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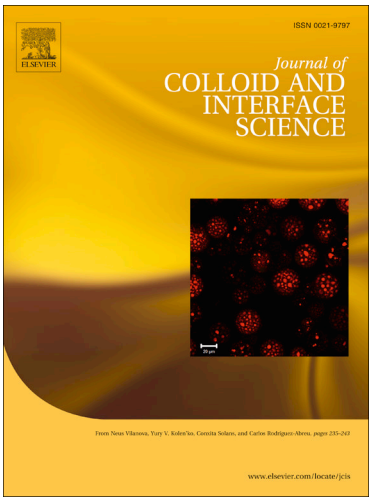

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FORMATION OF PEPTIDE LAYERS AND ADSORPTION MECHANISMS ON A NEGATIVELY CHARGED CATION-EXCHANGE MEMBRANE

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Abstract

Polypeptide/solid charged surface interactions are omnipresent in the biomedical and biochemical fields. The present study aimed to understand the adsorption mechanisms of a cation-exchange membrane (CEM) by a well-characterized peptide mixture at three different pH values. Results demonstrated that fouling was important at pH 6, twice lower at pH 2 and negligible at pH 10. At pH 6, ALPMHIR and TKIPAVFK sequences firstly established electrostatic interactions with the negative CEM charges (SO_3^-) through their positive K and R residues (NH_3^+) creating a first nanolayer. Secondly, peptide/peptide interactions occurred through their respective hydrophobic residues creating a second nanolayer. At pH 2, VLVLDTDYK and IDALNENK sequences interacted only electrostatically and that in a lower proportion since at low acidic pH values, most of the CEM charges would be protonated and uncharged (HSO_3) and then limit the potential electrostatic interactions. In addition, the sequences of peptides interacting at pH 2 and 6 were different. This was explained by their structure in terms of residue nature and position in the sequence. At pH 10, no fouling was observed due to the lack of positive peptide charges. To the best of our knowledge, it is the first in-depth study concerning the fouling of CEMs by peptides from a complex mixture.

Keywords

Cation-exchange membrane, β-lactoglobulin, Peptide sequence, Electrostatic and hydrophobic interactions, Peptide/peptide and peptide/membrane interactions