# Reduction and Sorption of Chromium by Fe(II)-Bearing Phyllosilicates: Chemical Treatments and X-Ray Absorption Spectroscopy (XAS) Studies

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**Abstract:** The reduction of hexavalent chromium species in aqueous solutions by interaction with Fe(II)-bearing solid surfaces was studied using a $0.96 \times 10^{-3}$ M Cr(VI) solution and iron-rich clays with different Fe(II)/Fe(III) ratios, layer charge, and exchange properties, *i.e.*, chlorite, corrensite, and montmorillonite. Experimental studies demonstrated that Fe(II)-bearing phyllosilicates reduce aqueous Cr(VI) ions at acidic pH. Chlorite and corrensite, owing to the high Fe(II)/Fe(III) ratio, are electrochemically reactive, as rapid Cr(VI) reduction indicated. In contrast, montmorillonite showed minimum to nil reactivity towards Cr(VI). Furthermore, corrensite, which is high in both Fe(II)/Fe(III) ratio and exchange capacity, adsorbs the greatest amount of chromium.

X-ray absorption spectroscopy at Al, Mg, Fe, and Cr K-edges was used to investigate the adsorbed chromium species. The montmorillonite sample, unaffected by treatment with Cr(VI) solution, displays no change at any investigated edge. Edge shape and energy also do not change for the Mg and Al spectra in corrensite, and changes are minor in chlorite. By contrast, the Fe K-edge changes both in chlorite and corrensite, and indicates an increase of Fe(III) in treated samples at the expense of pre-existing Fe(II). Cr K-edge spectra show that chlorite and corrensite sorb Cr(III), which implies its reduction from Cr(VI) in the interacting solution.

**Key Words:** Absorption • Chromium • EXAFS • Phyllosilicates • Reduction • XANES

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