Fouling of tubular ceramic membranes during processing of cane sugar juice

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Received 5 March 2009; Accepted 23 November 2009

ABSTRACT

This paper examines the fouling characteristics of four tubular ceramic membranes with pore sizes 300 kDa, 0.1 μm and 0.45 μm installed in a pilot plant at a sugar factory for processing clarified cane sugar juices. All the membranes, except the one with a pore size of 0.45 μm, generally gave reproducible results through the trials, were easy to clean and could handle operation at high volumetric concentration factors. Analysis of fouled and cleaned ceramic membranes revealed that polysaccharides, lipids and to a lesser extent, polyphenols, as well as other colloidal particles cause fouling of the membranes. Electrostatic and hydrophobic forces cause strong aggregation of the polymeric components with one another and with colloidal particles. To combat irreversible fouling of the membranes, treatment options that result in the removal of particles having a size range of 0.2–0.5 μm and in addition remove polymeric impurities, need to be identified. Chemical and microscopic evaluations of the juices and the structural characterisation of individual particles and aggregates identified options to mitigate the fouling of membranes. These include conditioning the feed prior to membrane filtration to break up the network structure formed between the polymers and particles in the feed and the use of surfactants to prevent the aggregation of polymers and particles.

Keywords: Ceramic membranes; Fouling; Membrane filtration; Sugar juice

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