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ACTIVATED COCONUT COIR AS Na^+ AND Mg^{2+} ADSORBENTS FOR DESALINATION APPLICATIONS

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Inadequate supply of safe drinking water is one of the major global issues and desalination of sea or lagoon water would be a plausible solution. Conventional desalination techniques are costly, require large amounts of energy, thus renewable sources of energy or cheaper alternatives should be sought out. This study focuses on the investigation of the potential of laboratory prepared activated coconut coir (ACC) in removal of sodium and magnesium ions from saline water, which could be extended to desalination applications at domestic level. Activated coir is prepared by pyrolysis of raw coconut coir treated with 50% (w/w) phosphoric acid. The adsorption characteristics of synthesized activated coconut coir was determined by measuring iodine number and methylene blue (MB) value of synthesized product and compared with those of commercial samples. Fourier Transform Infrared (FT–IR) spectroscopy indicates the presence of oxygen containing functional groups that are responsible for the adsorption of cations in desalination applications. The X-Ray diffraction pattern indicates the presence of weak graphitic structure in synthesized ACC. Sodium and magnesium ion removal efficiencies are studied using standard NaCl and $MgCl_2$ solutions. For both Mg^{2+} and Na^+, approximately 50% removal is observed. For seawater samples, 40% removal of both cations is achieved with ACC dosage of 80.0 g L^{-1}. Repeated filtration studies indicate 72% removal for Mg^{2+} after 6 filtrations and 75% removal for Na^+ after 10 filtrations from seawater. The equilibrium studies show that the adsorption behavior fits into Langmuir and Freundlich isotherms, implying homogeneous monolayer coverage and chemisorption for both sodium and magnesium adsorption.

Regeneration of spent activated coir is achieved by back washing using distilled water followed by either treatment with conc. HCl (RA – ACC) or pyrolysis (RP – ACC). Regenerated samples are characterized using MB adsorption value and FT-IR spectroscopy. The removal capacity of regenerated ACC have been compared with fresh activated coir by determining percent removal of Mg^{2+} from 0.200 mol dm^{-3} $MgCl_2$ solution. 52% removal of Mg^{2+} was obtained by RP – ACC indicating its suitability in reuse.