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Abstract

Full Text

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SYNTHESIS OF α-FURYLNITROETHYLENE AND INVESTIGATION OF ITS ABILITY TO POLYMERIZE

The questions of polymerization of nitrated monomers of the heterocyclic series have been studied extremely insufficiently. In connection with the investigation of the possibility of obtaining high-molecular compounds of the heterocyclic series containing nitro groups in the polymer chain, we obtained α-furylnitroethylene and tested its ability to polymerize.

Fig. 1. Yield of polymer of α-furylnitroethylene in the presence of sodium methylate catalyst as a function of temperature (A), amount of catalyst at the optimum temperature −10° (B), and duration of the polymerization process.

Among the methods of synthesis of α-furylnitroethylene available in the literature, the following merit attention: 1) condensation of furfural and nitromethane in the presence of alkalis ([1]); 2) condensation of furfural and nitromethane in the presence of sodium methylate ([2]); 3) synthesis of α-furylnitroethylene through the interaction of diketones with nitroparaffins ([3]).

The synthesis of α-furylnitroethylene was carried out by condensation of furfural and nitromethane in the presence of an anion-exchange resin, with a yield of 38–46%.

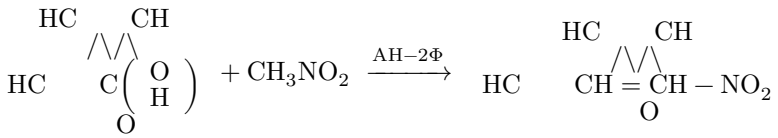

Fig. 2. Thermomechanical curve of poly-α-furylnitroethylene under a load of 100 g, obtained in the presence of sodium methylate catalyst

Figure 2: Fig. 2. Thermomechanical curve of poly-α-furylnitroethylene under a load of 100 g, obtained in the presence of sodium methylate catalyst

The constants of the product obtained differed little from the literature data. To study the polymerization reaction of α-furylnitroethylene, three types of catalyst were selected, carrying out the polymerization process by an anionic, cationic, and free-radical mechanism.

The possibility of polymerization of α-furylnitroethylene in the presence of boron fluoride etherate, ammonium persulfate, and sodium methylate was investigated. When boron fluoride etherate was used as the catalyst, no polymer formation was observed.

Carrying out emulsion polymerization of α-furylnitroethylene in the presence of ammonium persulfate led to the formation of a polymer in a yield of 6–8%, which was an amorphous brown powder. It is evident that catalysts of the cationic and free-radical types practically do not cause the polymerization reaction of α-furylnitroethylene.

Fig. 2. Thermomechanical curve of poly-α-furylnitroethylene under a load of 100 g, obtained in the presence of sodium methylate catalyst

The studies carried out on the polymerization of α-furylnitroethylene in the presence of sodium methylate showed the possibility of deep polymerization of α-furylnitroethylene in the presence of this catalyst.

We investigated the polymer yield as a function of temperature, amount of catalyst, and reaction duration (Fig. 1). The reaction was studied in the temperature range from 20 to 80°, the amount of catalyst was varied from 0.5 to 7%, and the duration from 30 min to 12 h.

As can be seen from the results given for the polymerization of α-furylnitroethylene in the presence of sodium methylate, the highest polymer yield, 74.5%, is obtained at a temperature of −10°, a reaction duration of 6–7 h, and the use of 5% catalyst (relative to the monomer). The polymers obtained are thermally stable, infusible, and insoluble in ordinary solvents.

Fig. 2 gives the thermomechanical curve, taken for poly-α-furylnitroethylene under a load of 100 g, obtained by polymerizing it under optimal conditions in the presence of sodium methylate catalyst.

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Note: Figure translations are in progress. See original paper for figures.