

Thermodynamic Study of Bambusa Tulda's Thermochemical Process for Energy Production

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Abstract

This study shows a path to convert waste into wealth. Slow pyrolysis of Bambusa Tulda or Indian bamboo, was carried out in the presence of nitrogen in a horizontal fixed bed reactor at 300 C, 400 C, 500 C, 600 C, 700 C, and 800 C. Complete characterization of Bambusa Tulda and its biochar was performed which includes SEM, XRD, FTIR, BET Ultimate analysis, and proximate analysis. The effect of pyrolysis temperature on the yield of Biochar, bio-oil, and syngas was studied. Also, the effect of temperature on the calorific value of biochar obtained was studied. The result shows that with an increase in temperature Biochar yield, Bio-oil yield, BET surface area, and calorific value increase and then start to decline after a particular temperature. Whereas the gas yield increases with an increase in temperature. Considering biochar and bio-oil as main components, exergy analysis was performed to find out the energy and exergy efficiency of the pyrolysis system. It was also observed that with an increase in temperature, both efficiency increases.

Keywords: Slow Pyrolysis, Energy balance, Exergy analysis, biochar, bio-oil torrefaction, syngas, calorific value, energy, and exergy efficiency.