Synthesis of Controlled Nano-spheres via a Reversible Addition-Fragmentation Chain Transfer (RAFT) Miniemulsion Polymerization

Soonja Choe
Department of Chemical Engineering, Inha University,
253 Yonghyundong, Namgu, Incheon 402-751, Korea
sjchoe@inha.ac.kr

ABSTRACT

A reversible addition-fragmentation chain transfer (RAFT) agent bearing a carboxylic acid group (TADB) is synthesized and applied to the miniemulsion polymerization of methyl methacrylate (MMA) and styrene in order to prepare the stability-enhanced functionalized latex. At the polymerization temperatures of 60, 70, and 80℃, the polymerization kinetics, evaluation of the molecular weight and PDI are found to be strongly dependent on the temperature. The higher the temperature, the faster the polymerization rate, and the lower the molecular weight and PDI are obtained. The PMMA nano-particles prepared by the miniemulsion polymerization using this RAFT agent show some interesting characteristics. As the amounts of the RAFT agent increase, the magnitude of the zeta potential and the conductivity correspondingly increase and the size of the PMMA nano-particle decreases from 118.8 to 49.5 nm. These results imply that the carboxyl group (or partially in anionic form) is present on the surface of the polymer particles and therefore, the stability of the system is enhanced. In addition, non-functionalized RAFT agent, benzyl dithiobenzoate (BDB), was also used to compare the surface properties of the PS nano-particles. For the TADB system, the rate of polymerization was approximately two-fold faster than the BDB system, while the molecular weights and PDI of PS remain intact. Furthermore, no noticeable sign of creaming or destabilization of the above polymer nano-particles was observed for at least several months by remaining as homogeneous latex.