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Biogas Potential of Coffee Processing Waste in Ethiopia

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Abstract: Primary coffee processing is performed following the dry method or wet method. The dry method generates husk as a by-product, while the wet method generates pulp, parchment, mucilage, and waste water. In this study, characterization, as well as the potential of husk, pulp, parchment, and mucilage for methane production were examined in biochemical methane potential assays performed at 37 °C. Pulp, husk, and mucilage had similar cellulose contents (32%). The lignin contents in pulp and husk were 15.5% and 17.5%, respectively. Mucilage had the lowest hemicellulose (0.8%) and lignin (5%) contents. The parchment showed substantially higher lignin (32%) and neutral detergent fiber (96%) contents. The mean specific methane yields from husk, pulp, parchment, and mucilage were 159.4 ± 1.8, 244.7 ± 6.4, 31.1 ± 2.0, and 294.5 ± 9.6 L kg^{-1} VS, respectively. The anaerobic performance of parchment was very low, and therefore was found not to be suitable for anaerobic fermentation. It was estimated that, in Ethiopia, anaerobic digestion of husk, pulp, and mucilage could generate as much as 68 × 10^6 m^3 methane per year, which could be converted to 238,000 MWh of electricity and 273,000 MWh of thermal energy in combined heat and power units. Coffee processing facilities can utilize both electricity and thermal energy for their own productive purposes.

Keywords: husk; pulp; parchment; mucilage; methane; renewable energy