Utilization of fruit waste as biogas plant feed and its superiority compared to landfill

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Abstrak

Fruit waste is a part of municipal solid waste which is typically disposed of directly to a landfill site. In order to utilize this valuable renewable resource, anaerobic biological processes can be employed to convert fruit waste to biogas. This usable gas is then used to generate electricity. This paper describes a comprehensive study to set up technology for converting fruit waste to electricity via biogas production. First, the fruit waste characteristics (type and composition) were systematically evaluated, and then laboratory experiments for biogas conversion to explore gas production from the waste were carried out. The biogas plant was then designed, based on the information obtained. Finally, a comparison of biogas plant with landfill was performed using life cycle assessment (LCA) to determine environmental impacts, and economic evaluation to assess daily processing costs. The results from waste characterization in one of the biggest fruit markets in Indonesia showed that the three main component fruit types were orange (64%), mango (25%), and apple (5%). Rotten fruit contributes up to 80% of the total waste in the fruit market. Based on the experimental work, the potential gas production in the biogas plant was calculated to be approximately 1075 Nm3/day, comprising 54% methane, based on 10 tons per day of fruit waste. The comparison demonstrates that it is a better option to utilize fruit waste in a biogas plant, in terms of LCA and daily operational costs, than to dispose of it in landfill.