

Oxygen Absorption Enhancement during Sulfite Forced Oxidation in the Presence of Nano-Particles

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Abstract : The TiO₂-Na₂SO₃ and SiO₂-Na₂SO₃ nano-fluids were prepared using ultrasonic dispersion method without any surfactant addition to study the influence of nano-fluids on the mass transfer during forced sulfite oxidation in a thermostatic stirred tank, and the kinetic viscosity of nano-fluids was measured. The influence of temperature (30 °C ~ 50 °C), solid loading of fine particle (0 Kg/m³~1.0 Kg/m³), stirring speed (50 r/min ~ 400 r/min), and particle size (10 nm~100 nm) on the average oxygen absorption rate were investigated in detail. Both TiO₂ nano-particles and SiO₂ nano-particles could remarkably improve the gas-liquid mass transfer. Oxygen absorption enhancement factor increases with the increase of solid loading of nano-particles to a critical value and then decreases with further increase of solid loading under 30°C. Oxygen absorption rate together with absorption enhancement factor increases with stirring speed. However, oxygen absorption enhancement factor decreases with the increase of temperature due to aggregation of nano-particles. Further inherent relationship between particle size, loading, surface area, viscosity, stirring speed, temperature, adsorption, desorption, and mass transfer was discussed in depth by analyzing the interaction mechanism.

Keywords : fine particles, nano-fluid, mass transfer enhancement, solid loading

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