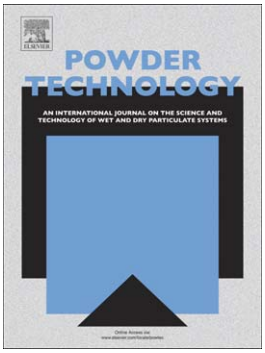

Mixing and separation of liquid-liquid two-phase in a novel cyclone reactor of isobutane alkylation catalyzed by ionic liquid

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Mixing and separation of liquid-liquid two-phase in a novel cyclone reactor of isobutane alkylation catalyzed by ionic liquid

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Abstract

To improve the existing problems of traditional isobutane alkylation catalyzed by ionic liquid reactors， a novel liquid-liquid cyclone reactor was designed for the liquid-liquid heterogeneous reaction. Compared with the traditional hydrocyclone, the novel cyclone reactor consists of two inlets, one for the light phase and one for the heavy phase. The light phase is injected into the reactor through two symmetric tangential slots in the inlet, while the heavy phase inlet is an axial entry with a guide vane. The trajectory and residence time distribution (RTD) of the light phase could influence the reaction process and product quality. In order to study the contact-mixing and separation mechanism of liquid-liquid in the novel cyclone reactor, the trajectory and residence time distribution in the reactor were investigated. Simulations using the species transport equation and experiments were performed on kerosene-water system. The tangential and radial dispersion process of oil was observed in the simulations. The simulation results showed that the mean residence time of the oil is between 0.6s-1.0s under different operating parameters. The kerosene flow in the reactor is not a smooth flow or a complete mixing flow judging from the dimensionless variance. The separation efficiency in the simulated method was higher than 99%. The volume fraction of water in the overflow mixture was less than 5%. The deviation between the simulated and experimental results was no more than 5%, which indicated that the simulated results are reliable and accurate.

Key Words: Isobutane Alkylation, Cyclone Reactor; Species Transport, Trajectory; RTD, Separation Efficiency