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PORE STRUCTURE CHARACTERIZATION OF CHEMICALLY MODIFIED BIOCHAR DERIVED FROM RICE STRAW

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Abstract

Biochar derived from agricultural biomass waste is increasingly recognized as multifunctional material for various applications according its characteristics. It is therefore essential to investigate biochar properties before large-scale application. In this study, rice straw-derived biochars produced at different temperature (550, 650, 750 ^{o}C). The resulting biochars were subjected to liquid-phase oxidation by different agents including KOH, HNO_3, H_2SO_4, H_2O_2 and $KMnO_4$ to obtain biochar with different properties. Pore structure characteristics including surface area, micro and meso pore volume, and pore size distribution were studied. Biochar surface is sensitive to the type of modifying reagent. Biochars treated by KOH, $KMnO_4$ and H_2O_2 give higher nitrogen uptake in the range of micropores and mesopores. The rice straw-derived biochars especially produced at 650^{o}C and treated by KOH have the highest surface area (179.7 m^2/g) and micropore volume (0.081 cc/g) than the rest of biochars. In contrast, biochars treated by H_2SO_4 and HNO_3 give lower nitrogen uptake and lead to loss of the biochars porosity. Loss of micropore volume is as low as 10-40% of pore volume in H_2SO_4 and HNO_3 treated biochars. Biochars exhibit wide pore size distribution, from narrow micropores to wide mesopores. One modal distribution was obtained with peak oscillate in region of 1.0 to 1.3 nm in the case of micropore region. However, for mesopore region, two minima at about 3.0 nm and 5.0 nm were observed. More homogonous micropore distribution was produced from KOH and H_2O_2 treatment in contrast to that of HNO_3 and H_2SO_4 treatment, which give heterogeneous micropore distribution.

Key words: activated biochar, pore size distribution, pore volume, rice straw, surface area

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