Performance study for membrane fractionation of second cheese whey from sheep

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Performance Study for Membrane Fractionation of Second Cheese Whey from Sheep

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Abstract
• Second cheese whey is fractionated by a sequence of three membrane processes: wide UF (NMWCO= 10 kDa), tight UF (NMWCO= 1 kDa) and NF.
• Nitrogenous compounds (as N kjeldahl) are concentrated in all the processes (both in UF and NF), being rejections about 71%.
• Lactose is fully rejected by NF and minerals are mainly rejected by NF (62.2%).
• The best performance was achieved in the 1st UF. Further studies about performance of NF are needed.

Introduction
• Second ovine cheese whey (SCW), a byproduct of the production of sheep whey cheese (Fig. 1), has a high nutritive value (proteins, amino acids, lactose, minerals).
• 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 highest BOD5 and COD (10,200 mg O2 L-1 and 69,500 mg O2 L-1, respectively).
• Studies about valorization of this dairy fluid are needed.

Objectives
✓ To study the performance of the sequence: wide UF, tight UF and NF to separate and concentrate different fractions in SCW.
✓ To evaluate the physicochemical composition of the various fractions for future uses.

Experimental
Equipment: LAB UNIT M20 (Alfa-Laval, Denmark) for MF, UF, NF, OI. 0.036 ≤ Am ≤ 0.72 (m2)

MEMBRANES AND EXPERIMENTAL CONDITIONS
1st UF: RC70PP: NMWCO= 10 kDa; ΔP = 2.0 bar; v = 10 m s-1; T = 25 º C
Material: regenerated cellulose; Am= 0.036 m2

2nd UF: ETNA01PP: NMWCO= 1 kDa; ΔP = 2.0 bar; v = 10 m s-1; T = 25 º C
Material: polivinilydene modified; Am= 0.036 m2

NF: NF99; ΔP = 20 bar; v = 10 m s-1; T = 25 º C
Material: polyamide semi-aromatic; Am= 0.036 m2

Results and discussion
Permeate fluxes
The variation of permeate fluxes (VCF) is shown in Figs. 2 and 3. In both ultrafiltration, permeate fluxes decreased about 22%, while in NF experiments a sharp decrease occurred (about 50%), till the VCF studied, perhaps due to scaling on the membrane. Washing with distilled water allowed to recover about 90% of flux, which indicates that no severe fouling occurred.

Fig. 4 show the concentrations of protein Kjeldahl and lactose in samples. The best separation between protein and lactose fractions was achieved in the first UF (rejection coefficients of 73% and 0.8%, respectively). Second UF allowed a good recovery of nitrogen compounds (rejection of about 65%); lactose and mineral rejections were12.5% and 5%.

Lactose was fully recovered by NF membranes. Rejection of minerals (ash) is about 60%.

Selectivity of the process

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