DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF A LABORATORY BIOMASS TORREFACTION MACHINE

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ABSTRACT

GALLARDO, REÑEL DOMINGO, Department of Agriculture and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, **May 2019. DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF A LABORATORY BIOMASS TORREFACTION MACHINE**

Adviser: **RUEL G. PENEYRA**

A prototype lab-scale torrefaction machine was designed fabricated and evaluated. Torrefaction process, being uncommon in the locality requires parameter studies to be implemented properly at economical scale. Hence this study was conceptualized.

The developed torrefaction machine have a reactor capacity of 4 liters. It is fitted with LPG burner heating assembly with temperature monitor and air locks for reduced O_2 environment inside the reactor. The machine can be operated at regulated torrefaction temperature of 200-250 °C and 250-300 °C. the machine was fabricated locally using locally available materials, mostly steel.

On the potential to convert biomass to char torrefaction temperature of 290 °C at 5 minutes residence time corresponding to one revolution per minutes resulted to complete degree of carbonization and produced less ash. The highest char production rate was obtained using combination of torrefaction temperature and residence time. The combustion resulted to char production rate of 0.46 kg per hour at a heating rate of 10.72 °C per minute. A mass recovery of 44 % was also observed with short ignition time of 28 second only. Combustion time was recorded at 15.59 minutes with 367.33 °C. Treatment combination 290 °C at 5 min consumed a total theoretical energy of 56.84 MJ in the conversion of 2.5 kg raw dried cacao pod husk. In mass basis 1.13 kg of LPG was used per 2.5 kg of sample.

The study was analyzed using factorial analysis Complete Randomized Design (CRD) and comparison among means was done using Least Significant Difference (LSD).

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