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Experimental Investigation of Fluid Dynamic Effects on Crystallisation Scale Growth and Suppression in Agitation Tank

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Abstract : Mineral scale formation is undoubtedly a more serious problem in the mineral industry than other process industries. To better understand scale growth and suppression, an experimental model is proposed in this study for supersaturated crystallised solutions commonly found in mineral process plants. In this experiment, surface crystallisation of potassium nitrate (KNO3) on the wall of the agitation tank and agitation effects on the scale growth and suppression are studied. The new quantitative scale suppression model predicts that at lower agitation speed, the scale growth rate is enhanced and at higher agitation speed, the scale suppression rate increases due to the increased flow erosion effect. A lab-scale agitation tank with and without baffles were used as a benchmark in this study. The fluid dynamic effects on scale growth and suppression in the agitation tank with three different size impellers (diameter 86, 114, 160 mm and model A310 with flow number 0.56) at various ranges of rotational speed (up to 700 rpm) and solution with different concentration (4.5, 4.75 and 5.25 mol/dm3) were investigated. For more elucidation, the effects of the different size of the impeller on wall surface scale growth and suppression rate as well as bottom settled scale accumulation rate are also discussed. Emphasis was placed on applications in the mineral industry, although results are also relevant to other industrial applications.

Keywords : agitation tank, crystallisation, impeller speed, scale
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