

Solubility of Iron(III) and Aluminum Phosphates in Aqueous Solutions

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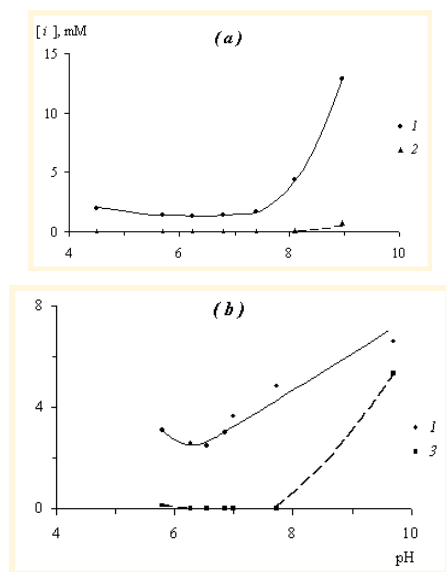
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It is generally believed that phosphates of Fe(III) and Al are main forms of phosphorus in acid soils. However, the existing experimental data on solubility of iron and aluminum phosphates in weak acid and weak base solutions are very scarce. Our study represents a part of concerted efforts aimed at experimental investigation thermodynamic stability of these solids. For this, we studied the solubility of synthesized amorphous phases (FePO_4 and AlPO_4) in NaClO_4 - HClO_4 - NaOH - NaHCO_3 solutions with different ratio of solid/solution (m/V) at pH range 4.5-9.5 and constant ionic strength ($I=0.05$).

It was found that in our experiments solid phases FePO_4 and AlPO_4 are transformed into hydroxides of Fe(III) and Al, but with increasing m/V, the concentration of soluble components (P, Fe and Al) is defined by solubility of initial FePO_4 and AlPO_4 . A pH dependence of P, Fe and Al in equilibrium with FePO_4 and AlPO_4 is presented in Fig. 1. The solubility of FePO_4 and AlPO_4 at pH 4.5-9.5 is a several orders higher than the concentration of phosphate ions in surface and ground waters ($1.5\text{--}10^{-6}$ M). Thus we can deduce a conclusion that phosphates of Fe(III) and Al are unstable in weak acid and weak base solutions and the phosphate phase is likely to transform to less soluble calcium phosphates.

This work is financially supported by Russian Fond for Basic Research (project 00-05-65495).

Fig. 1. The relationship between equilibrium phosphate, iron(III) and aluminum concentrations and pH value. a) solubility of FePO_4 , b) solubility of AlPO_4 . 1 – P, 2 – Fe, 3 – Al.



Metal and micro-organic pollutant partitioning between sediments and waste waters from a landfill

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Stream sediments in the vicinity of a landfill environment were collected and analysed for their metal and micro-organic pollutant content. These sediments were mechanically sieved into two different size fractions ($<63\mu\text{m}$ and $63\text{--}90\mu\text{m}$). Analytical methods used included bulk chemical analysis, XRD, SEM, sequential extraction of metals (Tessier *et al.*, 1979; Hirner, 1992), and Solid Phase Extraction (SPE) of organic compounds (Nogueira *et al.*, 2001). Surface and ground waters were also sampled and analysed. A high content of metals such as Cu, Zn and Pb was found, showing a decreasing concentration gradient down-stream away from the landfill facility. SEM observations determined that for some of these metals (Zn in particular) part of this behaviour could be due to the presence of artificial alloys. It also showed that most of Cu is concentrated at the mineral surfaces. The combined studies of sequential extraction and SPE showed that metals are preferentially bound to the organic pollutants present in the sediments. These compounds are responsible for 70-80% adsorption of Cu, 50-70% for Zn, 40-60% for Pb and 20% for Ni. This behaviour seems to relegate the presence of specific mineral types to a secondary role in these systems. The different size fractions of sediments do not show any remarkable difference in their composition and in metal distribution among different adsorption modes. Even considering that clay minerals have been shown to be present in both size fractions at least some difference should be apparent. The identification of micro-organic pollutants is currently being done by GC-MS both in the sediments and in the surface polluted waters that directly interacted with these sediments. Preliminary results also indicate that such interaction albeit important is rather limited, and that polluted waters may still carry significant concentrations of harmful substances, and these being easily transferable to the hydrological cycle.

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