

PERFORMANCE STUDY FOR MEMBRANE FRACTIONATION OF SECOND CHEESE WHEY FROM SHEEP

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Key Words: Sheep cheese whey; performance of membrane fractionation processes; wide and tight ultrafiltration; nanofiltration

Second ovine cheese whey (SCW) is a by-product resulting from the production of sheep whey cheeses, by thermal aggregation of whey proteins. Its nutritional value is high because it contains about half of the soluble protein that is present in the original whey, free amino acids, small peptides, lactose, oligosaccharides, vitamins and minerals. However, despite high volumes generated (about 18 L of SCW by kg^{-1} of whey cheese produced), SCW is not recovered, causing problems in water treatment plants due to its high biological oxygen demand (BOD_5) and chemical oxygen demand (COD), about $10,200 \text{ mg O}_2 \text{ L}^{-1}$ and $69,500 \text{ mg O}_2 \text{ L}^{-1}$, respectively. In order to valorize this by-product, the performance of a sequence of membrane processes, namely wide ultrafiltration (UF1), tight ultrafiltration (UF2) and nanofiltration (NF) was evaluated. In our previous work, we selected a wide ultrafiltration membrane of cellulose regenerated acetate, RC70PP with a nominal cut-off (MWCO) of 10 kDa) and hydrophilic characteristics, for recovering protein fraction. In this work, the membrane was used to concentrate SCW till a volume concentration factor (VCF) of 3.0. The permeates were then subjected to a second UF with a tight UF membrane (MWCO of 1 kDa), ETNA01PP, till a VCF of about 2.5. ETNA01PP is a surface-modified poly(vinylidene fluoride (PVDF) membrane, with hydrophilic characteristics. Nanofiltration of permeates of the second UF was performed using a membrane made of polypiperazine amide, NF99, till a VCF of 2.5. In all experiments, the membrane area used was 0.072 m^2 . Both ultrafiltration processes were carried out at a transmembrane pressure of 2.0 bar, whereas nanofiltration was realized at a transmembrane pressure of 20.0 bar. The feed flow rate was kept at 0.92 m s^{-1} , in all experiments. Results showed that during UF1 and UF2, permeate fluxes decreased about 22%, while in NF experiments a sharp decrease occurred (about 50%), till the VCF studied (Fig.1), perhaps due to scaling on the membrane.

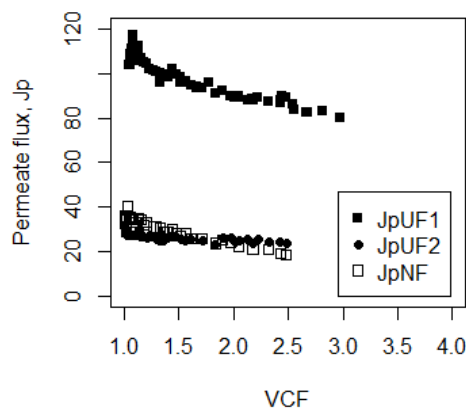


Fig.1 Variation of permeate fluxes, J_p , ($\text{L h}^{-1} \text{ m}^{-2}$) with VCF.

However, after the experiments, washing with distilled water allowed to recover about 90% of the initial permeability for all the membranes, indicating that no severe fouling occurred. Rejections of nitrogen fractions for UF membranes were in the range 75-90%, while lactose rejections were between 1-10%. NF membranes rejected about 30% of nitrogen and more than 90% of lactose, thus contributing for a significant reduction of organic load.