

Topic: GHG and Financial Assessment of Biogas Production from Mango Peel Waste:
Case Study of a Dry Mango Factory in Thailand

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ABSTRACT

Thailand, an agriculturally based country, is one of the world's largest producers and exporters of processed foods. Thailand is among the three top largest producers of mango. The processing of mango into dry mango sheet leads to the production of mango waste, including mango seed and mango peel. Mango peel represents about 10 to 18% by weight of the total fresh fruit and along with mango seed is usually open dumped by mango processing factories. Mango peels are organic in nature, so a biogas technology could be an interesting treatment option to produce energy.

This research study aimed to assess a specific mango factory in Thailand, the potential environmental benefits associated with biogas production from mango peels as compared to open dumping in nearby mango fields. The assessment focused exclusively on greenhouse gas emissions using global warming potential as the indicator. The financial viability of the biogas system was also investigated. For both the environmental and financial assessment, the potential of biogas to substitute LPG in the mango factory and solid digestate (a co-product of the biogas system) to substitute chemical fertilizers in the mango orchards supplying the factory, were included.

Based on the amount of mango peel waste produced during the mango season (120 days) each year, the results of this research study showed that, open dumping would result in emissions of 0.77 kgCO_{2eq} per kg of mango peel waste. The utilization of all the mango peel waste as feedstock for biogas production and its internal recycling as a source of energy for mango processing, would substitute 17% of the annual amount of LPG used by the factory. Aside from biogas, a total of 4.3 tonnes of solid digestate is also produced which was estimated could enable substituting about 1% of the annual amount of chemical fertilizers applied in the mango plantations supplying the factory.

The overall GHG emissions associated with such a biogas system were found to be lower than those associated with open dumping of mango peel waste, amounting to 0.057 kgCO_{2eq} per kg of mango peel. However the financial assessment revealed that the biogas system is not a viable option under the conditions of this study. The net present value (NPV) was found to be negative. This is mainly because of limitation in the amount of feedstock (mango peel) available for the biogas system, as only generated during the mango growing season.

Keywords: Biogas, GHG Emission, Financial assessment, Mango factory, Fruit waste, Recycle of waste