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Application of air flow for mitigation of particle deposition in submerged membrane microfiltration

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ABSTRACT

This study investigates the effect of microfiltration operating conditions on membrane fouling of colloidal particles of kaolin clay. Experiments were conducted with a flat sheet membrane submerged in a suspension prepared from kaolin clay powder of size varying from 0.1 to 4 μm (Sigma) with a mean particle size 2.10 μm. The particle size distribution of clay was unimodal and the concentration of kaolin clay was similar to the biomass concentration in a membrane bioreactor (10 g/L). The effects of scouring and permeate flux rates were studied in terms of the membrane fouling rate. A linear relationship between the transmembrane pressure (TMP) and particle deposition was established for different air flow rates and permeate flow rates. Air scouring was more effective at a low permeate flux. There was only a minor change in the mean particle size of deposited colloidal particles on the membrane at a given flux under varying air flows and at the beginning all had a similar rise in TMP. However, at the later stages as particles accumulated on the membrane surface there was a significant rise in TMP. 15 LMH flux was observed as critical flux beyond which a rise in the permeate flux showed a sharp rise in the TMP which varied with air flow rates and particle deposition. The sharp TMP rise that occurred during the initial few hours of operation indicated that air flow for fouling mitigation strategies should target this period to optimise the membrane process. The study showed that air flow and flux rates are the two major governing factors for particle deposition on the membrane surface.

Keywords: Air flow; Membrane fouling; Membrane technology; Permeate flux

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