Adsorption of $Cr(NH_3)_6^{3+}$ and $Cr(en)_3^{3+}$ on Clay Minerals and the Characterization of Chromium by X-Ray Photoelectron Spectroscopy

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Abstract: The nature of $Cr(NH_3)_6^{3+}$ and $Cr(en)_3^{3+}$(en = ethylenediamine) adsorbed on chlorite, illite, and kaolinite has been studied by X-ray photoelectron spectroscopy (XPS). The interaction of the chromium complexes with the clays began at pH 3. During the 7-day interaction time the pH of the complex-clay suspension increased to 8 for illite and chlorite. For kaolinite the pH increased to about 3.6 with $Cr(NH_3)_6^{3+}$ and to 6.4 with $Cr(en)_3^{3+}$. These pH changes appear to be associated with a clay-catalyzed hydrolysis of the chromium-amine complexes. XPS binding-energy data for adsorbed chromium indicate that the dominant species are chromium aqua complexes. Nitrogen/chromium atom ratios, calculated from the XPS photopeak intensities, are less than 6:1 for complexes adsorbed on the clays, suggesting that chromium complexes are initially adsorbed but subsequently hydrolyze to produce aqua-chromium surface species.

Key Words: Adsorption • Chlorite • Chromium • Complex ions • Illite • Kaolinite • X-ray photoelectron spectroscopy

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