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Optimization of carbonization of coconut (*Cocos nucifera* L.) rachis using the modified drum type carbonizer

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Coconut rachis was carbonized using a modified drum type carbonizer and the effects of fuel size and number of air openings on the carbonization efficiency were evaluated. Fuel size was varied to 3.0 inches, 4.5 inches, and 6.0 inches in length; the settings of air inlets opened per layer were varied to four, six and eight air openings. A two-factor three-level full factorial design was used for statistical analysis, and six experimental runs were conducted. Statistical analysis at 95% confidence level through ANOVA showed that fuel size has significant linear, and combined linear and quadratic effects while the number of air openings only showed significant linear effects on the carbonization efficiency. Results showed that increasing the fuel size and decreasing the number of air openings tend to increase actual recovery and efficiency. In addition, the optimal condition for carbonization was determined at 6.0 inches fuel size, and four air openings. A verification run was conducted and showed no significant difference with the predicted efficiency. Rachis charcoals were characterized to have a similar appearance with a wood charcoal and have a heating value of 26.09MJ/kg. Water boiling tests showed that rachis charcoal has a burning rate of 7.84g/min, specific fuel consumption of 1.11kg-fuel per kg-water, and thermal efficiency of 20.85%. Results showed that rachis charcoal has the comparable thermal efficiency to wood charcoal, thus renders a potential fuel source for domestic purposes.

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