

Gasification of Torrefied Coconut Shells for Energy Generation

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Case Description

The increasing global population calls for the development and use of alternate sources of electricity, as fossil based fuels pollute the environment and are depleting. Aside from sunlight, wind, water, the ocean and the earth's heat, biomass is another renewable resource that can help sustain economic growth while also being resistant to global disturbances. Biomass is a biodegradable and non fossilized organic material obtained from abundant, clean and carbon neutral plants, algae and animals that have the potential to replace fossil fuels as a bioenergy resource [1,2]. Coconut is a biomass resource found in tropical areas in abundance. The Philippines grows 347 million coconut trees yielding 14.7 million tons of nuts, resulting in 2.2 million tons of coconut shells every year. The study's objective is to use coconut shells as a biomass resource to produce electricity using a gasification process. The coconut shells were Torrefied and fed into the designed and developed 1.8 kVA Biomass Gasification Power System (BGPS) and were tested and the performance was evaluated. The raw coconut shells have an 8.55 kWh/kg calorific value [3-6]. After being torrefied at 275 °C for 30 minutes, the calorific value reached a high of 9.55 kWh/kg, indicating an increase of 11.70%. The mass yield was 90.10%, while the energy density was 111.64%, for a total energy yield of 100.59%. The torrefied coconut shells are heated to 904 °C in the gasifier and then thermochemically changed to release producer gas, resulting in thermal efficiency of 64.51%. The producer gas was converted into synthesis gas using the cooler, filters and other components, resulting in thermal efficiency of 62.67%. The BGPS's energy conversion efficiency was 13.06%. The calorific value of coconut shells was increased by 11.70% by torrefaction, bringing the total energy generated by the BGPS to 1.247 kWh per kilogram. Furthermore, the created BGPS can be scaled to produce rural and urban electrification (Figure 1).

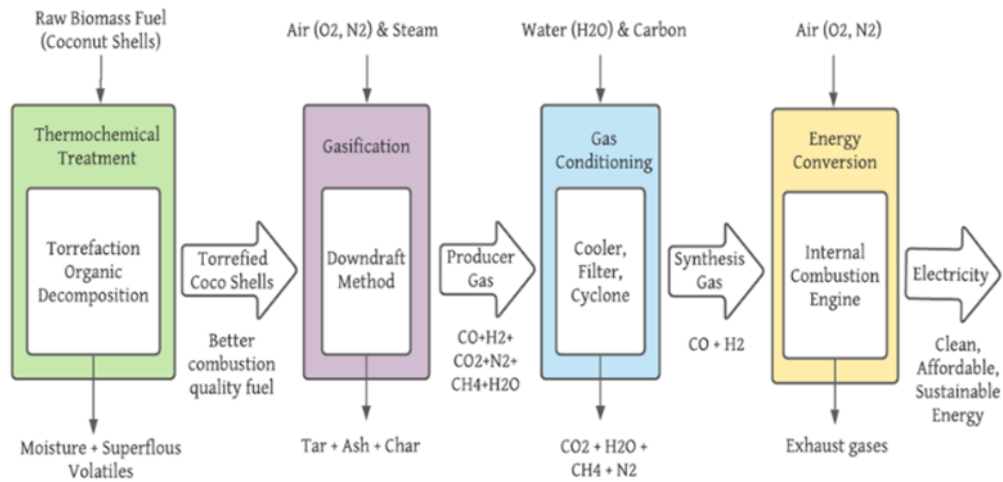


FIG.1. Gasification of the torrefied coconut shells to produce clean electricity.

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