

Use of poly(ethylene oxide) based macroRAFT agents as both stabilizer and control agent in the miniemulsion polymerization of styrene

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ABSTRACT

Two poly(ethylene oxide)-based macromolecular agents for reversible addition-fragmentation chain transfer (PEO-RAFT) were synthesized via two chemical routes to be used as a stabilizer and a control agent in the miniemulsion polymerization of styrene. Polystyrene (PS) latexes sterically stabilized by the PEO segments were obtained using 2,2'-azobis(isobutyronitrile) as initiator. Monomer consumption was followed by gravimetric analysis of samples withdrawn from the polymerization medium at different times. The latex particle size and the particle size distribution (PSD) were measured by dynamic light scattering (DLS). Molar masses and molar mass distributions (\bar{M}_w / \bar{M}_n) of the polymers were determined by size exclusion chromatography (SEC). The final polymers were analyzed using differential scanning calorimetry (DSC). The results showed that the droplet/particle sizes and the latexes stability are strongly dependent on the molar mass and the amount of macroRAFT agent used in the polymerizations. Shifts of the SEC chromatograms toward higher molar masses with conversion indicated that the majority of the polymer chains are living chains. In addition, the linear evolution of \bar{M}_n with conversion confirmed the livingness of the polymerizations. Nevertheless, the broad \bar{M}_w / \bar{M}_n observed for all the polymers synthesized, suggest a complex mechanism for the styrene polymerization in the presence of PEO-based macroRAFT agents.

Keywords: MacroRAFT agent, miniemulsion polymerization, styrene.