enhance the adhesive strength properties of this copolymer are important. In this field of research, the main attention was paid to the basic physico-chemical properties of the synthesized copolymer, the economic efficiency of its production and the production of starting materials from local raw materials. During the study, a copolymer was obtained in the presence of an acrylic (acrylate) monomer and a urethane oligomer, and its physico-chemical properties were studied.

Keywords: acrylic (acrylate) monomer, urethane oligomer, free radical copolymerization, copolymer, spectroscopy.

INTRODUCTION

Currently, in the synthesis of adhesion-resistant copolymers with acrylic (acrylate) varnish, nitrogenous urethane oligomers are one of the most common compounds in the modern high-molecular industry. The global production of such nitrogenous urethanes ranges from 8 to 9 million tons per year, which accounts for 6% of the polymer industry [1]. This in turn is the reason why research work in the field of high molecular substances with nitrogen-retaining urethane oligomers in the formation of adhesion copolymers with an acrylic (acrylate) monomer is being carried out intensively [2-3].

In continuation of these studies, the acrylic-urethane copolymer was obtained in practical experiments based on an acrylic monomer and a urethane oligomer and its physico-chemical properties were investigated.

LITERATURE REVIYEW

One of the most promising areas of acrylic monomer-based copolymers in the world are copolymers involving an acrylic monomer and a polyurethane oligomer. Today, the production of polyurethane on an industrial scale is the most widespread branch of the modern polymer industry [4]. According to data analysis, flexible polyurethanes account for about 66% of synthetic materials production in global production, hard foamed plastics account for 22%, and other polymer products account for 12% [5].

Although the synthesis of polyurethanes was first obtained in the laboratory in the nineteenth century, by 1930 the production of fibers, adhesive polymers and coatings from polyurethane oligomer was scientifically confirmed [6]. Several methods are used to produce polyurethanes on an industrial scale. Today, polyurethanes are widely used in many industries due to their diversity. Such properties of polyurethanes as mechanical hardness, high chemical resistance and resistance to climatic influences have led to their widespread use in the form of various copolymers [7].

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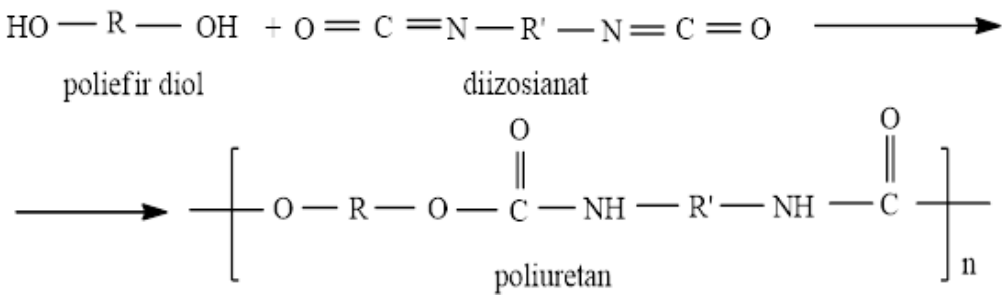


Polyurethane oligomer, with a global production of 8-9 million tons per year, is widely used in the construction and automotive industries (fig.1) in accordance with the above properties [7].

Upon preparation of the polyurethane-acrylate copolymer, an acrylic monomer and a polyurethane oligomer are obtained and obtained by free radical copolymerization in solution. The polymer product obtained during the experiment is precipitated in methanol and dried in vacuum at a temperature of $40^{O}C$ [8]. It was also proposed to obtain a polyurethane-acrylate copolymer obtained in the presence of a polyurethane oligomer and an acrylic monomer, a thermo- and moisture-resistant coating with acrylic polyurethane paint in the presence of binding agents and organic solvents.

