LARGE-AREA ALGINATE/PEO-PPO-PEO HYDROGELS WITH THERMOREVERSIBLE RHEOLOGY AT PHYSIOLOGICAL TEMPERATURES

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Alginate hydrogels have shown great promise for applications in wound dressings, drug delivery, and tissue engineering. Here, we report the fabrication, rheological properties, and dynamics of a multicomponent hydrogel consisting of alginate and poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide) (PEO-PPO-PEO) triblock copolymers, and the achievement of thick, castable gels with tunable, thermoreversible behavior at physiological temperatures (Figure 1). PEO-PPO-PEO triblock copolymers can form temperature-sensitive hydrogels that exist as liquids at low temperatures and soft solids at high temperatures. In this work, we have employed PEO-PPO-PEO triblock copolymers to impart thermoresponsive properties to alginate hydrogels in the form of a multicomponent hydrogel. These systems can transition between a weak gel and a stiff gel, with a corresponding increase in the viscoelastic moduli of approximately two orders of magnitude as temperature is increased. The temperatures corresponding to the upper and lower boundaries of the stiff gel region, as well as the storage modulus at physiological temperatures (e.g., 36 – 40 C), can be controlled through the PEO-PPO- PEO concentration. Additionally, we explore the properties of these materials under compression and large deformations, and describe how alginate and F127 concentration can be used to control the fracture stress and strain. Finally, we compare the results from bulk rheology to the structure and dynamics of the gels measured via small-angle X-ray scattering (SAXS) and X-ray photon correlation spectroscopy (XPCS) experiments.

Optically clear gels that are homogeneous on the microscale can be fabricated in a scalable manner to create flat, large-area thick films, making these systems favorable for applications in wound healing, soft tissue repair, and biomedical device coatings.

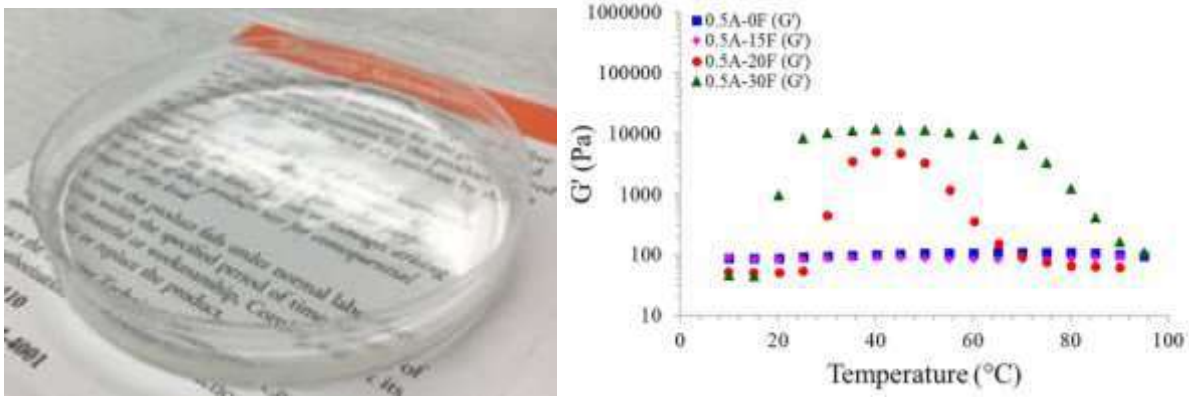

Figure 1. Left: Photograph of large, homogeneous gels. Right: Storage modulus of gels as a function of temperature for varying amounts of F127. From Quah et al., Polymer, 2018.