MODELLING OF CEREAL ORIGINATED BEVERAGE ULTRAFILTRATION BY HERMIA MODEL

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Abstract

Membrane filtration process are gaining more attention and focus in food industry due to them advantages (environmental friendliness, cost saving and product improvement) compared with other conventional methods. However, membrane can be easily fouled by various solutes, for instance, protein and polysaccharide in food industry. Fouling decreases permeate flux severely and thus increases filtration processing time, which is not economically effective. The characterization of membrane fouling mechanism is highly important especially during the ultrafiltration process. In order to produce higher permeate flux and greater solute rejections, a clear understanding on membrane fouling mechanism is essential.

In this work, Hermia's models were used to investigate the fouling mechanisms. According to the modified Hermia model, there are four main fouling mechanisms: complete blocking, standard blocking, intermediate blocking and cake layer formation. In complete pore blocking, the particle size is larger than the membrane pore size; thus, pores are blocked completely. In the standard-blocking mechanism, particles are much less than the membrane pore diameter so can enter the pores and deposit inside the pore walls, which may lead to blocking of pores and reduce the pore volume. In the intermediate-blocking mechanism, the particle size in the feed is the same as the membrane pore size; however, the membrane pore is not necessarily plugged by particles, and some particles may deposit on each other. Both large and small particles can accumulate on membrane surface to form the cake layer in the cake-formation mechanism.

Membranes made of polyethersulfone (PES) with molecular weight cut-off (MWCO) of 10 kDa were used in this study. Ultrafiltration experiments were performed at different cereal originated beverage (rice and oat), transmembrane pressures (0.05 and 0.1 MPa) and stirring rate (100, 200, 300 and 400 rpm). By fitting the experimental data into four models, fouling mechanism which was prevailing can be identified. The main fouling mechanism can be confirmed according to the relevant coefficients of determination (R^2) calculating experimental data. Larger R^2 values indicated better fitting models.

Key words: ultrafiltration, fouling, cereal originated beverage, Hermia model

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