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SOLUTE - MEMBRANE FOULING INTERACTIONS DURING THE ULTRAFILTRATION OF BLACK TEA LIQUOR

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ABSTRACT

This paper reports experimental results concerning the ultrafiltration of reconstituted ready to drink (RTD) black tea powder. The filters studied were (i) fluoropolymer (FP) and (ii) regenerated cellulose (RC) ultrafiltration membranes (both 30 KD MWCO).

The transmembrane pressure (TMP), cross flow velocity (CFV), temperature and concentration of tea liquor feed were examined and fouling mechanisms determined based on flux and rejection data. The clarified permeate was also analysed for polyphenol and total solids content, and colour and haze characteristics.

Rejection was found to increase with increasing transmembrane pressure (TMP) for both membranes, and a limiting flux was reached with the RC membrane at 1.0 bar suggesting the formation of a gel layer. When fouled at higher TMP values, the FP membrane resistance reduced significantly, increasing the permeability of the membrane following complete fouling / cleaning cycles. Concentration polarisation was found to be significant at higher TMP values. Increased attachment of hydrophobic species to the membrane surface is thought to cause irreversible fouling of the membrane surface. These foulants were not effectively removed from the FP membrane during caustic cleaning, and their chemical, structural and charge modification by NaOH is under investigation. As a result of successive fouling and cleaning treatments the FP membrane increased permeability whilst maintaining a constant rejection.

The RC membrane was much more hydrophilic than the FP membrane, and did not display this behaviour. This observation demonstrates a clear advantage in using hydrophobic membranes for tea filtration, providing a potential of increased permeate flux following multiple fouling and cleaning cycles.