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Removal of Hexavalent Chromium Using Pyrite and Biotite Columns.

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ABSTRACT

This study included bench-scale column experiments to evaluate the efficiency of a porous permeable reactive barrier system (PRBs), using finely ground pyrite and biotite, and investigate the reaction process. Total chromium concentration of the effluent from biotite and pyrite columns reached 5ppm of initial input concentration after passing through more than 150 pore volumes (PVs, 5600ml) and 27PVs (960ml) respectively, and kept a constant level thereafter. The Cr(VI) concentration in the effluent from biotite column came to a constant level after passing through 200PVs (7600ml) and the level of concentration was fixed at about 4ppm as 80% of input level. In pyrite column, however, the Cr(VI) was fixed at about 0.5ppm as 10% of input level after passing through 116PVs (4077ml). It means that the both columns were keeping up the chromate reduction although the Cr(VI) breakthrough curves (BTC) reached a constant(equilibrium). The trends in variances of iron concentration related closely to those of chromium. The observed data of both columns were fitted by CXTFIT, a program for estimating solute transport parameters from experimental data. Because the degradation coefficient (μ) of total Cr breakthrough curve (BTC) from the both column was zero, mechanisms of removal of chromate could limit the μ of Cr(VI) BTC. The degradation of pyrite column (6.60) was indeed faster than that of biotite column (0.27). In addition, the retardation coefficient (R) of pyrite column was larger. The R values of total Cr BTC from both columns were smaller than that of Cr(VI) BTC, and especially the total Cr BTC of pyrite column was little retardation (1.5). These solute transport parameters, calculated by CXTFIT from data of column test, can provide

quantitative information to evaluate a bench or field-scale columns for removal technology of Cr(VI).

Key words: Chromate reduction, Pyrite, Biotite, Permeable Reactive Barrier

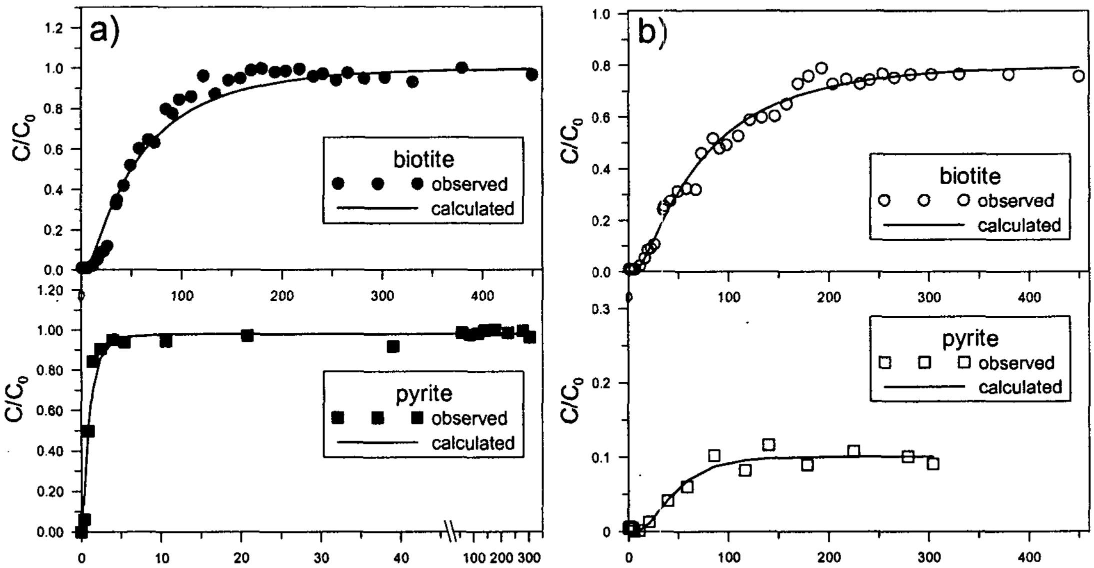

Fig. 1. Experimental and fitted breakthrough curves for: a) total Cr and b) Cr(VI), using CXTFIT program, for the biotite and pyrite column studies.

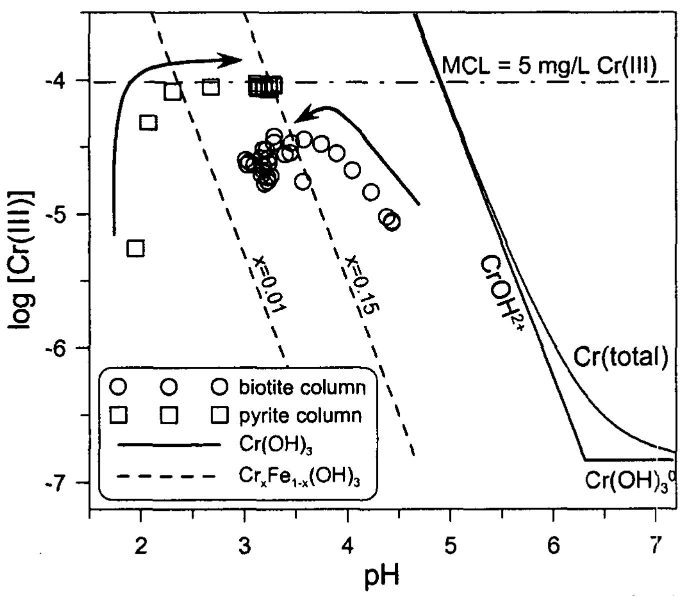

Fig. 2. Cr(III) concentration in equilibrium with $Cr(OH)_{3(am)}$ (solid line), and $Cr_xFe_{1-x}(OH)_{3(am)}$ (dashed line), based on data from Rai *et al.* (1987) and Sass and Rai (1987), respectively. MCL is the maximum contaminant level.

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