

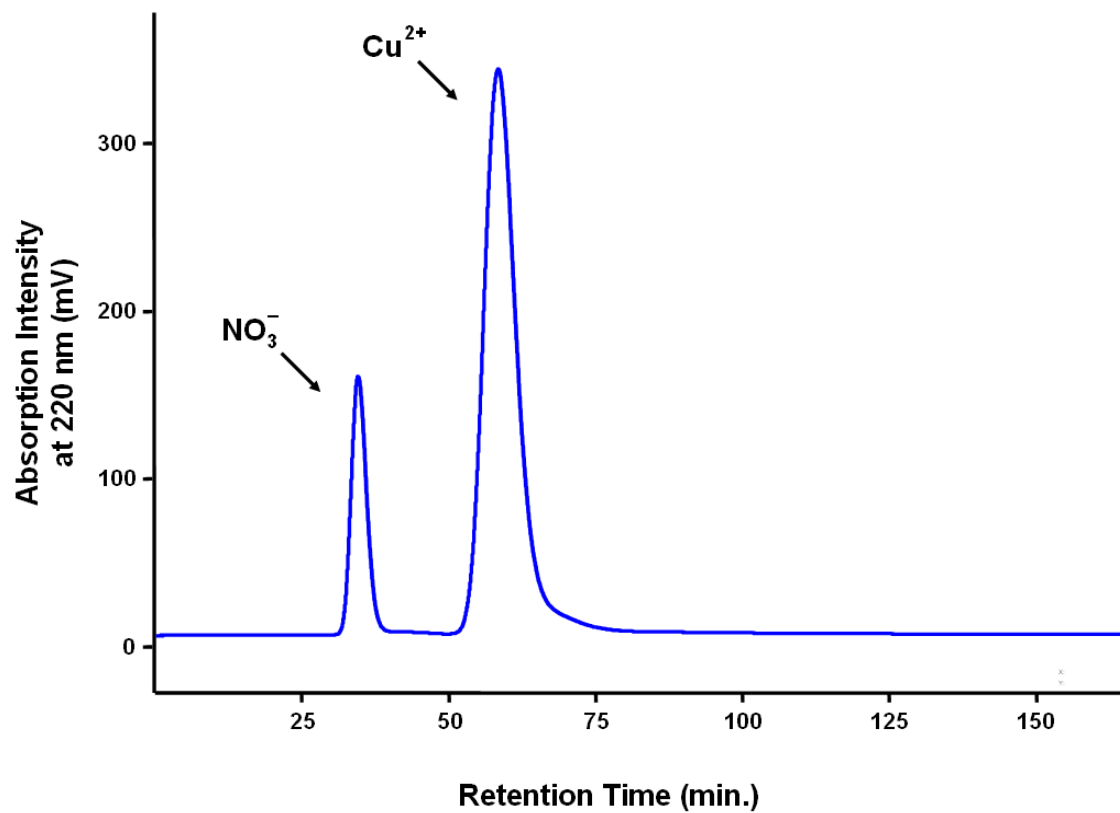
Supporting Information for  
**Fabrication and Manipulation of Ionotropic Hydrogels Crosslinked by Paramagnetic Ions**  
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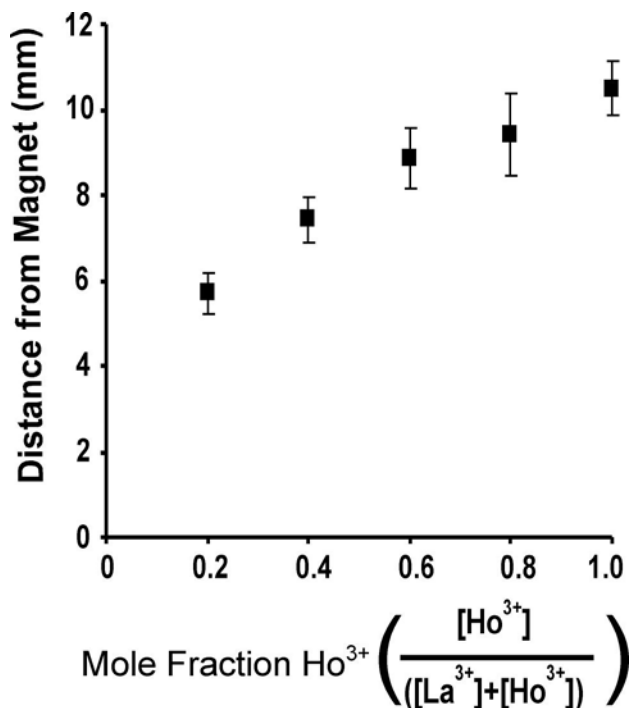
Supplemental Figure 1:

