Biofouling phenomena on the ceramic microfiltration membranes – an experimental research

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Received 30 March 2018; Accepted 5 July 2018

ABSTRACT

The research was focused on the study of biofouling on ceramic microfiltration membranes. The membranes differing in pores diameters (0.14, 0.20, and 0.45 μm) were examined. The influence of the driving force (transmembrane pressure) and the feed concentration on the amount of biomass deposited on membranes was tested. The low biomass concentration only caused the formation of a thin layer on the membrane surface (and pores filling) and a small decrease of the permeate flux (approximately 18% at 200 g m⁻³ cells concentration in the feed). In the case of the higher feed concentration a significant decline of the permeate flux – 46% and 55% (for 500 and 200 g m⁻³ feed concentration, respectively) was observed. It was associated with three types of phenomena: a pores filling, a formation of thin layer on the surface of the membrane and finally, the concentration polarization phenomenon. Despite significant differences of the initial permeate flux obtained for different Δp and different membranes, quasi-static (established) permeate fluxes were similar. The highest value of the final permeate flux was obtained during separation using 0.45 μm pores size membrane and it was almost the same in Δp ranged 0.2–1.0 bar. Finally, the selected membrane was modified by the phosphoric acid. Unfortunately, this modification did not bring the positive effects. The grafting of the ceramic membrane with phosphoric acid aggravated the biomass retention on its surface and it resulted in the permeate contamination by biomass.

Keywords: Permeate flux; Microfiltration; Biomass separation; Biofouling; Membrane modification

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