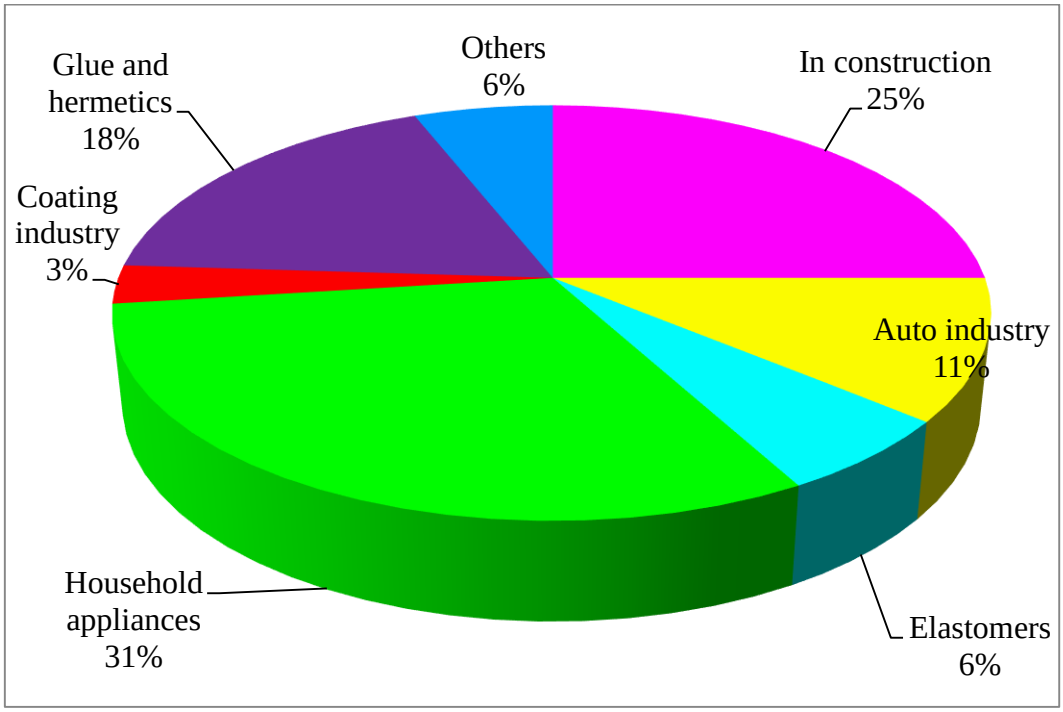


Figure 1. Areas of application of the urethane oligomer.

As a continuation of such research work, the specific characteristics of the copolymerization reaction and the resulting copolymer were considered, which go on the basis of an acrylic monomer based on local raw materials and a nitrogen-retaining urethane oligomer in the composition. In particular, during the carried out study, an acrylic-urethane copolymer was synthesized with the acryl monomer based on a free radical copolymerization reaction in the presence of a nitrogen-retaining urethane oligomer in its composition.

