Effect of Insulator on Temperature Distribution and Char Quality in Slow Pyrolysis Process Clove Leaves

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Abstract. Clove (Syzygium aromaticum L) is a plant that bears fruit once a year and can support the community's economy. Clove leaf waste can be converted into biochar fuel through pyrolysis. This research aims to determine the temperature distribution and biochar quality in three sections (bottom, middle, and top) of the pyrolysis reactor using an insulator. This method involves proximate analysis and calorific value measurement. Dried clove leaves are collected, cut into pieces, and placed in three zones inside the reactor. Gradual heating is applied using a combustion heat source, and the temperature is recorded every two minutes. Isolation affects the characteristics of biochar in different zones. The isolator affects the characteristics of biochar in various zones. At a temperature of 300 °C, biochar from the bottom reactor zone without an insulator has a moisture content of 4.11%, ash content of 12.97%, volatile matter of 18.78%, fixed carbon of 64.14%, and a calorific value of 6523 cal/g. In the reactor equipped with an insulator, biochar has a moisture content of 5.47%, ash content of 13.05%, volatile matter of 32.49%, fixed carbon of 48.99%, and a calorific value of 5852 cal/g. Although the characteristics of biochar from the reactor without an insulator are not significantly different, the process requires more time, specifically 2 hours and 14 min, and consumes more energy to reach a temperature of 300 °C. The reactor equipped with an insulator reaches 300 °C in 54 minutes and 350 °C in 58 min, with more efficient energy usage.

Keywords: Biomass, Clove leaf, Insulator, Pyrolysis, Heat transfer