PHOTOINITIATED RADICAL POLYMERIZATION OF IONIC MONOMERS RESULTING IN SOLUBLE AND CROSSLINKED POLYMERS

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Ionic polymers made by polymerization of ionic liquid monomers are interesting materials for various applications ranging from coatings, membranes for fuel cells, up to encapsulation of various particles [1]-[3]. Photoinitiated radical polymerization of ionic liquid monomers has received increased interest recently, although traditional free radical polymerization has been applied as well [4],[5].

Depending on the anion selected for synthesis of the ionic methacrylates and dimethacrylates, ionic liquids or solid monomers were obtained. The photoinitiated radical polymerizations using Ivocerin® as photoinitiator were carried out in case of the ionic liquid monomers in bulk although a further ionic liquid bearing the same anion as the monomer was applied as solvent if the monomer was solid at room temperature. The presence of the solvent resulted in a reduction of the maximum of the polymerization rate (R_p^{max}) and a slight increase in the time (t_{max}) to obtain the R_p^{max} value relative to the polymerization in bulk. Furthermore, the ionic liquid used as inert solvent avoided vitrification during the polymerization if the glass transition temperature of the polymer was higher compared to the temperature used for the photoinititated polymerization. Quantitative conversion of the methacrylate group was mostly observed in case of soluble polymers as analyzed by ^{1}H NMR spectroscopy.

[1] R. Bielas, A. Mielanczyk, A. Siewniak, D. Neugebauer, Trimethylammonium-Based Polymethacrylate Ionic Liquids with Tunable Hydrophilicity and Charge Distribution as Carriers of Salicylate Anions, ACS Sus. Chem. Eng. 4 (2016) 4181-4191.

[2] J. R. Nykaza, R. Benjamin, K. M. Meek, Y. A. Elabd, Polymerized ionic liquid diblock copolymer as an ionomer and anion exchange membrane for alkaline fuel cells, Chem. Eng. Sci. 154 (2016) 119-127.

[3] G. Hussain, A. Robinson, P. Bartlett, Charge Generation in Low-Polarity Solvents: Poly(ionic liquid)-Functionalized Particles, Langmuir 29 (2013) 4204-4213.

[4] B. Sanay, B. Strehmel, V. Strehmel, Green Approach of Photoinitiated Polymerization Using Monomers Derived from Oleic Acid and Ionic Liquid, ChemistrySelect 4 (2019) 10214 – 10218.

[5] P. Kaestner, V. Strehmel, Synthesis of ionic polymers by free radical polymerization using aprotic trimethylsilylmethyl-substituted monomers, J. Polym. Sci. (2020) 1–11.