

Anti-freezing and Anti-swelling Properties of Alginate Organohydrogels in Water-organic Solvent Mixtures

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ABSTRACT

Structural uniformity is necessary for well-controlling gel properties. Gel with a gradient in cross-linking density loses its mechanical properties.

Anti-freezing gel are an important class of soft materials with potential applications in electronics, tissue engineering, soft robots, wearable devices and sensors. Due to anti-freezing capacity, ice crystals cannot form at subzero temperatures, thus they retain their conductivity, transparency, and flexibility.

The swelling-deswelling characterization of a uniform alginate in hydrophilic organic solvent-water mixtures is presented.

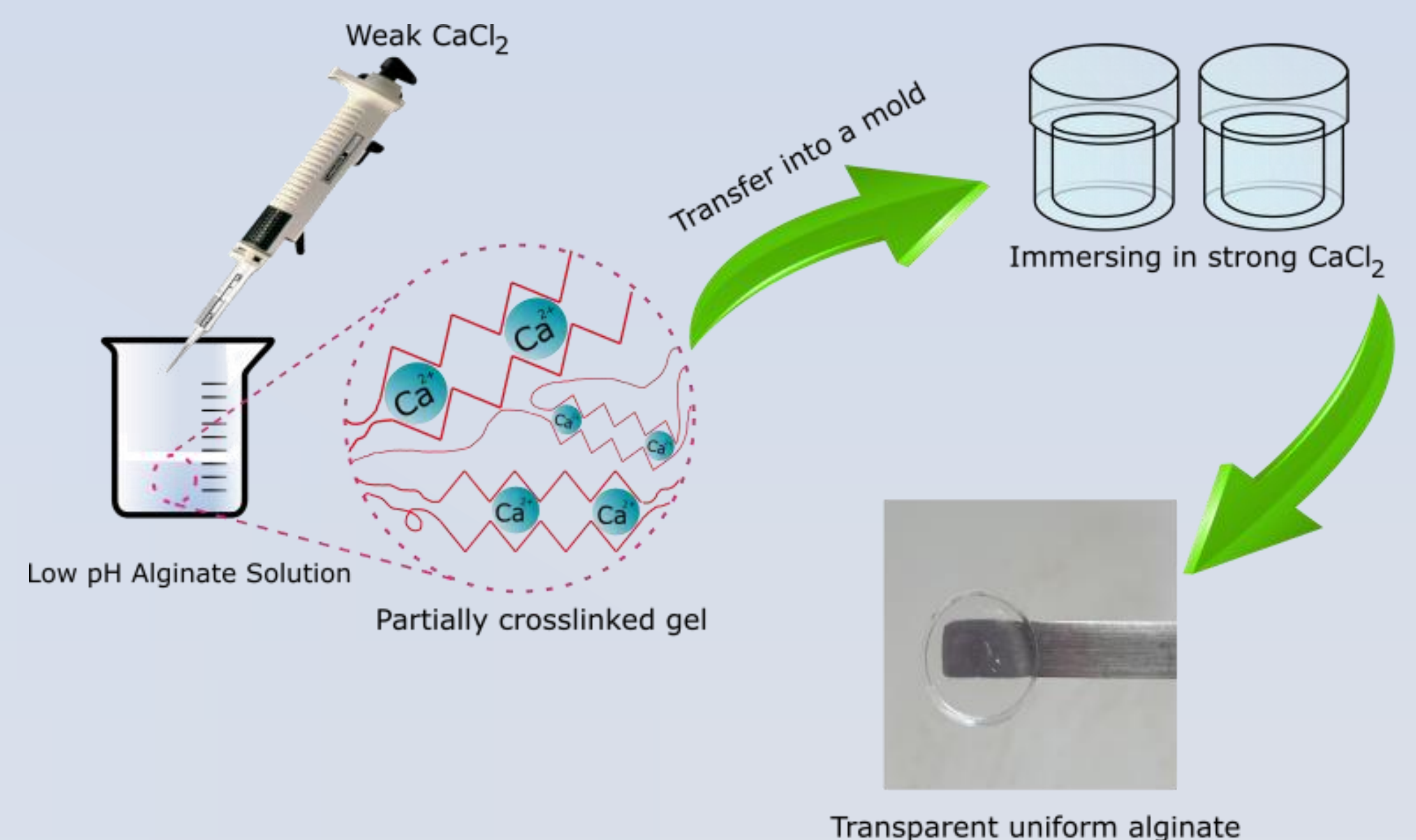
Ca-alginate hydrogel was immersed in organic solvents-water mixtures and the water was displaced by the organic solvent, endowing it with freeze resistance.

