0082 Hydroxyapatite Solubility in Simple Inorganic Solutions Using Solid Titration

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Objective: To use solid titration and laser-scattering end-point detection to determine the hydroxyapatite (HAP) solubility isotherm at 37°C in (A) 0.1 M KCl, (B) 0.1 M KCl equilibrated with 3.5 vol% CO_2 in air, and (C) 0.1 M KCl + 1 mM [PO_4]. Methods: Pulverized HAP solid was used to perform a titration to saturation. Light scattered at small forward angles from a laser beam was monitored using a very sensitive detector to determine the onset of precipitation (or failure to dissolve) near the equilibrium point. Each small incremental addition of HAP solid caused an immediate step increase in scattered light and this signal decreased quasi-exponentially with time. When a steady but elevated scattering was obtained, small portions of 1 M HCl were added to lower the pH by about 0.5 to 2 units, according to need, to dissolve excess solid and allow a further titration. The scatter signal and pH data, plotted against the amount of HAP added, were used to estimate the actual endpoint by interpolation and thus construct each point on the solubility isotherm. Results: The solubility isotherm for HAP in plain KCl solution in the absence of CO_2 obtained now differs substantially from the results of previous solubility studies (i.e. much lower, by ~0.01x at pH 5). The increase in solubility due to CO_2 reported earlier was confirmed (~7x at pH 5), while the effect of excess phosphate was found to be to increase the solubility of HAP (~2x at pH 5), contrary to elementary mass-action expectations. Conclusions: The solid titration method is a more reliable approach than the conventional excess-solid method with respect to the determination of the HAP carrying-capacity. The solubility of HAP appears to be substantially lower than previously reported, and a reconsideration of all aspects of the system is warranted.

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