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Characterization of Suspension Polymerized Polyacrylamide and Poly(sodium acrylate-acrylamide) Copolymer and their Size Influence on the Properties of Concrete

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ABSTRACT

Shrinkage leading to cracking and mechanical instability is a major problem for concrete due to the loss of water during the curing process. However, through the addition of Superabsorbent Polymer (SAP) hydrogels, shrinkage can be prevented, increasing the strength of concrete. Characterization of suspension polymerized polyacrylamide (PAM) poly(sodium acrylate-polyacrylamide) (PANA-PAM) copolymer microsphere sizes, morphology and swelling behavior was conducted before adding them to concrete. Size was determined using microscopy paired with ImageJ analysis. Coulter Counter size characterization was also used to determine the particle size distribution. Swelling behavior was determined using the tea bag method as well as size analysis before and after hydration. After characterization, concrete containing various sizes of SAP microspheres will be tested for shrinkage and mechanical strength. These tests will allow us to discover the optimal size of SAP microspheres in concrete to increase its mechanical properties as well as control shrinkage. We will also investigate if the shape of particles has an impact on the final properties of the concrete. The results of this study will contribute to the growing knowledge of applying SAPs in concrete and will give a better understanding on how the size and shape of SAP hydrogels influence the properties of concrete. Using this knowledge, concrete can be made to perform better resulting in more mechanically sound structures.

KEYWORDS

Suspension Polymerization, Characterization, Superabsorbent Polymer, Hydrogel, Concrete.