

Spectroscopic characterization of clays from Assam and Meghalaya

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Clay is widely utilized for different industrial applications. Clay particle sizes are in the micrometer to nanometer range length scale. The basic structural units in clays consist of the silica sheet formed of silica tetrahedra and the octahedral units formed of octahedrally coordinated cations with oxygens or hydroxyls octahedral. Vibrational spectroscopic investigations yield useful information about hydration characteristics, interlayer cations and moisture content in clays. Clays are layered aluminosilicate minerals forming important components of soils and sedimentary rocks. Their layers consist of TO₄ tetrahedra (T = Si⁴⁺, Al³⁺, etc.) and MO₆ octahedra (M = Al³⁺, Fe³⁺, etc.). Layers in 1:1 family of clay minerals hold together by hydrogen bonds formed between hydroxyl groups attached to coordinately unsaturated oxygen sites of the MO₆ side of each layer and oxygen atoms terminating the opposite SiO₄ side of the next layer. The FTIR technique has been well used for the identification of functional groups in clays. This study demonstrating the Fourier transform infrared (FTIR) spectroscopic characterization of clay minerals procured from north-eastern India. The X-ray Fluorescence (XRF) indicates that the minerals of the samples are mainly kaolin. The main peaks in the infrared spectra reflected Al-OH, Al-O and Si-O functional groups in the high frequency stretching and low frequency bending modes. Few peaks of infrared spectra inferred to the interference peaks for quartz as associated minerals. The minor and trace compositions are iron, calcium, magnesium oxide and other elements. The present study might have significant implications in understanding the clay quality of the region.

Sorption characteristics of Co(II) ions on biogenic birnessite: Comparison with synthetic analogues

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Cobalt is regarded as a surrogate of radionuclides. Biogenic manganese oxide produced by a Mn-oxidizing fungus *Paraconiothyrium sp.* WL-2 [1-3] and its synthetic analogues like spinel and tunnel types of Mn oxides were investigated to compare sorption behaviour of Co²⁺ from the aspect of the sub-structural influence of manganese oxides on sorption mechanism of Co²⁺. Biogenic and synthetic birnessite (X₄Mn₁₄O₂₇·9H₂O) showed superior sorption capacity of Co²⁺ over other manganese oxides with spinel and tunnel types. Biogenic birnessite showed further larger sorption capacity of Co²⁺ over chemically synthesized ones, independently of the specific surface area of the sorbents. The required time to achieve the equilibrium was longer with the biogenic birnessite than the synthetic ones. Biogenic birnessite was characterized to be poorly crystalline by XRD, includes ion-exchangeable Mn²⁺, K⁺, and Mg²⁺, as well as in a layer sheet structure [4]. It can be considered that Co²⁺ ions are sorbed not only by ion-exchange with involved cations but also by coordination to free edge sites of oxygen atoms in octahedral of MnO₆ units and occupation of vacant sites in MnO₆ layer sheets. In case of sorption of Zn²⁺ and Ni²⁺ ions on biogenic birnessite, the required time to achieve the equilibrium was much shorter than sorption of Co²⁺ ions and sorbed mass of Zn²⁺ and Ni²⁺ ions were fewer than Co²⁺ with biogenic birnessite. These results imply that sorption sites for Zn²⁺ and Ni²⁺ ions are more restricted than Co²⁺ on biogenic birnessite.

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