A sample chromatogram from the LC analysis of metal ions on a column of acidified AA. In this experiment, a 100- $\mu$ L aliquot of 50 mM  $\text{CuSO}_4$  and 2 mM  $\text{KNO}_3$  was eluted off of a 19-cm column of AA with 0.1 M HCl. Detection was observed at a wavelength of 220 nm.



Supplemental Figure 2:

The farthest distance a paramagnetic CMC hydrosphere was attracted to a set of NdFeB magnets was measured and plotted against the mole fraction of  $\text{Ho}^{3+}$ . The graph is non-linear because the geometry of the magnets used in the experiment created a gradient of the magnetic field that is not constant. The distance from the magnets is proportional to the magnetic force on the sphere, and this force is proportional to the dot product of the magnetic field and its gradient (eq. 1). Since the gradient is not constant, the dot product of these two vectors is non-linear. All of the spheres that became attached to the magnet completed their movement in five seconds or less.

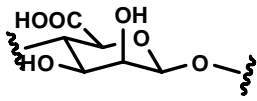


Supplemental Figure 3:

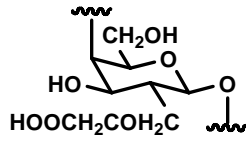
Structures of the monomer units for all of the polymers that we attempted to crosslink with  $\text{Ho}^{3+}$ .

The top five polymers (above the dotted line) formed stable hydrogels with  $\text{Ho}^{3+}$ ; the bottom eight polymers (below the line) did not.

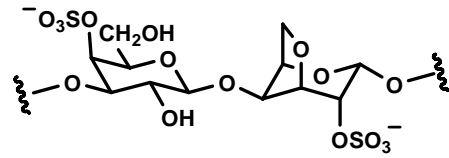
Alginate Acid



Carboxymethylcellulose

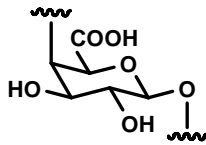


ι-Carrageenan

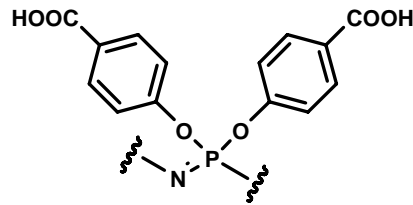


M:G varies from ~1-3 based on species

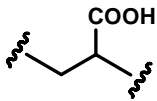
Galacturonic Acid



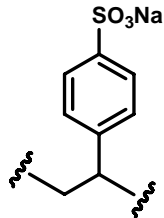
Poly(bis(4-Carboxyphenoxy)phosphazene)



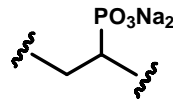
Poly(acrylic acid)



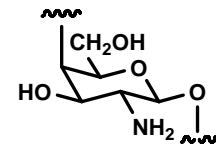
Polystyrene Sulfonate



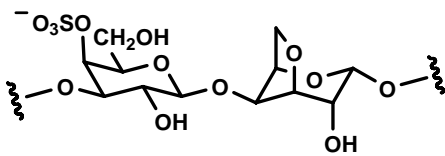
Poly(vinyl phosphonic acid)



