MODELLING OF FOULING IN AN ULTRAFILTRATION CELL USING DIFFERENT SPACERS

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ABSTRACT

The dairy industry generates the large volume of wastewater due to large water consumption, originated from washing and cleaning operations during the technology, which has to be treated effectively. Membrane filtration processes (such as ultrafiltration, UF or nanofiltration, NF) seem to be promising methods for the treatment of dairy industrial wastewater, which has several advantages compared with other conventional methods. Unavoidably, membrane fouling always hinders the membrane performance. The characterization of membrane fouling mechanisms and the reduction of the fouling tendency are highly important research topics.

In this work, two mathematical models were used to investigate the fouling and flux decline mechanism. The resistance-in-series model was used to identify the place (membrane surface or internal pore) of fouling. In this model membrane resistance, total resistance, irreversible resistance and reversible resistance were determined. According to the modified Hermia model, there are four main fouling mechanisms: complete blocking, standard blocking, intermediate blocking and cake layer formation.

In this study polyethersulfone (PES) UF membranes with molecular weight cut-off (MWCO) of 10 kDa and 150 kDa were tested. The UF experiments were carried out at model dairy wastewater with different stirring velocities (100, 200, 300 and 400 rpm) and six different polyacid (PLA) 3D printed element/spacer configurations. By fitting the experimental data into four models, fouling mechanism which was prevailing can be identified. The main fouling mechanism can be confirmed according data. Larger R^2 values indicated better fitting models.

Keywords: fouling, modelling, spacers, ultrafiltration, 3D printed elements

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