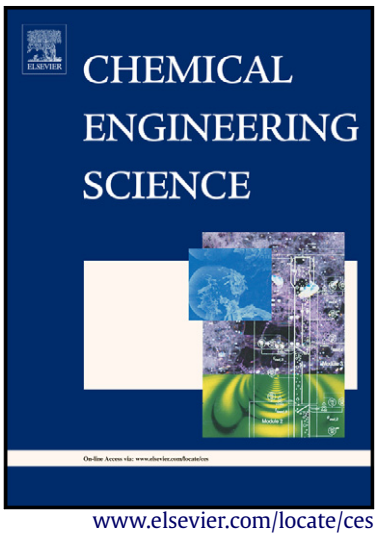

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Petri Tervasmäki, Jari Tiihonen, Heikki Ojamo

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Comparison of solids suspension criteria based on electrical impedance tomography and visual measurements

Petri Tervasmäki*, Jari Tiihonen, Heikki Ojamo

*Corresponding author, petri.tervasmaki@oulu.fi, +358 40 5474973

Abstract

Different approaches have been adopted to quantify the performance of stirred vessels in suspending sinking solids into liquid phase. In this study we used electrical impedance tomography (EIT) to estimate the solids distribution in a lab-scale stirred vessel with a diameter of 362 mm. Also visual measurements were made to determine the cloud height and just suspended impeller speed. Quartz sand with a density of 2650 kg/m^3 was employed as the solid phase with different particle size fractions from 50 to 180 µm and solids volume fractions of 7.5 and 15 %. The effect of impeller type was studied by using two axial flow impellers, a pitched blade turbine and a hydrofoil impeller.

Two different states – partial and homogeneous suspension – were defined from the EIT data in addition to visual measurement of complete off-bottom suspension and cloud height. Partial suspension was determined from the EIT data, and it was reached at relatively low agitation rates. Visual measurements and data from the literature also support this observation, and EIT was proved to be a suitable method to quantify a repeatable partial suspension criterion. Complete off-bottom suspension was measured visually by determining the agitation rate at which there were no stationary solid particles at the vessel bottom for longer than 2 seconds. However, the applicability of this widely used criterion was questioned in the case of dense suspensions of small particles. Homogeneous suspension was estimated from the EIT data, and it was reached by approximately doubling the impeller revolution rate from the partial suspension criterion. The hydrofoil impeller reached all states of suspension with lower power consumption compared to the pitched blade turbine.