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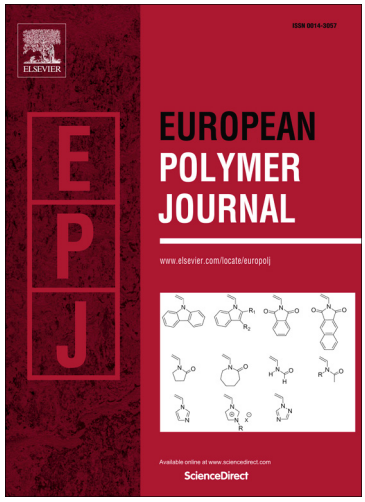

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Continuous Flow Reactor For Miniemulsion Chain Photopolymerization: Understanding Plugging Issue

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Abstract

Plugging is probably one of the most challenging issues facing further continuous polymerization process development. Starting with the photopolymerization of *n*-butyl acrylate miniemulsion in a continuous photoreactor composed by fluoropolymer coiled tubing, we show that three parameters have a critical role on the occurrence of plugging: solids content (≥ 30 wt%), surfactant concentration (≤ 1 wt%) and tubing diameter (≤ 1 mm). In contrast, monomer droplet stability, size and flow rate have a minimal impact. The use of nanodroplets, as individual reactors able to confine the solid products to these droplets, is in no way an efficient strategy to prevent channel clogging. Polymer adsorption occurs locally on macroscopic nucleation sites, where polymer build-up leads gradually to plugging. Based on interfacial tension measurements, we show adhesional wetting as the main trigger of plugging. In this process driven by the high cohesive energy of water, the monomer droplets not originally in contact with the reactor wall makes contact with that surface by displacing water, adhere to it, and polymerize.

Keywords : plugging, continuous process, photoreactor, photopolymerization, interfacial tension