Adsorption Of 2,4-dichlorophenol (2,4-DCP) Onto Activated Carbon Derived from Coffee Waste

ABSTRACT

In this study, activated carbons (ACs) were prepared from coffee waste via a two-stage self-generated atmosphere method after impregnation by zinc chloride (ZnCl2). The effect of impregnation ratio (IR) on the physicochemical properties and adsorption capacity for 2,4-dichlorophenol (2,4-DCP) was studied. Characterizations of the generated ACs were carried out to determine the percentage of yield, moisture and ash contents, pH, surface chemistry studies and morphological attributes. The results showed that the yield of AC decreased from 41.16% to 37.12% with the increase in IR. As for moisture and ash contents, the percentage values ranged from 4.18% to 6.16% and 9.73% to 10.34% respectively. Meanwhile, the AC samples were slightly acidic with pH values varying between 6.06 and 6.56. The adsorption capacity increased from 16.8 mg/g for AC1 to 21.72 mg/g for AC4. The AC produced with an IR of 4:1 (AC4) had the highest adsorption capacity of 2,4-DCP, which was 21.72 mg/g. The maximum Brunauer, Emmett and Teller (BET) surface area of the best produced AC4 was found to be 951.10 m2/g, which is by far the highest achieved in comparison with other coffee waste-derived ACs reported in the literature. N2 adsorption-desorption graph showed a Type I isotherm, indicating that the AC4 was a microporous solid with chemisorption properties. Langmuir isotherm model was found to be a better fit for the adsorption data when compared to the Freundlich isotherm model. Pseudo-second order kinetic model was best described for the kinetic of 2,4-DCP adsorption. This proved that 2,4-DCP adsorption by AC4 was a chemisorption process.