CROSSFLOW MICROFILTRATION OF SUSPENSIONS CONTAINING LACTALBUMIN PARTICLES

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ABSTRACT

Crossflow microfiltration (CFMF) is a very important membrane separation process with many applications in different fields including the dairy and other food industries. Often these applications involve processing of particulate suspensions. Many reports on the CFMF of particulate suspensions are found in the literature. However, these reports often deal with uniform sized and/or shaped rigid model particles and often contain contradictory and unexplained results. There is a need to develop further understanding of the CFMF of particulate suspensions, particularly of biological origin with a wide particle size distribution (PSD). This work was carried out to investigate the effects of the operating and feed conditions, and membrane configurations on the CFMF of particulate suspensions using tubular ceramic membrane modules that are commonly used in the food and other similar industries. Lactalbumin particles were selected as the feed material for their irregular shape, wide PSD, and food origin. Experiments were carried out in both constant transmembrane pressure and constant flux modes and all important parameters: internal and surface fouling, and cake mass, height, porosity and PSD were estimated to provide a more complete understanding of the process than has been attempted before. Simple methods were developed and used for the estimation of cake height and porosity.

Although many unforeseen effects of the studied parameters were obtained, the results of the study explained some observations and contradictory results reported in the literature. Mathematical models based on resistance in series and force balance mechanisms were developed and successfully used to describe the results of this study. This was achieved by extending these models to include the wide PSD and compressibility of the lactalbumin particles. The developed force balance model was further successfully used to achieve separation of desired feed particle sizes by CFMF under the constant flux mode.

A process was developed based on the observed effects of the operating parameters on the CFMF performance that enables operation at very low internal fouling and high flux for as long as 160 min. The developed process has the potential to become commercial if coupled with backflushing.

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