Engineering Ionic Hydrogels to Overcome Charge and Size Barriers in Multi-Protein Co-Delivery

Samantha Wheatley, Massachusetts Academy of Math and Science

Research Queation: How does hydrogel composition, specifically charge, stiffness, andcrosslinking density, affect the individual and co-delivery release rates of model proteins with different molecular weights and charges?

Hypothesis: Hydrogel charge, stiffness, and crosslinking wll control protein release, slowing positively charged lysozyme, speeding neutral/negatively charged BSA, and co-delivery altering overall release profiles

Methodology:

Prepare Hydrogels → Load Proteins → Release Study → Quantification → Analyze Data

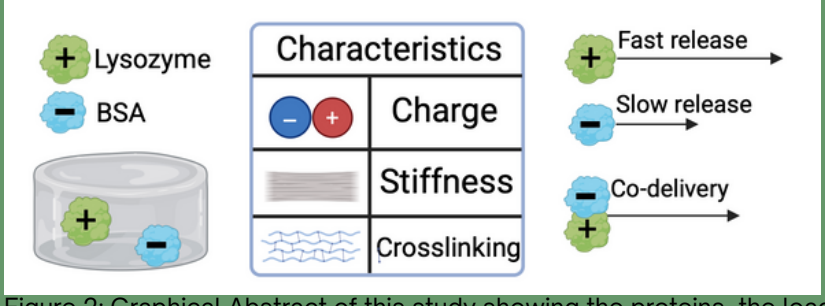

Figure 2: Graphical Abstract of this study showing the proteins, the loading, what characteristics are being modified, and the release predictions

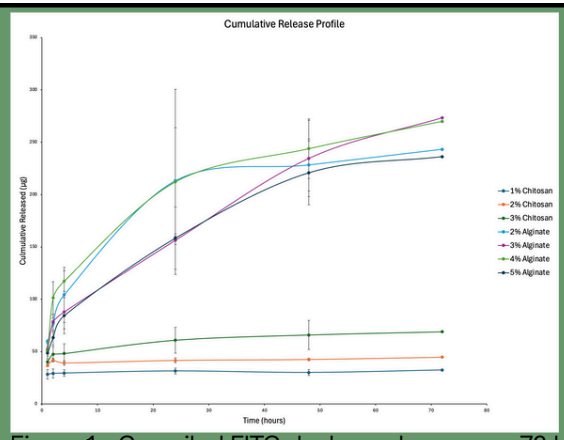

Figure 1: . Compiled FITC-dextran release over 72 hours from alginate and chitosan hydrogels with different concentrations

The alginate hydrogels shower higher and faster simulative release than the chitosan hydrogels across all each time point.

The alginate had an clear optimum concentration (3% and 4%) while chitosan seemed to have stronger protein retantion.

MAIN TAKEAWAY: Hydrogel composition is the dominant factor in controlling protein release

Conclusion:

Hydrogel composition and concentration has a significant influence over release behavoir. Alginate hydrogels allow for faster and greater protein release while chitosan hydrogels strongly retains the proteins. The results show that tuning hydrogel stucture can be used to control the protein delivery kinetics.