OBJECTIVES

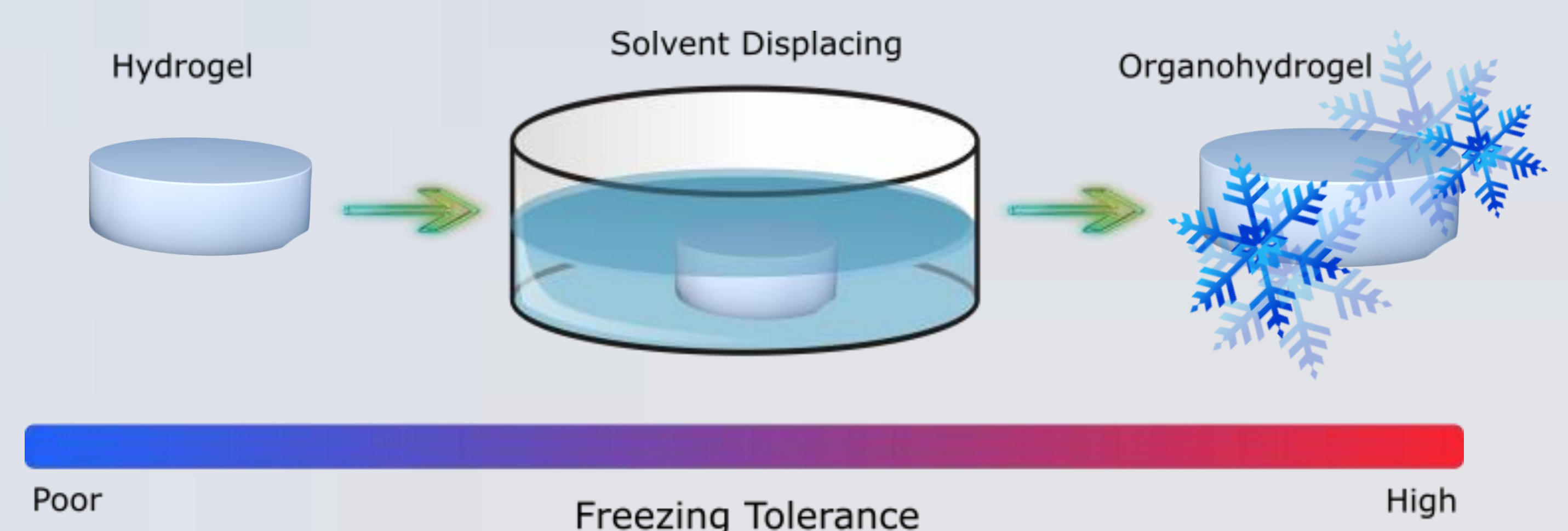
- To synthesize a uniform hydrogel network based on alginate
- To prepare an organohydrogel with anti-freezing and anti-swelling properties
- Structural analysis of organohydrogels using SANS measurement

