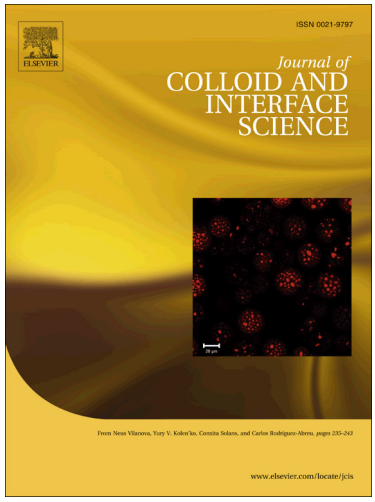

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Continuous Production of Polymer Nanoparticles Using a Membrane-Based Flow Cell

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Abstract

We demonstrate the surfactant-free production of polymer nanoparticles using a continuous membrane-based tangential flow cell. Co-current streams of water and polymethylmethacrylate (PMMA)/acetone/water solution were separated by a porous regenerated cellulose (RC) membrane. The water concentration in the PMMA solution was adjusted so that as additional water diffused through the RC membrane, the PMMA solution composition crossed the two phase boundary to precipitate PMMA nanoparticles. The size of these nanoparticles varied with the concentration of the PMMA feed and the amount of water diffusing across the membrane. The size distribution of PMMA particles produced in a continuous flow membrane cell was much narrower than those produced by drop-wise water addition or batch dialysis precipitation of PMMA particles. A continuous production of polymer nanoparticles of high purity and narrow polydispersity are important requirements for biomedical applications such as delivering therapeutics.

Keywords: Polymer Nanoparticles, Membrane, Solvent-shifting

1. Introduction

Polymer nanoparticles find applications in drug delivery, medical imaging, structural colors, composites, and paints[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]. Nanoparticle preparation methods include emulsion or micro-emulsion polymerization and precipitation from polymer solution[11, 12, 13, 14]. In emulsion polymerization potentially toxic surfactants, initiators and oligomers yield contaminated nanoparticles unsuitable for drug and medical applications[15, 16].

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