**142x Mechanical and Rheological Properties of Polyalkenoate Cements Designed as Portland Cement Substitutes**

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Low-cost polyalkenoate cements analogous to dental cements, i.e. cements based on polymers containing acrylic acid crosslinked both covalently and via bridging metal cations, were developed with a goal of producing a more flexible alternative to normal Portland cement. Economic constraints necessitated the replacement of soluble glass beads normally used in dental cements; the dual functionality of the glass beads was accomplished via the use of manganese tetraoxide as the filler and aluminum chloride as the cation source for the ionic crosslinks. Unlike dental cements that have a gel-like consistency, pumpable cement was produced by using acrylic-acid monomer rather than low-molecular weight acrylic acid oligomers. Mechanical and rheological properties were used to monitor the characteristics of the cement. Because of the large number of formulation variables, a design of experiments (DOE) approach was used. DOE helped delineate economic constraints on the independent variables, narrow the search for formulations that would result in hardened cements, and find the optimal set of ingredients that led to cements with the best mechanical properties. Rheology was adjusted to match that of Portland cement by altering the filler volume fraction; which was very effective since the rheology depended strongly on that variable. The most pertinent independent variables for the mechanical properties were the curing time and cation ratio in the ranges tested; however, monomer/water ratio was fixed at the minimum level possible and not increased because of economic considerations. The best materials produced in terms of mechanical properties resulted when acrylic acid monomer was partially replaced by N,N'-Methylene-bis-acrylamide; this substitution resulted in a much more flexible, tough cement.