METHODOLOGY

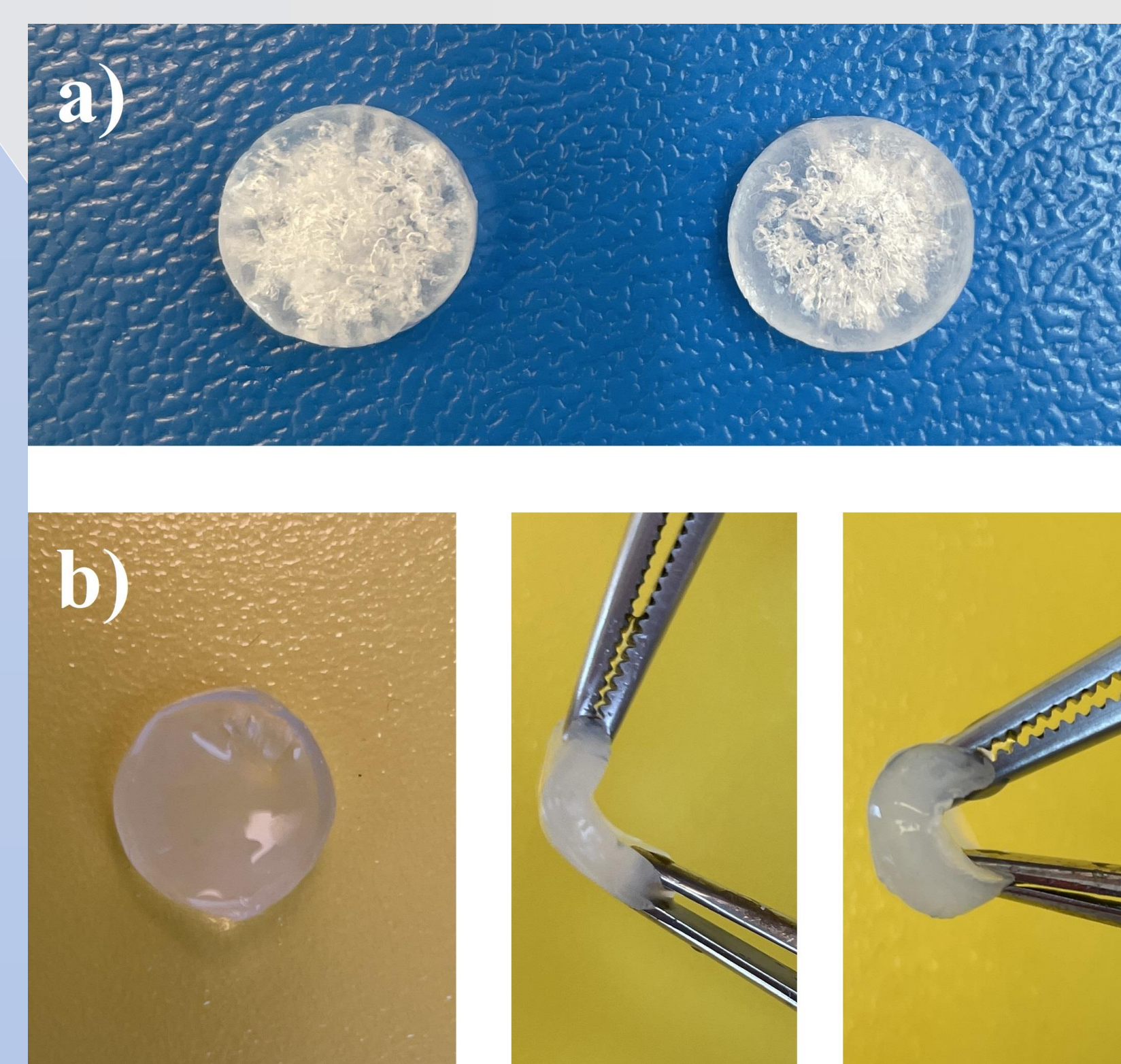
Homogeneous Ca-alginate preparation:



Anti-freezing and anti-swelling organohydrogel preparation:



RESULTS



Anti-freezing illustration of alginate in a) partially frozen mixture, b) unfrozen mixture. The organohydrogel samples displayed flexibility after the cold-storage process at -20 °C.

