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Fluxes in reverse osmosis of model acidic and alkaline transient effluents issued from skim milk filtration

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ABSTRACT

The flux behaviour in reverse osmosis of natural and modified skim milks corresponding to more or less concentrated transient effluents with pH varying in the range 3.5–11.5 was in-depth studied. For critical and limiting filtration conditions, the origin of flux decline, namely concentration polarisation, gel formation, irreversible fouling and osmotic pressure effects, was discussed with respect to the pH variation inducing physico-chemical variations in the complex equilibrium existing in these fluids. At lower fluxes, corresponding to sub-critical conditions the flux decrease was shown to be mainly due to osmotic effects. At higher fluxes corresponding to limiting conditions, the flux decrease was equally shared by osmotic pressure and other reversible phenomena (concentration polarisation and gel) and irreversible fouling. Fouling resistances appeared to be correlated to casein micelles deposit as the increase of casein net charge could be in good agreement with the increase of the porosity of the fouling deposit. Moreover, the fouling resistance increased with the calcium and phosphate soluble fractions in modified skim milks and mainly with free calcium appearing as the main promoter of the mineral fouling in/on the membrane.

Keywords: Reverse osmosis; Limiting flux; Critical flux; Caseins; Milk; Effluents

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