Red-light induced emulsion photopolymerization

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Photopolymerization is a light induced process offering significant advantages compared to thermal process in terms of safety, mainly due to their low energy consumption, use of low temperature and reduced emissions of volatile organic compounds (VOCs).[1] This process will be more favorable when using an economical, safer light source with deeper light penetration such as red light (620-780nm), which is more advantageous than others at shorter wavelengths.[2] On the other hand, emulsion polymerization is a process for producing fluid latex in an aqueous suspension, i.e. in an affordable, safe and green solvent, with a particle size between 50 and 500 nm. It occupies an important place in many industrial sectors, such as coatings, adhesives, paints, additives for constructions materials and non-woven textiles.[3] Therefore, it is interesting to combine the advantages of both processes. Then, emulsion photopolymerization requires a water-soluble, red-light sensitive photinitiating system (PIS). In this context, methylene blue (MB) was used as red-absorbing photoinitiator (PI), combined with a co-initiator (coI) such as sodium para-toluene sulfinate (NapTS), for the photopolymerization of methyl methacrylate (MMA). In this work, poly(methylmethacrylate) (PMMA) latexes were synthetized following irradiation with a LED @ 660 nm. These latexes were characterized using different technics, polymerization kinetics were determined by gravimetry and their photoinitiating mechanisms were investigated through a variety of methods, including fluorescence spectroscopy, steady state photolysis and light transmission measurements (experimental and simulated).

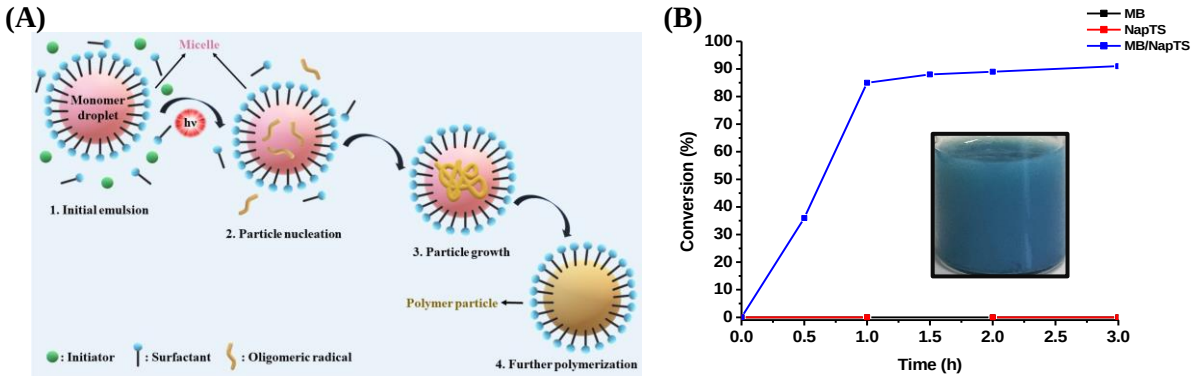

Figure: (A) Emulsion photopolymerization mechanism; (B) Photopolymerization profile of PMMA latex.

References

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