

Highly efficient removal of diazinon pesticide from aqueous solutions by using coconut shell-modified biochar

ABSTRACT

This study evaluates the adsorption of diazinon from aqueous solutions onto coconut shell-modified biochar using a batch system. The amount of dosage and initial pH are the main parameters being studied to obtain maximum adsorption capacity of the probe molecules. The carbonized coconut shell biochar (BC1), activated coconut shell biochar (BC2), chemically modified phosphoric acid (BC3) and sodium hydroxide coconut shell biochar (BC4) were prepared and tested as variables in the adsorption experiment. The characteristic of biochar via SEM, EDX and BET analysis revealed the large porous of surface morphology and slight changes in the composition with high surface area (405.97 – 508.07 m²/g) by following the sequence of BC3 > BC2 > BC4. Diazinon removal percentage as high as 98.96% was achieved at pH 7 with BC3 as adsorbent dosing at 5.0 g/L. The high coefficient of determination, R² with a small value of ERRSQ and χ^2 error analysis present the BC1 (0.9971) and BC2 (0.9999) are best fitted with Freundlich isotherm indicates multilayer sorption onto heterogeneous surface whereby the Langmuir isotherm model is the best fitting is described of monolayer adsorption process onto the homogenous surface of BC3 and BC4. The results indicated the maximum adsorption capacity (q_m) was achieved by BC3 with 10.33 mg/g, followed by BC2 (9.65 mg/g) in accordance to the Langmuir isotherm while Freundlich isotherm showed the highest adsorption capacity (kF) with 1.73 mg/g (L/mg)^{1/n} followed by BC4 with 0.63 mg/g (L/mg)^{1/n} at favorable adsorption isotherm (1 ≤ n ≤ 10). Thus, the results obtained depicted that BC2 and BC3 are highly efficient adsorbents and both exhibit great potential in removing diazinon from aqueous solutions.

Keyword: Adsorption; Biochar; Organophosphorus pesticides; Diazinon; Treatment