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Biogas Production from Kitchen Waste for a Household Sustainability

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Abstract : South African's informal settlements produce tonnes of kitchen waste (KW) per year which is dumped into the landfill. These landfill sites are normally located in close proximity to the household of the poor communities; this is a problem in which the young children from those communities end up playing in these landfill sites which may result in some health hazards because of methane, carbon dioxide and sulphur gases which are produced. To reduce this large amount of organic materials being deposited into landfills and to provide a cleaner place for those within the community especially the children, an energy conversion process such as anaerobic digestion of the organic waste to produce biogas was implemented. In this study, the digestion of various kitchen waste was investigated in order to understand and develop a system that is suitable for household use to produce biogas for cooking. Three sets of waste of different nutritional compositions were digested as per acquired in the waste streams of a household at mesophilic temperature (35°C). These sets of KW were co-digested with cow dung (CW) at different ratios to observe the microbial behaviour and the system's stability in a laboratory scale system. The gas chromatography-flame ionization detector analyses have been performed to identify and quantify the presence of organic compounds in the liquid samples from co-digested and mono-digested food waste. Acetic acid, propionic acid, butyric acid and valeric acid are the fatty acids which were studied. Acetic acid (1.98 g/L), propionic acid (0.75 g/L) and butyric acid (2.16g/L) were the most prevailing fatty acids. The results obtained from organic acids analysis suggest that the KW can be an innovative substituent to animal manure for biogas production. The faster degradation period in which the microbes break down the organic compound to produce the fatty acids during the anaerobic process of KW also makes it a better feedstock during high energy demand periods. The C/N ratio analysis showed that from the three waste streams the first stream containing vegetables (55%), fruits (16%), meat (25%) and pap (4%) yielded more methane-based biogas of 317mL/g of volatile solids (VS) at C/N of 21.06. Generally, this shows that a household will require a heterogeneous composition of nutrient-based waste to be fed into the digester to acquire the best biogas yield to sustain a households cooking needs.

Keywords : anaerobic digestion, biogas, kitchen waste, household
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