The Summer Undergraduate Research Fellowship (SURF) Symposium
4 August 2016
Purdue University, West Lafayette, Indiana, USA

Characterization of Superabsorbent Polymers in Aluminum Solutions

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ABSTRACT

Over the past few decades, super absorbent polymers (SAPs) have been the topic of research projects all around the world due to their incredible ability to absorb water. They have applications in everything from disposable diapers to high performance concrete. In concrete, aqueous cations permeate the polymer network, reducing swelling and altering properties. One of these ions, aluminum, alters SAP properties by creating a stiff outer shell and greatly reducing absorbency, but these effects have not been well characterized. One method of characterizing the effects of aluminum on SAP hydrogels was performing gravimetric swelling tests to determine equilibrium water capacity at different aluminum ion concentrations. Compressive strength was also determined for swollen particles using a rheometer to perform compression tests. Results from this testing show that low concentration solutions take several hours to permeate the polymer network and reduce swelling capacity, while high concentration solutions are able to limit swelling immediately. The compressive strength of the gel was increased greatly in polymers containing mostly poly(acrylic acid), while SAPs containing more poly(acrylamide) did not have their strength as greatly influenced by the aluminum ions. These results help elucidate the negative effects that may be caused by multivalent cations in concrete. Further research will include studying the interactions of aluminum ions with polymer strands using polymer brushes on a quartz crystal microbalance. This will hopefully reveal the mechanism and kinetics of salt absorption in polymer networks.

KEYWORDS

Superabsorbent polymers, ionic absorption, aluminum, hydrogels