

## XANES Studies of Remediation of Cr(VI) Contaminated Soils by Applying Compost Amendment and Various Treatments

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The effect of soil pH on the degree of Cr(VI) reduction to Cr(III) was investigated. The soil pH was adjusted by applying various amounts of CaCO<sub>3</sub> and incubated at room temperature for one month to reach three levels of pH. Two acid soils, Pinchen (Pc; pH 4.3) and Neipu (Np; pH 4.1), were used in this study. After soil pH adjusted, Cr(VI) (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>) was spiked into soils with various pH to reach the level of 0, 150, 300, 500, 1000, 1500 mg Cr(VI)/kg soil respectively. Then, the Cr(VI)-spiked soils underwent three wetting-drying cycles at room temperature to mimic the field situation. After the wetting-drying cycles, the soil samples were ground and sieved through 400 mesh to give fine powder for XANES analysis.

The XANES spectra were collected at NSRRC of Taiwan. The X-ray absorption Cr K-edge (5989 eV) spectra were obtained using wiggler beam line, BL-17C1. The electronstorage ring was operated with the energy of 1.5 GeV and a current of 120 - 200 mA. The standards were prepared from the mixtures of Cr<sub>2</sub>O<sub>3</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. After these solids were ground and sieved through 400-mesh, the powders were mixed with boron nitride to form various standards that contain 5% Cr by weight and have different ratios of Cr(VI) to Cr(III). The XANES spectra of standard samples containing various percentage of Cr(VI) are shown in Fig. 1. A sharp and intense peak at 5992-5994 eV indicates the existence of Cr(VI) and peak intensities increase with the increasing of Cr(VI) percentage in Cr standards. Therefore, the peak intensity can indicate the percentage of Cr(VI) in the analyzed samples.

The XANES spectra of Cr(VI)-spiked soils at various pH of two tested acid soils are shown in Fig. 2. (a) and 2(b). It shows that the reduction of Cr(VI) to Cr(III) in Pc soil was affected by soil pH. The degree of reduction was decreased with increasing soil pH. However, in Np soil, in the three pH levels, the Cr(VI) peak did not exist. It indicated that Cr(VI) was reduced to Cr(III) completely in the Np soil. The complete reduction of Cr(VI) was resulted from large amounts of soil organic matter (93.7 g/kg) in the Np soil. The above results suggest that Cr(VI) reduction was affected by both soil pH and organic matter content, but the latter affects Cr(VI) reduction markedly. Both figures prove clearly that the identification of Cr species can be implemented by XANES analysis which is useful to reveal reduction of Cr(VI) to Cr(III) in various soil pH and organic matter content

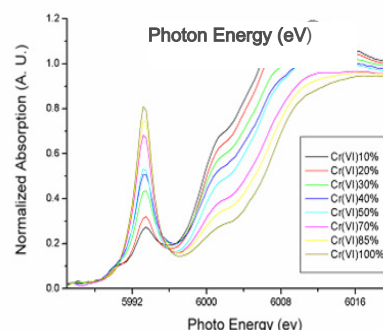


Figure 1. The XANES spectra of the Cr standard samples containing various percentage of Cr(VI).

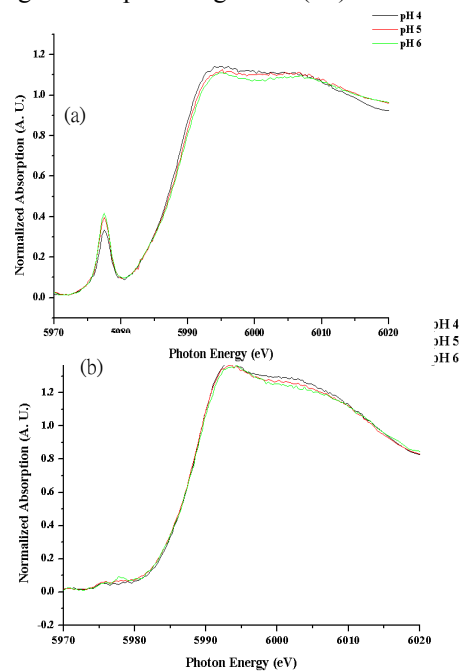


Figure 2. The XANES spectra of Cr(VI)-spiked soil (1500 mg Cr(VI)/ kg soil) at different pH. (a) Pc and (b) Np soil.