Surface modification and characterization of a RS activated carbon: density, yield, XRD, ash, and moisture content

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ABSTRACT
Rice straw (RS) is considered to be agricultural waste in developed countries. Since the collection and disposal of this residue is becoming more difficult and expensive, it is left unused as waste material or simply burned in the fields, thereby, creating significant environmental problems like poor air quality that has serious consequences for the population. Converting this renewable biomass to produce activated carbons would have both economic and health benefits for rural communities. Communities could gain income from the sale of the RS to companies or institutions processing them to carbon. In addition, wastewater treatment from organic and inorganic pollutants using the RS based carbon could be developed. Otherwise, this reduces the pollution resulting from RS burning. In this concern, single-step steam activation was performed at temperature ranges 550–750°C. The activated RS was subjected to liquid-phase oxidation by different modifying agents include KOH, HNO3, H2SO4, H2O2, and KMnO4 to obtain carbon with various surface characters. We studied the physico-chemical properties of the 18-activated carbons derived from RS and prepared by one-step steam pyrolysis. Most of adsorbents exhibited bulk density greater than 0.25 g/ml (American Water Works Association lower limit of AC for practical use). Treatment of carbons with oxidizing agents leads to an increase of ash content except KOH; this may be due to silica which is dissolved easily in KOH. X-ray analysis of activated RS results showed a reduction of the amorphous structure.

Keywords: Activated carbon; Rice straw; Density; Yield; XRD; Ash and moisture content

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