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Fluoride ion removal from aqueous solution, groundwater, and seawater by granular and powdered *Conocarpus erectus* biochar

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ABSTRACT

This paper reports on the development of granular and powdered biochar of *Conocarpus erectus* (GBC and PBC) for the removal of fluoride ions from aqueous solution. The surface and adsorption characteristics of the fresh and used samples of GBC and PBC were analyzed by fourier transform infrared spectroscopy (FTIR), Brunauer–Emmett–Teller (BET), and scanning electron microscope (SEM). The parameters affecting the adsorption capacity, such as the pH (2–12), initial fluoride concentration (5–10 mg/L), contact time (3–80 min), adsorbent dosage (2–15 g/L), mixing velocity (0–150 rpm), temperature (20°C–50°C), and co-existing ions, have been evaluated. The results show that the maximum removal of fluoride (PBC: 98.5% and GBC: 80%) was achieved at pH 6 for both adsorbents. The adsorption data obtained at 23°C were fitted to the Langmuir model slightly better than to other isotherms (PBC: 205.7 mg/g and GBC: 13.17 mg/g), and they were also fitted to a pseudo-second-order kinetics model. After seven times of reuse, the adsorption efficiency of PBC and GBC reached 70.1% and 49.6%, respectively. The thermodynamic study indicated that the fluoride adsorption process by both adsorbents is exothermic in nature. In order to assess the practical utility of the studied adsorbents, batch studies were carried out with two real samples (fluoride contaminated groundwater and seawater). The PBC adsorbent is a more effective adsorbent than the GBC for the reduction of fluoride ion levels to the standard permissible limit (1.5 mg/L).

Keywords: Conocarpus erectus; Fluoride ion; Biochar; Adsorption; Granular; Powdered

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