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QUANTIFICATION OF METHANE EMISSIONS OF BIOGAS PLANTS FROM DIFFERENT WASTE MATERIALS & TECHNOLOGIES

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ABSTRACT

Global warming and climate change occur due to natural causes and anthropogenic activities. Disposal of organic waste results in considerable amount of methane (CH4) emissions. At the same time, the interest on alternative energy sources has increased in the background of rising energy crisis. Biodegradable wastes are a good source of alternative energy and helps to reduce CH4 emissions. The main objective of this study was to quantify the CH4 emission of biogas plants based on different waste materials and technologies used in biogas plants in Sri Lanka. Out of a list of 218 active biogas plants obtained using the information collected from reputed biogas plant designing agencies, 132 biogas plants were selected for the study using a stratified sampling method, considering the sizes of the biogas plant, waste materials used, and technology adopted. The amount of CH4 emission were measured using a metered instrument connected to the gas releasing outlet and flow meter outlet connected to the cooker. Using this setup, the biogas quantity used during a 2-hour period was measured for each biogas plant. The quantity of biodegradable waste fed to the plant was measured in locations where possible. Methane concentration in most of the tested plants was around 48% from gas yield which is closer to the values reported in literature. The highest CH4 generation (74% out of total gas yield) was recorded from a plant installed in a hotel despite overloading the digester with excess waste water from the wash rooms. Approximately 81% of the plants used kitchen waste as the main feeding material while 23 % used cow dung and 20% used sewerage feeds. Noticeable changes recorded in CH4 production between sewerage (74%) and kitchen waste + *Gliricidia sepium* (70%) as waste material feedstock. Highest CH4 concentration was generated from continuous flow fixed dome technology type and it was about 57% of the total gas yield. Plants with Flug-flow technology recorded 55% CH4 yield. Although, there is a correlation between waste material and technology type of biogas plant to the production of CH4, digester required significant amount of heat to maintain bacterial function for the stability of gas production and the outdoor climatic conditions also found to affect CH4 generation.

Keywords: Biogas, climate change, organic waste, alternative energy