FOULING OF MICROFILTRATION MEMBRANES DURING THE REMOVAL OF THERMOPHILIC SPORES FROM HIGH SOLIDS CONTENT MILK PROTEIN ISOLATE (MPI) SOLUTIONS

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ABSTRACT

The use of microfiltration to reduce the microbial load in skimmed milk is a well established technology. However, its application in reducing spore counts in highly viscous dairy based solutions has not been well established, due to issues of low flux and high fouling tendency. In this paper we report an experimental programme aimed at producing commercially viable fluxes and spore rejection ratios for the microfiltration of milk protein isolate (MPI) solutions containing 5 - 20 wt % solids. These are commercially relevant feed concentrations, and the results could lead to a reduction in the current thermal load required to pasteurise high viscosity dairy based liquors, and also result in an improvement in product quality.

Bacillus cereus is an endospore forming bacterium that is a major concern to the dairy industry. In this project *Bacillus mycoides* is being used as an analogue to *Bacillus cereus* commonly found in raw milk. Both strains have appendages and an exosporium that promotes their adhesion to surfaces, and both share an increased surface hydrophobicity compared to other *Bacillus* sp. However, *Bacillus mycoides* is less hazardous than *B. cereus*, and as such is easier to handle.

Particle size distribution analysis and viscosity measurements recorded for the reconstituted MPI powder both indicate that the desired separation is physically possible. Filtration results are presented for (*i*) 0.5, 0.9 and 1.5 μm pore size flat sheet polysulfone polymer membranes (Alfa Laval –GRM-RT5, PSU-RT1 and PSU-RT8) and (ii) 0.8 and 1.4 μm ceramic membranes (Pall Filtration, Membralox GP). These membranes are constructed with a longitudinal permeability gradient, to try to ensure an even permeation rate down the length of the module.

The filtration resistances due to the membrane, reversible and irreversible fouling and concentration polarisation are presented. Spore rejection ratios are also reported using data collected via a Petrifilm^{TM} aerobic count plating technique.

Chemical and hydraulic cleaning protocols are reported that return the membranes to satisfactory condition for further experimentation. Operational strategies for minimising fouling and maintaining the MPI permeate flux during the filtration process are also presented.