CHARACTERIZATION AND CO-FIRING POTENTIAL OF A HIGH ASH COAL WITH *BAMBUISA BALCOOA*

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Abstract:

Two pre-treatment methods, i.e. torrefaction and low-temperature carbonization, were applied to a bamboo species, "Bambusa balcooa" at a temperature between 250 °C and 380 °C. The physicochemical characteristics and thermal behavior of the coal, raw bamboo and thermally treated bamboo sourced from South Africa were investigated using thermogravimetric analysis (TGA). The aim was to enhance the fuel quality and to determine the combustion potential of Bambusa balcooa solely, or co-fired with a low rank Bituminous coal. The co-firing of the raw and thermally treated bamboo samples with coal of 27.50% ash content was conducted in the absence of oxygen, using a ratio of coal inclusion of 10%, 30%, 50% and 75%.

Results obtained from the proximate and ultimate analyses show a considerable difference in the quality of the raw bamboo from the thermally–treated samples. The ash content and fixed carbon “dry basis” of the raw Bambusa balcooa (BB) were found to be 0.49% and 6.01%, respectively, with a calorific value of 18.53 MJ/kg. After the BB was torrefied (TBB) at 280 °C and carbonized (CBB) at 380 °C, a fuel with 3.63% ash content and 38.20% fixed carbon, with calorific values of 24.02 MJ/kg and 28.20 MJ/kg respectively was produced. The nitrogen content of the raw BB was found to be 0.22% while the sulphur was untraceable. A wide range in the sample characteristics was obtained from the plot of H/C and O/C ratios.

DTG results indicate that as the biomass samples decomposed from 250 °C to 380 °C, a solid with similar characteristics to and higher energy density than the coal utilized in this investigation was achieved. The raw BB sample was the fastest and easiest fuel to ignite with very low devolatilization and peak temperatures compared to the thermally treated BB and high ash coal utilized. In summary, the results provided data on the co-firing characteristics of raw BB, thermally treated bamboo samples and coal/bamboo blends in various proportions and indicated their co-firing compatibility.

Keywords: Bamboo, Blending, Carbonization, Coal, Combustion, Torrefaction

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