Effect of concentrate recycle on anti-scalant performance

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Received 15 September 2008; Accepted 30 March 2009

ABSTRACT

A convenient reverse osmosis (RO) laboratory technique for rapid initial screening of anti-scalant performance is based on full recycling of concentrate and permeate to the feed vessel and observing the scale suppression effectiveness under different operating conditions. Once-through flow tests in which both permeate and concentrate are continuously withdrawn from the RO system simulate more closely actual plant conditions but are usually impractical as they require a large inventory of the feed solution. In the recycle mode of operation, the residence time of the anti-scalant in the system is increased. The objective of the present study was to investigate if the increased residence time leads to a deviation between results measured by the simple recycle technique with those obtained by the more elaborate once-through technique. A comparison between inhibition results observed in full recycle and once-through tests respectively was carried out in a continuous flow pilot RO system. Tests were performed with three anti-scalants applied to solutions having a CaCO₃ scaling propensity. In all cases permeability decline data measured in the full recycle and in the once-through modes of operation respectively were in substantial agreement, within the experimental accuracy of +5%. Data previously obtained with CaSO₄ scaling solutions gave similar results. It may be therefore concluded, that recycle tests of anti-scalant performance simulate reasonably well once-through flow conditions.

Keywords: Reverse osmosis; CaCO₃ scale; Anti-scalants testing; Once-through; Recycle

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Presented at the conference on Membranes in Drinking Water Production and Wastewater Treatment, 20–22 October 2008, Toulouse, France.