CE.AGR.9

PERFORMANCE EVALUATION OF A PROTOTYPE GASIFIER TO PRODUCE COCONUT-SHELL CHARCOAL

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The coconut shell charcoal manufacturing industry faces a challenge of developing a highly efficient environment-friendly charcoal manufacturing reactor. In this research, the performance of a gasifier cum pyrolysis reactor which was built by the Coconut Research Institute was evaluated. The aim was to produce good quality charcoal from coconut shells with minimum modifications to the available prototype gasifier.

The gasifier was tested for two process modifications: control of air supply for combustion and change of charcoal removal frequency and thereby changing the retention time. The performances were evaluated based on the mass production efficiency, energy budget and cost effectiveness. Eight trials were conducted for different retention times and oxygen supply conditions, and the best time and oxygen supply condition was selected for further investigations. The product quality was tested based on the specifications stipulated by Sri Lanka Standards Institute (SLS 571:1982).

Results showed that mass loss of material during pyrolysis exceeds the expected yield at a hypothetical optimum condition. Among the tests, 20-30 minute removal frequency under limited air supply condition gave the best mass recovery rate. The least energy consumption was also recorded for the same treatment. The cost of charcoal production in all treatment conditions gave a net loss. Although the quality of produced charcoal fulfills the SLS standards for volatile and fixed carbon, the fraction of undersized particles and ash content of charcoal were higher than the standards.

Although the gasifier produces charcoal that is superior to the charcoal made in traditional pits, the gasifier is unable to make the charcoal with sufficient mass, energy and cost recovery. Therefore, further modifications are needed to reduce mass loss and percentage of undersized particles in the final product.

Funding: Coconut Research Institute.