SYNTHESIS AND PROPERTIES OF POLY(STYRENE-*CO*-BUTYL ACRYLATE) PARTICLES VIA MICROWAVE-AIDED EMULSION COPOLYMERIZATION

Youngjae Yoo, Geun-Hye Hong, Kil-Yeong Choi, Jae Heung Lee
Advanced Materials Division
Korea Research Institute of Chemical Technology
P.O. BOX 107, Yuseong, Daejeon, Korea
(e-mail : jahlee@krict.re.kr)

As a peculiar and powerful energy source, microwave has been widely applied to optimize and accelerate the chemical reaction. As an alternative to conventional heating techniques, microwave irradiation provides an effective, selective and fast synthetic method by heating the molecules directly through the interaction between the microwave energy and molecular dipole moments of the monomers. This internal heating is thought to increase the efficiency of the reaction because the monomers, which have strong dipole moments, are the primary source of activation in the microwave electromagnetic field. For the monomers with high dipole moments which are strongly affected by microwave irradiation, their polymerizations including addition polymerization, condensation polymerization, graft polymerization and ring-opening polymerization have been dramatically accelerated by microwave irradiation.

In this study, a novel process for synthesizing polystyrene(PS), poly(butyl acrylate)(PBA) and their copolymers by microwave irradiation of the respective monomers, styrene(St) and butyl acrylate(BA), was described. Emulsion copolymerization of St with BA was performed in a microwave oven by the forward power being controlled to keep the reaction temperature, 60□. Potassium persulfate(KPS), sodium lauryl sulfate(SLS) and t-dodecyl mercaptan(TDM) were used as an initiator, a surfactant and a chain transfer agent, respectively. The resulting PS/PBA copolymer compositions for overall St/BA monomer compositions were found to be considerably different in microwave heating and conventional heating. Copolymerization rate by microwave irradiation was increased compared to conventional heating, and the reaction rates were affected by the values dipole moment of monomers. The influences of the monomer contents, the initiator contents, the agitation speed and the reaction temperature on the monomer conversion, the particle size and its distribution were investigated. Characteristics of copolymers were evaluated by differential scanning calorimeter(DSC) and Fourier transform infrared spectroscopy(FT-IR). Morphologies of the copolymerized particles were investigated by scanning electron microscopy(SEM).

Keywords : Microwave, Dipole moment, Particles, emulsion copolymerization