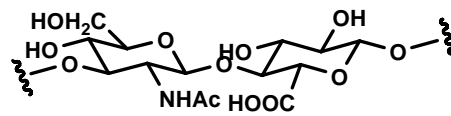
Chitosan



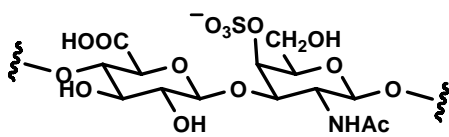
κ-Carrageenan



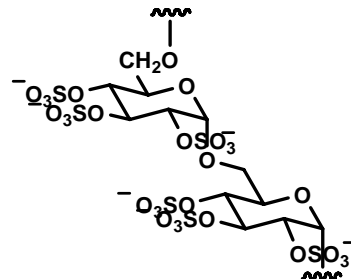
Hyaluronic Acid



Chondroitin Sulfate

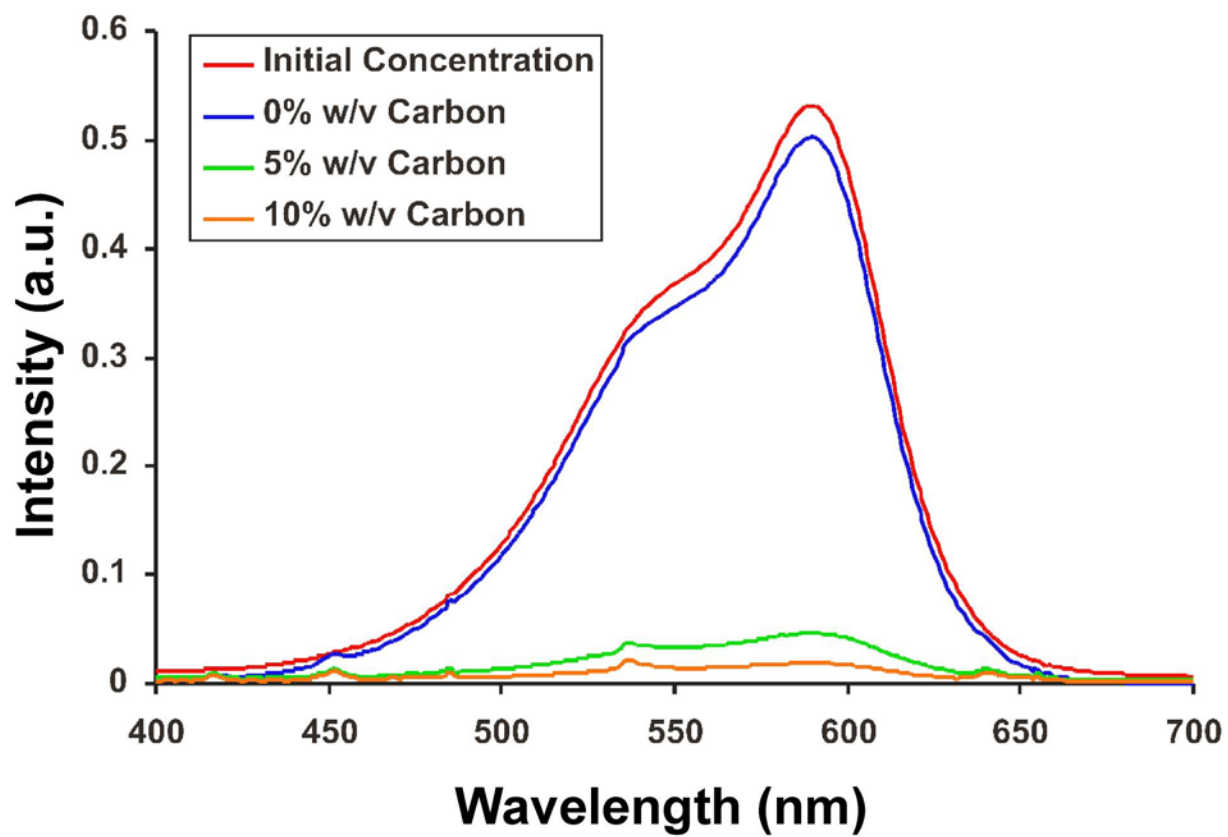


Dextran Sulfate



Supplemental Figure 4:

A) A set of UV-vis spectra for solutions containing AA spheres crosslinked with  $\text{Ho}^{3+}$  with embedded carbon powder (0%, 5%, or 10% (w/v)) after soaking in an aqueous solution containing crystal violet (0.1 mg/mL). The spheres containing the carbon powder remove the dye from the aqueous solution. B) An optical image of the three types of spheres after completion of the removal of the dye by the spheres containing carbon.

**A****B**