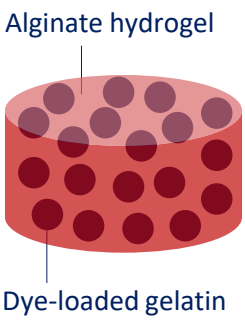
Correlating the Release of a Model Drug with the Mechanical Properties of a Degrading Alginate/Gelatin Composite Hydrogel



Background

Controlled release of drugs at precise locations within the body can prevent systemic toxicity and deliver accurate dosages to patients. Hydrogels have recently been used in research as drug release vehicles. One method of controlling drug delivery is by modification of the mechanical properties of hydrogels. In this note, the ElastoSens™ Bio^2 is used to monitor mechanical properties of a degrading gelatin/alginate hydrogels concurrently with a dye release study. Here, we show that melting gelatin beads can be detected using the ElastoSens™ Bio^2 and combined with drug release study.

Materials & Methods

ElastoSens™ Bio^2

The ElastoSens™ Bio^2 was used to measure the mechanical properties of hydrogels. A 10% gelatin solution (Bovine, Sigma) was heated and combined with green food dye (Club House). Gelatin was dropped into ice-cold mineral oil to form gel beads. After rinsing with water, beads were weighed into sample holders and 5% alginate solution was added. Samples were chilled and $CaCl_2$ solution was added to the surface to crosslink the alginate. After gelling overnight, water was added to each sample holder and removed at designated timepoints. Gels were analyzed for their mechanical properties while images of the supernatant were taken and analyzed with ImageJ to measure dye release.

Mechanical Properties Influence Dye Release from Alginate/Gelatin Hydrogels

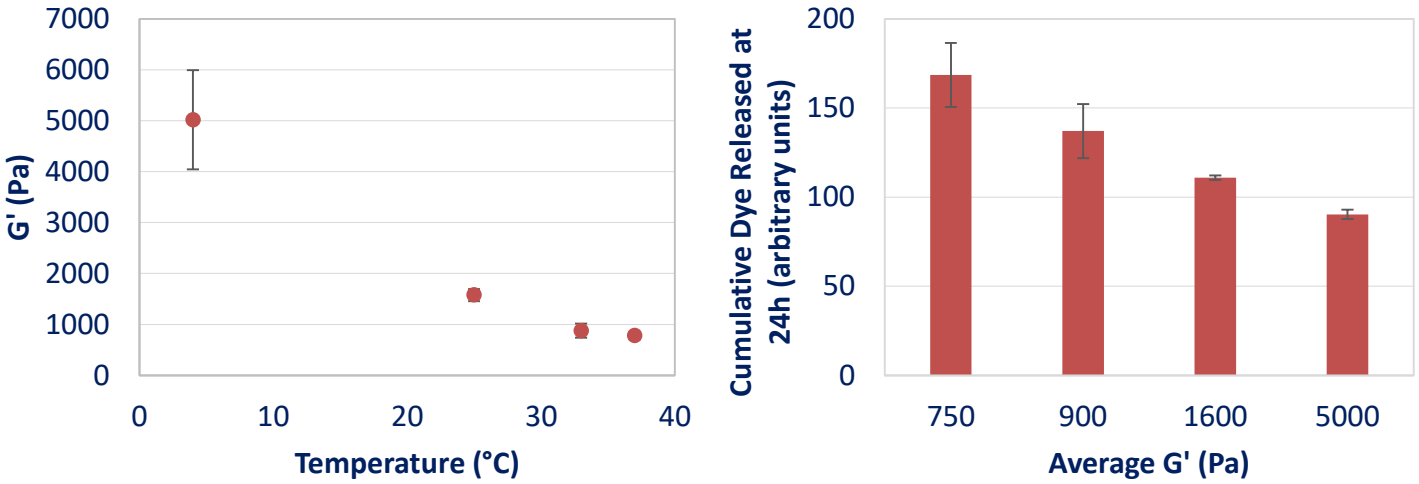


Figure 1: G' of alginate/gelatin gels at different temperatures, measured using the ElastoSens™ Bio^2 (left). Total dye released from composite gels at 24 hours relative to average G' (right).

As temperature increases, the gelatin beads melt and the apparent G' of the composites decreases, as seen in Figure 1 (left). The total amount of dye released after 24 hours, analyzed using ImageJ, increases as the gelatin melts and the apparent shear storage modulus of the gels decreases.

Due to its non-destructive testing methods, the ElastoSens™ Bio^2 can be used to analyze the mechanical properties of hydrogels during long drug release studies. This instrument facilitates drug release studies by correlating the release of drug with the mechanical properties of the gel. Ultimately, the mechanical properties of an implantable gel may be tuned to control the amount and speed of drug release.