HIGH FLUX ULTRAFILTRATION BASED ON CHARGED MEMBRANES: BACKGROUND AND DATA FROM THE FIELD

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Commercial-scale charged membranes have been developed and applied to protein concentration in the dairy industry. The charged membranes are based on functionalization of polyethersulfone membranes with sulfonated polystyrene grafts. Membranes have been produced at the industrial scale and tested as flat-sheet and as spiral elements. Small-scale testing of the membrane was performed with skim milk on an Amicon stirred cell. The stirred cell results showed a significant difference between pure water flux and process flux for skim milk, and confirmed the fallacy of using pure water flux to predict process flux. They also demonstrated the importance of cross-flow in protein concentration.

Two field trials were performed on dairy streams, including: skim milk, whole milk, and whey. The trials were performed with 4 inch and 6 inch spiral elements. A standard 10K MWCO polyethersulfone membrane was used as the control. The data show a dramatic increase in process flux for the charged membrane. Skim milk permeate fluxes were 20% higher than the control. Whole milk permeate fluxes were 40% higher than the control. The whey protein tests showed the greatest advantage, with up to 70% higher process flux compared to the control. In all cases, there was no significant difference in the permeate quality. Given the consistency of performance in the field, these functionalized membranes have the potential to revolutionize the application of UF in the dairy industry and beyond.