

Effect of pyrolysis temperatures on the properties of biochars derived from lignocellulosic biomass and their methylene blue adsorption behavior

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A comparative study of the adsorption of an organic compound such as methylene blue was carried out using biochars derived from local waste in Morocco as argan cake (AC) and olive cake (OC). The biochars were prepared at three different pyrolysis temperatures of 600, 700, and 800 °C to investigate the effect of pyrolysis temperature on the properties of the biochar's and also on their adsorption capacity towards methylene blue (MB). Pyrolysis was performed in a muffle furnace at 600, 700, and 800 °C with a heating rate of 2 °C/min. Proximate, TGA-DTG, CHNS-O, XRF, FTIR, SEM-EDX, BET, and XRD analyses were used to characterize the materials for physicochemical, structural, and thermal properties. Results showed that biochar yield, decreased with increasing pyrolysis temperature for both feedstocks. However, ash content, fixed carbon, thermal stability, carbon content, pH, electrical conductivity (EC), and specific surface area (SSA) of biochar increased with increasing pyrolysis temperature. Fourier-transform infrared spectroscopy (FTIR) analysis showed that the surface of the biochar was rich with hydroxyl, phenolic, carbonyl and aliphatic groups. SEM scanning revealed a porous structure for olive cake biochar. In batch adsorption studies, the biochars were used to remove MB from aqueous solutions, showing that adsorption capacity increased with pyrolysis temperature for both biomasses. MB adsorption capacity was used as an indicator of biochar quality. In addition, the three biochars prepared from olive cake (BOC600, BOC700, and BOC800) showed higher ability to remove MB from aqueous solutions compared to biochars prepared from argan cake (BAC600, BAC700, and BAC800).