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Discussion

A discussion of the paper "The removal of phosphate ions from aqueous solutions by fly ash, slag, ordinary Portland cement and related blends" By N.M. Agyei, C.A. Strydom and J.H. Potgieter☆

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Drs. Agyei, Strydom and Potgieter have studied the removal of phosphate ions from aqueous solutions by Portland cement and cementitious mineral admixtures such as fly ash and slag. It is a very interesting and informative paper. Even with my limited knowledge of ionic sorption and adsorption, I can follow most of the theoretical side. I think the authors can clarify the chemical or chemisorptional mechanisms of the removal of phosphate ions.

Phosphate sorption by calcium carbonate was investigated in batch experiments [1]. At low phosphate concentrations, it was found that phosphate adsorbs to calcite particles, while at higher phosphate levels, a calcium phosphate precipitated as dicalcium phosphate ($CaHPO_4$).

The concentrations of $H_2PO_4^-$, HPO_4^{2-} and PO_4^{3-} in aqueous solution strictly depend on the concentration of a mineral acid [2]:

$$Ca_3(PO_4)_2 + 4H^+ \rightarrow Ca(H_2PO_4)_2 + 2Ca^{2+}$$

$$Ca_3(PO_4)_2 + 2H^+ \rightarrow 2CaHPO_4 + Ca^{2+}$$

$$Ca_3(PO_4)_2 + 6H^+ \rightarrow 2H_3PO_4 + 3Ca^{2+}$$

Calcium, fluoride, phosphorus, magnesium and carbonate ions considerably affect on the forming of hydroxyapatite [$Ca_{10}(PO_4)_6(OH)_2$]-seeding material on calcium phosphates precipitation [3]. The results show that using a higher amount of seeding material, the removal rate of phosphate ion from solution is higher. A decrease in the apatite growth was observed when magnesium or carbonate ion was present. The presence of magnesium ions in solution was found to inhibit the formation of amorphous calcium phosphate [4].

If I have misunderstood the authors, then I hope the authors will correct me.

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☆ Cem. Concr. Res. 30 (12) (2002) 1889–1897.

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