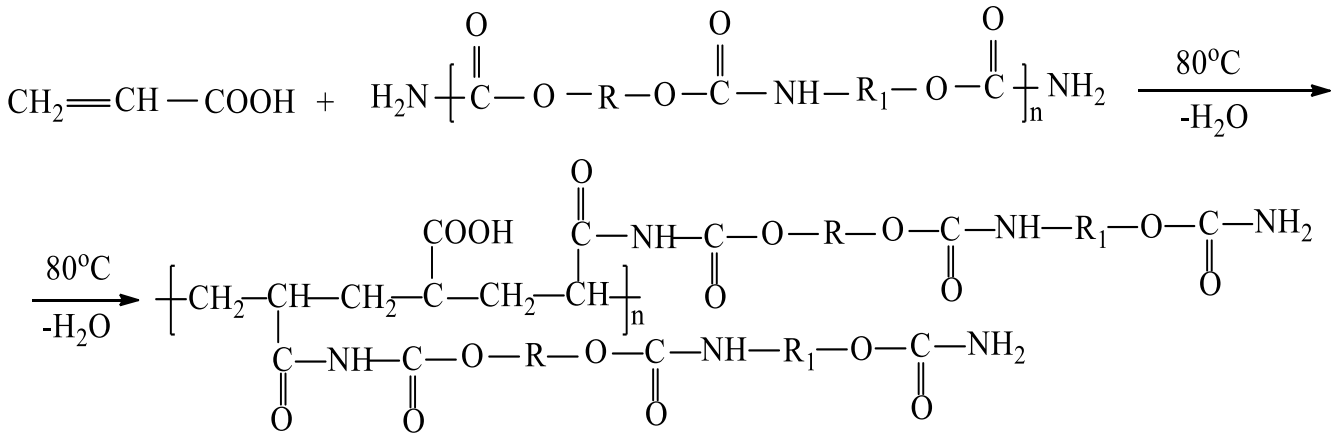
RESEARCH METHODOLOGY

In the practical experiments of this study, an acrylic-urethane copolymer was obtain because of the reaction of the copolymerization of the acrylic monomer and the urethane oligomer. The

physical and chemical properties of the resulting copolymer were study according to the existing methodology.

METHODS AND MATERIALS.

In practical experiments, work was carry out to obtain an acrylic-urethane copolymer. In this case, a three-headed flask, a cooler and a dropper were obtain, equipped with a thermometer, a heating device and a mechanical stirrer. The urethane oligomer and acrylic monomers were obtain as the initial organic monomers. In practical experiments, a urethane oligomer with a content of nitrogen preservative, an average molecular weight of 700-800, was taken from the compound as well as acrylic acid in a ratio of 1:1 and a copolymerization reaction was carried out at a temperature of 80-90^{O}C for 8 hours, in a nitrogen environment.



RESULTS AND DISCUSSIONS.

The characteristics of the IR spectra of the copolymer were also study in order to study the chemical bonds and existing functional groups of the copolymer obtained because of the copolymerization reaction occurring between the acrylic monomer and the urethane oligomer (fig. 2).

