Mesophilic anaerobic co-digestion of poultry dropping and *Carica papaya* peels: Modelling and process parameter optimization study

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Mesophilic anaerobic co-digestion of poultry dropping and *Carica papaya* peels: Modelling and process parameter optimization study

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Abstract

The study evaluated anaerobic co-digestion of poultry dropping and pawpaw peels and the optimization of important process parameters. The physic-chemical analyses of the substrates were done using standard methods after application of mechanical, thermal and chemical pre-treatments methods. Gas chromatography analysis revealed the gas composition to be within the range of 66 to 68% Methane and 18 to 23% Carbon dioxide. The study equally revealed that combination of the different pre-treatment methods enhanced enormous biogas yield from the digestion. Optimization of the generated biogas data were carried out using the Response Surface Methodology and the Artificial Neural Networks. The coefficient of determination (R^2) for RSM (0.9181) was lower compare to that of ANN (0.9828). This shows that ANN model gives higher accuracy than RSM model for the current. Further usage of *Carica papaya* peels for biogas generation is advocated.

Keywords: Biogas, Pawpaw, Methane, Microorganisms, Optimization, Pre-treatment.

1. Introduction

Anaerobic digestion is a proven technological method of converting organic matter thereby producing biogas and nutrient-rich digestate (Astals et al. 2015; Leite et al. 2016; Zou et al. 2016). It has been globally applied in the treatment of diverse wastes, agricultural residues, energy crops and is a veritable means of abating environmental pollution (Razaviarani and Buchanan, 2015; Fierro et al. 2016).

The organic fraction of poultry dropping is biodegradable and thus fitting for anaerobic digestion for methane yield (Dalkilic and Ugurlu, 2015). However, the digestion of poultry dropping is usually slowed down due to its low C/N ratio, richness in nitrogen and high total ammonia levels (Tian et al. 2015). Therefore, co-digestion with other carbon-rich substrates is often recommended to guarantee the success of anaerobic digestion and subsequent improvement in