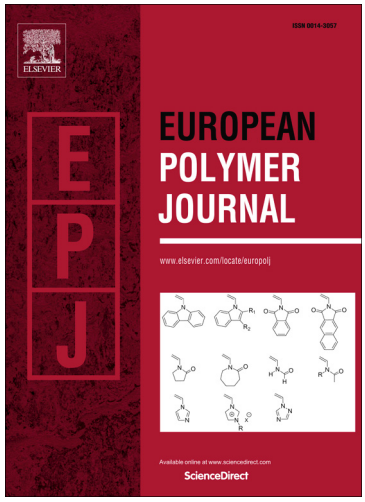

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Morphology Evolution of Poly(glycidyl methacrylate) Colloids in the 1,1-Diphenylethene Controlled Soap-Free Emulsion Polymerization

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Abstract: This work reports for the first time that milky poly(glycidyl methacrylate) (PGMA) colloids produced in the early stage of 1, 1-diphenylethene (DPE) controlled soap-free emulsion polymerization of GMA evolved into transparent polymer solution 90 min after the polymerization was initiated. Qualitative and quantitative analysis confirmed that during the polymerization large amount of hydrophilic hydroxyls and flexible aliphatic ethers were generated by the ring-opening reactions of epoxy groups catalyzed by H^+ which is a byproduct of the decomposition of potassium persulfate. As a control agent, DPE could dramatically decrease the polymerization degree of PGMA, resulting in much shorter hydrophobic main chains comparing with PGMA produced in the absence of DPE. The hydrophilic hydroxyls by ring-opening reaction and the shorter hydrophobic main chains by DPE controlled polymerization would facilitate water swelling into the polymers. The swelled polymers along with the aliphatic ethers and shorter main chains endowed the particles with flexible and proteiform, forming structures similar to transparent polymer solution rather than milky colloidal suspensions.

Keywords: 1, 1-diphenylethene; glycidyl methacrylate; controlled polymerization; soap-free emulsion; hydrolysis; colloids

1. Introduction

Poly(glycidyl methacrylate) (PGMA) composed of highly reactive epoxy group that could be conveniently converted to hydroxyl, carboxyl, amine, quaternary ammonium, halogen and