World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

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 dispertion 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 ℃ ~ 50 ℃), solid loading of fine particle (0 Kg/m^3~1.0 Kg/m^3), 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℃. 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
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020