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The extraction and reclaiming of anions from water solutions utilizing biochar obtained from waste wood infused with iron oxide nanoparticles. RSM experimental design with isotherm, kinetic, and thermodynamic studies.

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Slow pyrolysis method of biochar was used for the conversion of waste wood which in turn proved to be more efficient than other procedures. Through this study, a novel method for producing magnetic biochar from waste wood sourced from Acacia auriculiformis is achieved. Nanoparticles which were successfully deposited onto the surface of biochar were derived from iron powder transformed into iron-oxide. High specific surface area of 266.564 m^2g^{-1} was achieved through Brunauer–Emmett–Teller (BET) analysis. Scanning Electron Microscopy (SEM) images demonstrate the formation of triangular pyramid-shaped nanoparticles in the adsorbent's inner and outer wall pores [1]. Fe_3O_4 was coated on the surface of the adsorbent in a crystalline, carbonaceous form, as indicated by XRD peaks. A number of hydroxyl and aliphatic stretching bonds of carbon serve as functional groups in the impregnation and anionic targeted pollutants adsorption process, according to FTIR research [2]. The establishment of the best-fit model for several anionic pollutants followed the method of multi-layer heterogeneous adsorption. Removal efficiencies of 95%, 85%, and 80% of arsenic, chromium, and fluoride are attained, respectively. The adsorption process was modeled and optimized using RSM, as well as was monitored in detail. Kinetic models were used to determine the adsorption process. Surface mechanism involved electrostatic attraction followed by pseudo first, second order, Bangham equation and Weber Morris intra-particle diffusion and complexation helping in adsorption of the anionic ions. Whereas, chromium and fluoride followed Temkin and Dubinin-Radushkevich adsorption isotherms. The maximum capacity of the manufactured biochar for arsenic, chromium and fluoride is estimated to be 294.1176, 204.22 and 102.36 mgg^{-1} respectively. Regeneration studies showed that upto 80-90% of ions can be recovered.

References:

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