HYDROCHAR SYNTHESIS FROM WASTE CORNCOB USING HYDROTHERMAL CARBONIZATION AND EVALUATION FOR AMMONIUM ADSORPTION

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Abstract

Corncob (CC) is one of the important wastes in Turkey due to its large-scale production and consumption. Efficient disposal of this large-scale waste and even converting it into industrial materials such as hydrochar can provide significant added value. Ammonium, one of the important pollutants in water, should also be reduced below acceptable limits before being discharged into receiving environments. Therefore, this study aimes to synthesize and characterize microwave-assisted (MHC) and subcritical water (SHC) based hydrochars from CCs for ammonium removal from water. For this purpose, it was a goal to determine the effective hydrochar synthesis method for ammonium adsorption. The synthesized hydrochars were characterized by Scanning Electron Microscopy- Energy Dispersive X-Ray (SEM-EDX), N_2 adsorption-desorption isotherms, and Fourier Transform Infrared (FT-IR) analysis. According to the EDX results, the C/O ratio (atomic %) was determined as 0.55 and 0.35, in MHC and SHC, respectively. Nitrogen adsorption-desorption isotherms revealed that hydrochars obtained by both methods have two different pore types micro and meso. According to the BET theory, the surface areas were calculated as 6.40 m^2 g^{-1} and 5.20 m^2 g^{-1} for MHC and SHC, respectively. The maximum pore volume calculated with the Howarth-Kawazoe model was determined as 0.021 cm^3 g^{-1} for MHC, and 0.016 cm^3 g^{-1} for SHC. In the energy consumption per unit adsorbent, MHC was lower than SHC. In the ammonium removal studies, the maximum adsorption capacity of MHC and SHC was measured as 13.1 mg g^{-1} and 10.5 mg g^{-1}, respectively. As a result, MHC came to the forefront in terms of surface area, maximum pore volume, and energy consumption compared to SHC. It was also seen that MHC was more advantageous than SHC in ammonium removal. The use of synthesized hydrochars from CC in ammonium removal, which creates a serious pollution problem in waters, can make significant contributions to water pollution and control. In addition, the use of hydrochars enriched with ammonium as fertilizer in soil improvement is worth investigating.

Keywords: Corncob, hydrochar, hydrothermal carbonization, microwave-assisted, ammonium removal.

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