

## Article Abstract

<b>Title:</b>	<b>Pb(II), Cd(II) and Zn(II) adsorption on low grade manganese ore</b>
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<b>Abstract:</b>	<p>Low grade manganese ore (LMO) of Orissa containing 58.37% SiO<sub>2</sub>, 25.05% MnO<sub>2</sub>, 8.8% Al<sub>2</sub>O<sub>3</sub>, and 5.03% Fe<sub>2</sub>O<sub>3</sub> as the main constituents was taken to study its adsorption behaviour for Pb(II), Cd(II) and Zn(II) from aqueous solutions. The XRD studies showed the crystalline phases to be quartz, <math>\beta</math>-MnO<sub>2</sub>, <math>\delta</math>-MnO<sub>2</sub> and Fe<sub>2</sub>O<sub>3</sub>. Batch adsorption studies were carried out by varying the experimental parameters which included contact time, pH, adsorbate and adsorbent concentrations and temperature. The time data fitted well to pseudo second order kinetics for Pb(II), Cd(II) and Zn(II) adsorption. With the increase in adsorbent dose, loading capacities decreased. With the increase in pH from 2.0 to 5.5, Pb(II) adsorption increased while Cd(II) and Zn(II) adsorption increased till an initial pH of 3.0. Positive <math>\Delta H^\circ</math> values confirmed the adsorption process to be endothermic and positive <math>\Delta S^\circ</math> values suggest the increased randomness at the solid-solution interface during the adsorption of cations on the sample. The adsorption data showed good fit to both Langmuir and Freundlich isotherm models for the three cations. The Langmuir monolayer capacities for Pb(II), Cd(II) and Zn(II) were estimated to be ~142.85, 59.17 and 98.0 mg per gram of LMO sample respectively. From the XRD studies of loaded samples, it was observed that Pb(II) adsorption affects silica phase whereas Cd(II) adsorption affects both silica and <math>\beta</math>-MnO<sub>2</sub> phases. With Zn(II) adsorption both the intensity and peak position of silica phase were disturbed. From the electron probe micro analysis (EPMA) it was observed that Pb(II), Cd(II) and Zn(II) adsorption are more prone to silica, iron oxide and <math>\beta</math>-MnO<sub>2</sub> phase respectively though their distribution in other phases was also marked but to a lesser extent. Due to high loading capacities obtained for Pb(II) and Zn(II), low grade manganese ore can be regarded as a potential adsorbent for these metals.</p>
<b>Keywords:</b>	Low grade manganese ore, adsorption, Pb(II), Cd(II), Zn(II), EPMA