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PREVENTION OF PEPTIDE FOULING ON ION-EXCHANGE MEMBRANES DURING ELECTRODIALYSIS IN OVERLIMITING CONDITIONS

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Abstract

Peptide fouling occurring on anion- (AEMs) and cation-exchange membranes (CEMs) is one of the most serious issues of conventional electrodialysis (ED) process for hydrolysate demineralization. Nonetheless, recent studies discussed about the advantages of non-conventional ED phenomena such as water splitting and electroconvection on decreasing scaling and fouling. Thereby, peptide fouling was characterized using four different ED regimes: no current applied, underlimiting (conventional), limiting (water splitting) and overlimiting (electroconvection and water splitting) conditions. Results demonstrated that fouling-related interactions were mainly electrostatic with AEMs whereas they were both electrostatic and hydrophobic with CEMs. After 60 min, the demineralization rate was six times higher in overlimiting than underlimiting conditions. In addition, peptide fouling was 62 and 36 % lower in overlimiting condition for AEMs and CEMs, respectively. It was hypothesized that (1) water splitting would have repealed the peptide charges through its "barrier effect" and (2) electroconvective vortices generated at the membranes interfaces would have washed-out their surfaces and hampered the attachment of peptides. Interestingly, ED under overlimiting conditions is a promising way to avoid peptide fouling. Consequently, membranes lifetime would be longer and new ED applications would be possible.

Keywords: Demineralization, Peptide fouling, Electrostatic interactions, Water splitting, Vortices