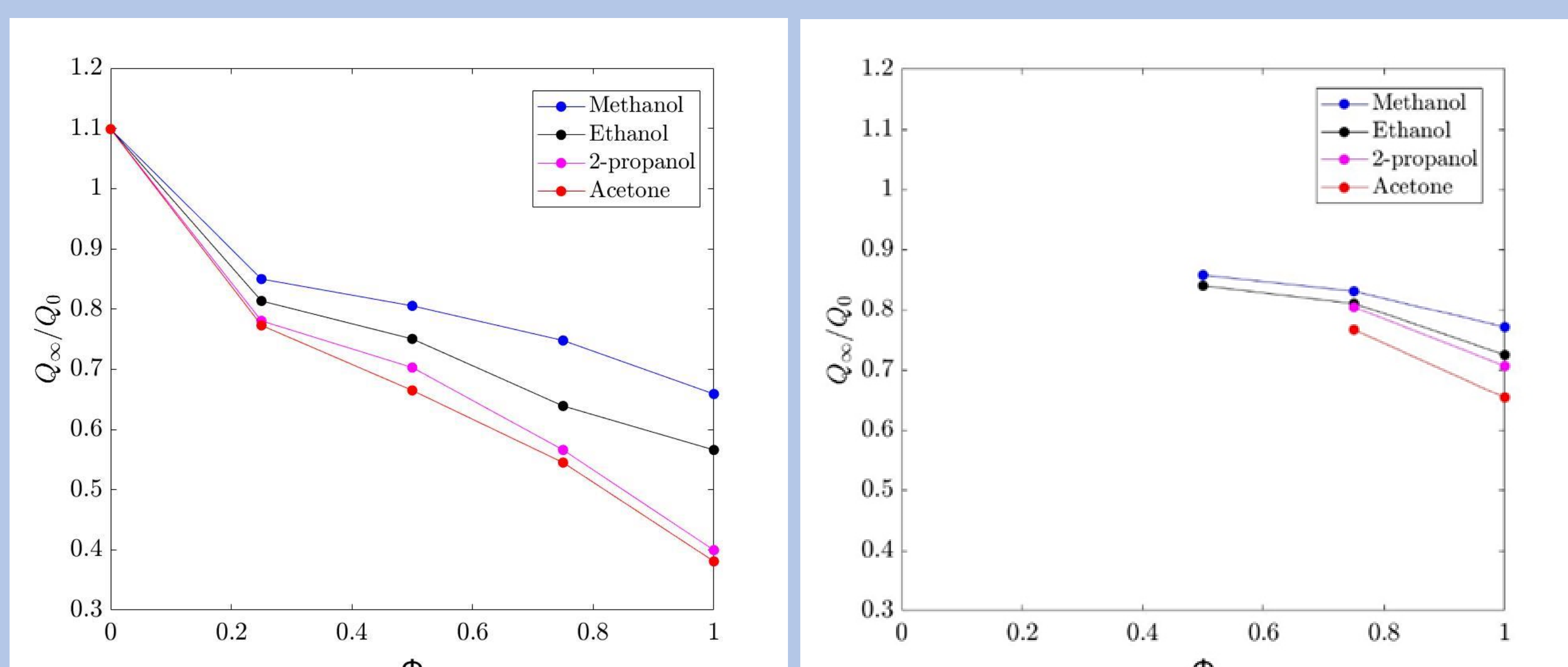
Future Works

SANS measurements will perform to study the homogeneity and structural properties of the synthesized hydrogel.

SANS measurements are suitable for the investigation of gels because scattering contrast can be easily manipulated in the sample by simply producing the hydrogel in a deuterated solvent.

Alginate gel is a stimuli-responsive and we can apply SANS techniques to examine the structural changes in gels induced by external stimuli.

SANS profiles of swollen organohydrogels will be expected to exhibit more detail about the structural characterization of the gel, and the characteristic peaks will be analyzed in detail.



Q_{∞}/Q_0 versus Φ of different organic solvents a) at room temperature, b) at -20 °C.

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