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Processing of East African Highland Green Bananas: Banana Waste Characterisation for Bio-Energy Production in Uganda

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Abstract

World over, agro-processing is a high energy consuming enterprise that in-turn generates a lot of waste residues. Uganda is the second largest global producer of bananas and the industry generates different waste fractions both at production and banana fruit processing. However, no thorough auditing and characterisation of such waste had been done to guide potential value addition through bioenergy production. This study therefore aimed at assessing general banana processing, waste management methods, characterisation of waste residues and evaluation of wastes' potential for biogas energy production through anaerobic digestion. The results revealed that methods for management of these wastes were mainly by dumping, reuse as mulching materials and animal feeds, as well as use of dried fraction for fuel. The study further indicated that processing of a unit bunch of green bananas generates 40 % as pulp and 60 % as total waste residues with total waste to pulp ratio of 1.5 and peel / pulp ratio of 1.3. Laboratory waste analysis indicated that the waste contained high moisture content; 90 % and 83 % for peduncle and peels respectively. The high moisture content suggests that banana waste is amenable to biochemical conversion technologies and would require minimal additional water requirement thus reducing water costs. Other analysis results indicate that waste was highly organic with more than 80 % of the total solids as volatile. However, the waste had higher carbon content than total nitrogen that translated into higher C:N ratio of 41 in mixed waste. Furthermore, the lignocelluloses content of the waste comprised of 21.16 %, 10.46 % and 11.31 % for cellulose, hemicelluloses and lignin, respectively. The current waste management methods were found to be neither efficient nor profitable, thus research into economically viable options for waste utilisation and reduction strategies is imperative. In conclusion, the physic-chemical characteristics of banana waste make it favourable for bioenergy production through anaerobic digestion. Appropriate waste pre-treatment would enhance the process for improved energy yields.

Keywords: Banana processing, banana waste, bio-energy, bio-gas production, waste characterisation, waste value addition

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