Abstract No: 168 ***Earth and Environmental Sciences***

IMPREGNATION OF COCONUT COIR BASED ACTIVATED CARBON WITH MAGNETITE TO ENHANCE EFFICIENCY OF WATER SOFTENING

B.M.D.S. Balasuriya[1], M.N.S. Kottegoda[2] and A.D.L.C. Perera[1*]

[1]*Department of Chemistry, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka*
[2]*Department of Chemistry, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[*]*chandanip@pdn.ac.lk*

The hardness of water caused by the presence of excessive amounts of calcium and magnesium ions has led to a multitude of health and economic impoverishments worldwide. Adsorption techniques are celebrated as an excellent strategy to remediate water hardness at present. Even though activated carbon derived from charcoal has been widely employed as an adsorbent for hardness removal, it inherits many drawbacks such as lower adsorption rates and efficiency. Therefore, the development of novel advanced adsorbent materials for water softening has become essential. Identifying this requirement, we disclose the development of magnetite nanoparticles impregnated activated carbon derived from coconut coir (M-ACC) as a novel and efficient adsorbent material for water hardness remediation. The synergistic quantum effects arising at the nanoscale due to the surface functionalization of activated carbon with magnetite nanoparticles have awarded these nanohybrids enhanced adsorption properties and ease of removal after adsorption due to its magnetic behaviour. In this study, the applicability of M-ACC was tested and optimized conditions of the process parameters including contact time, adsorbent dose, and pH using representative natural water sample (total hardness-370 mg L^{-1}). The M-ACC was prepared by an *in-situ* one-pot synthesis approach where raw coir was dipped in a solution of 1 M $FeCl_3$, 1 M $Fe_2SO_4.7H_2O$ and 5 M NaOH followed by pyrolysis at 450 °C under N_2 gas flow. Characterization studies entrusted the successful impregnation of magnetite nanoparticles to activated carbon, and powder X-ray diffraction and Fourier transform infrared spectroscopy confirmed the formation of magnetite phase and its interactions with activated carbon matrix. This novel material was capable of removing total hardness of water over 70% with an adsorbent dose of 0.6 g/50 mL at normal pH (pH_{pzc} 5.29) by dual filtration. Therefore, we can claim the suitability of magnetite nanoparticles impregnated activated carbon derived from coconut coir as an adept adsorption material in developing next-generation solutions for restoring water softness.

Keywords: Coconut coir, Functionalized activated carbon, Magnetite nanoparticles, Optimization, Water hardness