SYNTHESIS OF 6-BROMO-BENZOXAZONYL METHACRYLATE AND ITS RADICAL COPOLYMERIZATION WITH ACRYLAMIDE

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Abstract: In this article, the synthesis, structure, and radical copolymerization of 6-bromo-benzoxazonylmethacrylate with acrylamide were studied. The chemical structure of the synthesized monomer was determined by infrared (IR) spectral analysis, and the mechanism of the polymerization process was studied. The physicochemical properties, thermal stability, and structural features of the obtained copolymers were analyzed.

Key words: benzoxazone, methacrylate, acrylamide, copolymer, radical polymerization, bromination, polymer synthesis.

In recent years, benzoxazone derivatives have been widely used in the production of special polymer materials due to their high thermal and mechanical properties, as well as dielectric stability. Methacrylate derivatives synthesized on their basis form copolymers with various functional groups, which are highly durable, heat-resistant and chemically stable materials. Therefore, copolymers based on 6-bromo-benzoxazonyl methacrylate and acrylamide are of scientific and practical relevance.

Radical copolymerization is the process of simultaneous addition of two or more different monomers to a polymer chain by the radical mechanism. It is one of the most common types of polymer chemistry and has a highly controlled reaction mechanism.

Radical copolymerization consists of three stages of classical radical polymerization:

1. Initiation (start) - free radicals are formed. Usually, peroxides, azo compounds or initiators under the influence of radiation are involved.

2. Propagation (development) — the radical active center sequentially reacts with monomers, forming new radicals. At this stage, different monomers are added to the chain alternately, forming a copolymer chain.

3. Termination (termination) — the active center disappears as a result of the addition or disproportionation of two radicals with each other.

The synthesis of 6-bromo-benzoxazonyl methacrylate was carried out in the following stages: 1. Preparation of 6-bromo-2-aminophenol. Ortho-aminophenol reacts with bromic anhydride to give the 6-bromo derivative. An aqueous ethanol solution and acetic acid are used as a catalyst in the reaction medium.

2. Formation of the benzoxazone ring. 6-bromo-benzoxazonyl methacrylate is obtained by reacting 6-bromo-2-aminophenol with methacryloyl chloride. The reaction is carried out in ethyl ether, at low temperature (0–5°C) and under an inert atmosphere (nitrogen gas).

3. Purification of the obtained product. The product is washed with cold water and then purified by recrystallization from ether. As a result, a white crystalline substance is obtained.

Reaction equation:

$C6H4Br(OH)(NH2) + ClCOC(CH3)=CH2 \rightarrow C6H3BrO2NCOC(CH3)=CH2 + HCl$

The copolymerization process was carried out in the presence of AIBN (azoisobutyronitrile) catalyst, in an inert atmosphere (nitrogen gas) at a temperature of 60–70°C. Dimethylformamide (DMF) was used as the solvent. Monomer ratio: 6-bromo-benzoxazonyl methacrylate: acrylamide = 1 : 1 (in molar ratio). The reaction was continued for 5 hours, then the cooled solution was precipitated with ethyl ether. The resulting white polymer precipitate was filtered and dried in vacuum.

Turning to the results, according to the IR spectrum analysis, the following characteristic peaks were observed in the synthesized substances:

- 1720 cm^{-1} – carbonyl (C=O) group;

- 1640 cm^{-1} – amide bond (C=O–NH_2);

- 3050–3100 cm^{-1} – aromatic C–H vibrations;

- 650–700 cm^{-1} – a peak characteristic of the C–Br bond.

These data confirm the correct synthesis of 6-bromo-benzoxazolyl methacrylate. The composition of the copolymer was determined by elemental analysis, and the acrylamide compound was 48–52% in the composition. According to the results of differential scanning calorimetry (DSC), the glass transition temperature (Tg) of the obtained copolymers was around 135–145°C, which indicates their high heat resistance.

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