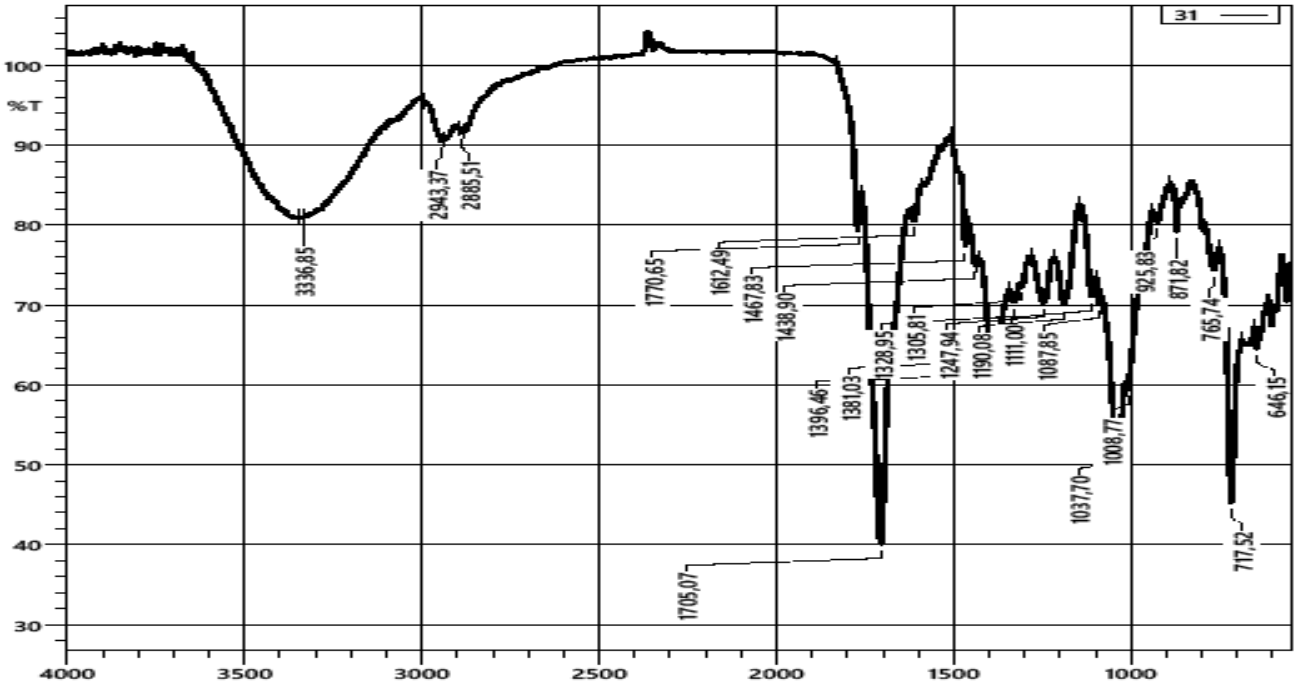


Figure 1. Indicators of the IQ spectrum of acrylic-urethane sopolimer.

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To test-experiment the IR-spectroscopy method, a sample of the acrylic-urethane copolymer obtained during the practical experiments was taken in the emulsion aggregate state. The resulting sample was placed in a special pribori (IRAffinity-1s (Shimadzu). With the help of a special pribor, vibrational spectra were obtained through the transfer of infrared light from the sample composition. In this method, at the expense of infrared rays transferred from the sample macromolecule, the fluctuations of the bonds were determined in relation to the dipole moment.

It was found that the spectrum of atoms in the sample obtained in this case consists of thin lines. During the passage of infrared light from the sample, determining frequency indicators of groups were determined under the influence of a factor associated with the passage of light between the oscillations of the macromolecule.

In particular, the indicators obtained for studying the chemical bonds and existing functional groups of acrylic-urethane copolymer were analyze. According to the results obtained, 3336 cm^{-1} belongs to the moderately strong valence vibration – CONHR group in the field. 2913-2885 cm^{-1} strong valence vibration fields-CH_2 - group, 1770 cm^{-1} belongs to the RR'N-COOR urethane group in the field of deformation vibration. 1705 cm^{-1} strong valence vibration field C═O group, 1612 cm^{-1} deformation vibration field - NH_2 group, 1037 - 1008 cm^{-1} strong valence 717-646 cm^{-1} weak valence has been found to have absorbents belonging to the C-S group at the expense of sulfur contained in the initiator added in the vibration areas.

The main distinguishing features of this synthesized copolymer, obtained based on a nitrogen-containing urethane oligomer and an acrylic monomer, were investigate in accordance with the requirements of current regulations (GOST). In particular, when studying the appearance of the synthesized copolymer, it was found that it is a dark oily (density 1.07 g /cm3) chemical composition at a temperature of 20^{O}C. dark red, and that this substance belongs to hazard class 4 with a low hazard level according to GOST 12.1.007-76.

Also, according to the characteristics of the synthesized nitrogenous copolymer acrylic - urethane, it was found that the pH value is in the range 7.5-9.0 (table 1).

TABLE 1

The main nitrogen retention parameters of the acrylic-urethane copolymer in the synthesized copolymer are determined.

o/n	Index name	Mark	Unit of measurement	Detection method and description
1	Appearance and color	-	-	Visually, dark greasy in dark red
2	Density	$\rho = m/v$	g/sm^3	15139, 1,07
3	Hydrogen indicator	pH	-	Using the indicator, 7,5-9.0
4	Hazard level	-	-	GOST 12.1.007-76, 4-class

In the course of the experiments, the solubility property of an acrylic-urethane copolymer with adhesive properties in synthesized solvents was investigate. According to the research results, a good

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solubility of the synthesized copolymer in water and other organic solvents at room temperature was reveal (table 2).

TABLE 1

Solubility of acrylic-urethane copolymer

o/n	Solvent name	Melting temperature	Melting index (%)
1	Water	20°C	60 %
2	Ether	20°C	25 %
3	Alcohol	20°C	20 %

Thus, according to the results obtained during the study of the physico-chemical properties of the nitrogen-preserving acrylic-urethane copolymer in the composition, it is consider advisable in the future to create a production technology for its extraction from local raw materials.

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