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Application of clay nanoparticles in removal of lead and cadmium from water

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The importance of water purification especially removal of heavy metals has been emphasized again and again, hence the need to develop water purification materials that are cheap, easily available and efficient. This study involves removal of Lead and Cadmium from water using clay nanoparticles (CNP) through batch process. Clay was acquired locally, purified by treating with H2O2 and NaOH and CNP isolated by sedimentation and centrifugation. The CNP were characterized using FTIR, UV/VIS and XRD where the crystal size was 40.1 nm. CNP had a Lead removal efficiency of 88% at initial concentration of 80 ppm and 94% for Cadmium at initial concentration of 50 ppm. Lead adsorption study data fitted well in Freundlich isotherm with a R2 of 0.9718 while Cadmium data fitted well in Langmuir isotherm with a R2 of 0.9921 and qm (maximum adsorbed capacity) of 400 mg/g. Both data were fitted in Elovich isotherm where Lead had a R2 of 0.9172 and 0.0238 for Cadmium. The free energy of adsorption was calculated using BD, a constant related to free energy and derived from Dubinin –Radushkevish isotherm, where -3.107 kJ/mol for Cadmium and -5.345 kJ/mol for Lead. Finally the data was fitted in Florry-Huggins isotherm to determine surface coverage, where the number of Cadmium ions on the surface of CNP was 2.30 and 0.2 Lead ions on CNP surface. Clay being locally available in large quantities in deposits, can provide a cheap material for removal of Lead and Cadmium in water and isolation of CNP, increases its efficiency as evident by the 88% removal efficiency for Lead and 94% for Cadmium hence would highly recommend use of CNP for Lead and Cadmium removal both at household and large-scale levels.

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Studies on flexible bionanocomposite films composed of carboxymethyl cellulose and nanocellulose for packaging

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Moderately flexible nanocellulose/carboxymethyl cellulose (CMC) bionanocomposite films were prepared from CMC solution (30 wt.%) containing nanocellulose (NC) (70 wt.%) which was in the form of dispersion by using solvent casting method. Samples of composites where CMC was crosslinked were also investigated. The mechanical properties, thermal stability & barrier properties of the nanocomposite films were studied by tensile testing, TGA, DSC & MVTR characteristics. The crystallinity & morphologies of composites were analyzed with XRD & scanning electron microscopy (SEM). The addition of CMC (minimum quantity of 30 wt.%) to the NC films increased tensile strength and reduced elongation at break of the composite films. The CMC crosslinked with GTMA produced composite films with improved thermal stability as was revealed from DSC & TGA thermograms of linear and crosslinked CMC/NC blends at an identical concentration of NC. The barrier properties of such transparent composite films were improved in terms of MVTR values with respect to CMC in the presence of NC.

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