**Facile preparation of amine -functionalized corn husk derived activated carbon for effective removal of selected heavy metals from battery recycling wastewater**

**Abstract**

In this work, an efficient and eco-friendly amine functionalized corn husk derived activated carbon with high adsorption capacity was prepared and utilized for Pb (II), Cu(II) and Ni(II) ions removal from battery recycling wastewater. The developed adsorbent was characterized to determine the surface morphology, elemental composition, surface chemistry and surface area using SEM/EDS, FTIR and BET techniques. The BET surface area of the corn husk (CH) and amine-functionalized corn husk activated carbon (AF-CHAC) was found to be 92.11 and 442.70 m2/g, respectively. The effect of adsorption variables which includes temperature, pH, contact time, and adsorbent dosage on uptake behaviour were all examined. Langmuir, Freundlich, Harkin-Jura, Elovich, and D–R isotherm models were fitted to the adsorption data. The adsorption of Pb (II), Cu(II), and Ni (II) ions followed a pseudo-second order kinetic and fit well to the Freundlich isotherm, indicating multi-layer adsorption and chemisorption. The maximum adsorption capacity of Pb(II), Cu(II), and Ni(II) ions, was 2.814, 0.724, and 0.337 mg/g, respectively. According to the thermodynamic parameter values, the adsorption process was spontaneous, exothermic, and physical in nature, with an increase in randomness at the adsorbates-adsorbent interaction. The desorption and reusability experiments revealed that the AF-CHAC has a greater potential as an adsorbent , with a removal efficiency of 99 % after three cycles. Overall, the prepared amine functionalized corn husk derived activated carbon has advantages such as ease of preparation, cost effectiveness, and excellent recyclability, as well as high adsorption capacity, providing a new approach for efficiently treating battery recycling wastewater contaminated with heavy metal ions.