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Protein-Alginate Complexes as pH-/Ion-Sensitive Carriers of Proteins

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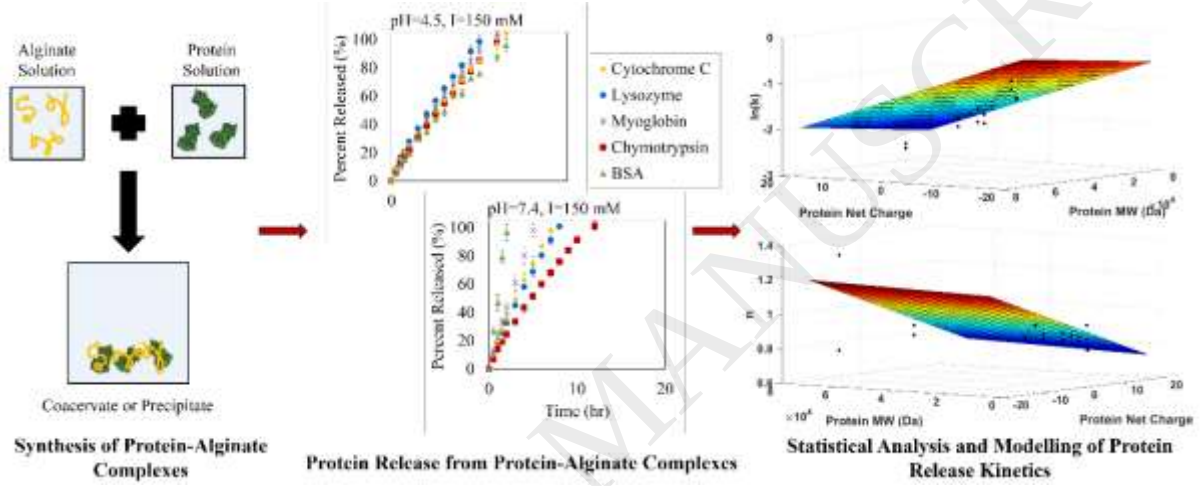
Graphical Abstract



Abstract

Protein-alginate complexes were prepared with the objective of quantifying the influence of the parameters such as protein characteristics on the final complex properties and their dissociation rates. Cytochrome C, lysozyme, myoglobin, chymotrypsin, and bovine serum albumin were used as model proteins for preparing the complexes and physical properties such as composition, average diameter, and zeta potential of the complexes formed were measured. In addition, protein release kinetics from the complexes in response to changes in pH and ionic strength were investigated. The results clearly demonstrated that, even in the absence of a cation, proteins could be complexed with alginate and showed a decreased release rate under the appropriate conditions. Projection to Latent Structures was applied as a multivariate statistical analysis method to mathematically describe the final properties and the protein release kinetics as functions of the influencing variables. It was found that the physical characteristics of the complexes could be accurately modelled with low error thresholds indicative of good fit and prediction capabilities of the model. The statistical model indicated that the release kinetics parameters were highly dependent on the ionic strength and the protein net charge as a function of pH, demonstrating the potential use of these complexes in ion-/pH-sensitive delivery systems.

Keywords: Alginate; Protein; Polyelectrolyte complex; Electrostatic self-assembly; Controlled release; Multivariate statistical analysis