Characterisation and Implications for Potential Environmental Applications of Montmorillonite Extracted from Clay Deposits in Murunkan, Sri Lanka

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Montmorillonite (MMT) is one of the most commonly used smectite clay as a low–cost adsorbent in water purification due to its ubiquitous nature, high cation exchange capacity, surface area and porosity. Although high purity MMT deposits are absent in Sri Lanka, MMT–rich clay can be found in arid regions such as Murunkan, Mannar. Cadmium (Cd^{2+}) is a known human carcinogenic heavy metal deemed as a high priority water pollutant by the USEPA. This study is focused on investigating the potential environmental applications of MMT as a low–cost adsorbent for the removal of Cd^{2+}. MMT was extracted using clay collected from Murunkan area by both wet and dry sieve methods. Wet sieve method resulted in higher percentage (14%) of fine clay fraction (<63 µm) compared to dry sieve method (3.8%). X–ray Diffraction and Fourier Transform Infrared Spectroscopy revealed the beneficiation of montmorillonite in <63 µm fraction and main impurities were identified as quartz and feldspar. Upon sedimentation, impurity content was minimised and montmorillonite rich portion (MMT–Ex) in <63 µm fraction was separated. The optimum adsorbent amount for effective Cd^{2+} removal was investigated by varying the amount of MMT-Ex (0.5–4 g). The adsorbent was mixed with 25 ml of Cd^{2+} solution (5 mg L^{-1}, pH 7.3) and agitated for 24 hrs at room temperature. The supernatant was separated by centrifugation and analysed using Atomic Absorption Spectroscopy. MMT–Ex resulted 98% of Cd^{2+} adsorption with a low adsorbent dose (0.5 g). Overall, this study describes effective methods to extract MMT from MMT–rich clay and shows its potential application as an economic and effective adsorbent for inorganic contaminants in wastewater treatment and environmental remediation.

Keywords: Montmorillonite, Characterisation, Water purification, Cadmium adsorption