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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 BOD_5 and COD (10,200 mg O_2 L^{-1} and 69,500 mg O_2 L^{-1}, respectively).
•Studies about valorization of this dairy fluid are needed.

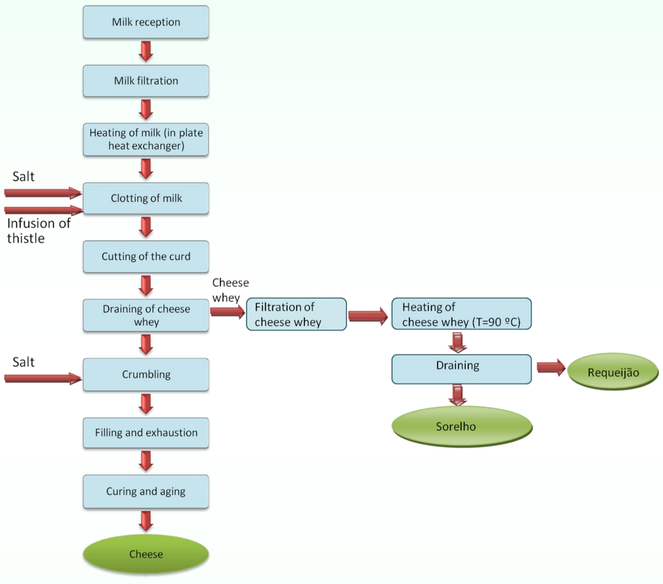


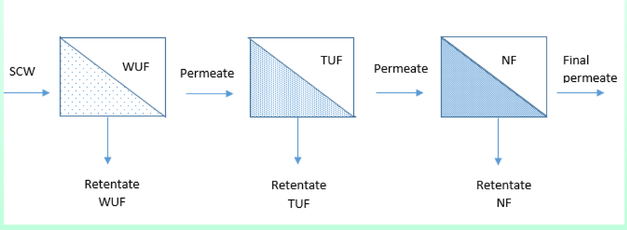
Fig.1 Traditional process of production of ovine cheese, curd cheese (“requeijão”) and SCW (“sorelho”).

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. $0.036 \leq A_m \leq 0.72$ (m^2)



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 ; A_m= 0.036 m^2

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

NF: NF99; ΔP = 20 bar; v = 10 m s^{-1}; T = 25 º C
Material: polyamide semi-aromatic ; A_m= 0.036 m^2

Results and discussion

Permeate fluxes

The variation of permeate fluxes with 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.

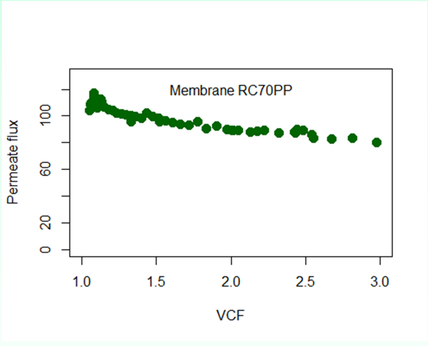


Fig. 2 Variation of permeate flux (L h^{-1} m^{-2}) with VCF for membranes RC70PP

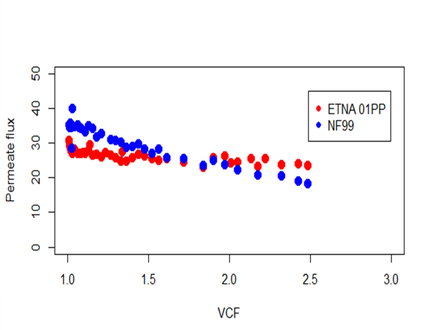


Fig. 3 Variation of permeate flux L h^{-1} m^{-2}) with VCF for membranes ETNA01PP and NF99

Selectivity of the process

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%.

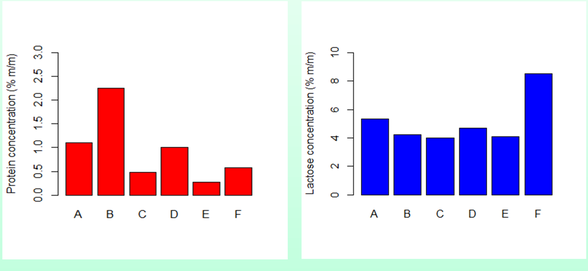


Fig. 4 Variation of protein and lactose concentrations (%m/m) in samples
(A= SCW; B = retentate of 1st UF; C = permeate of 1st UF; D = retentate of 2nd UF; E = permeate of 2nd UF; F = retentate of NF).

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