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A Comparative Study on Biochar from Slow Pyrolysis of Corn Cob and Cassava Wastes

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Abstract : Biomass such as corn and cassava wastes if left to decay will release significant quantities of greenhouse gases (GHG) including carbon dioxide and methane. The biomass wastes can be converted into biochar via thermochemical process such as slow pyrolysis. This approach can reduce the biomass wastes as well as preserve its carbon content. Biochar has the potential to be used as a carbon sequester and soil amendment. The aim of this study is to investigate the characteristics of the corn cob, cassava stem, and cassava rhizome in order to identify their potential as pyrolysis feedstocks for biochar production. This was achieved by using the proximate and elemental analyses as well as calorific value and lignocellulosic determination. The second objective is to investigate the effect of pyrolysis temperature on the biochar produced. A fixed bed slow pyrolysis reactor was used to pyrolyze the corn cob, cassava stem, and cassava rhizome. The pyrolysis temperatures were varied between 400 °C and 600 °C, while the heating rate and the holding time were fixed at 5 °C/min and 1 hour, respectively. Corn cob, cassava stem, and cassava rhizome were found to be suitable feedstocks for pyrolysis process because they contained a high percentage of volatile matter more than 80 mf wt.%. All the three feedstocks contained low nitrogen and sulphur content less than 1 mf wt.%. Therefore, during the pyrolysis process, the feedstocks give off very low rate of GHG such as nitrogen oxides and sulphur oxides. Independent of the types of biomass, the percentage of biochar yield is inversely proportional to the pyrolysis temperature. The highest biochar yield for each studied temperature is from slow pyrolysis of cassava rhizome as the feedstock contained the highest percentage of ash compared to the other two feedstocks. The percentage of fixed carbon in all the biochars increased as the pyrolysis temperature increased. The increment of pyrolysis temperature from 400 °C to 600 °C increased the fixed carbon of corn cob biochar, cassava stem biochar and cassava rhizome biochar by 26.35%, 10.98%, and 6.20% respectively. Irrespective of the pyrolysis temperature, all the biochars produced were found to contain more than 60 mf wt.% fixed carbon content, much higher than its feedstocks.

Keywords : biochar, biomass, cassava wastes, corn cob, pyrolysis
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