Investigating the Effects of Nanoparticle and Surfactant on Mass Transfer : Determine dominant mass transfer mechanism

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Abstract

The purpose of this paper is to improve mass transfer by using nanoparticles and surfactant simultaneously that the use of surfactant has not been investigated by researchers. Hence, the influences of various concentrations of SiO2 nanoparticle and Sodium dodecyl sulfate surfactant on hydrodynamic characteristics and the mass transfer coefficient were surveyed. The results show that the droplet size was decreased by increasing volume fraction of nanoparticles and surfactant. The effect nanoparticles concentration in chemical system on mass transfer coefficient was investigated. It was found that molecular diffusion coefficient was a dominant mechanism which by adding nanoparticle from 0.01 to 0.1 vol.% extraction efficiency was raised from 46% to 78%. Also, by adding surfactant from 0.003 vol.% to 0.01 vol.% to the chemical system, the extraction efficiency enhanced dramatically from 70% to 90%. Finally, using Newman, Krong and Hendlos theories, the mass transfer coefficient was predicted with and without nanoparticles.

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