DEVELOPMENT OF A PILOT-SCALE BIOGAS PLANT TO UTILIZE BIOMETHANE AS A TRANSPORT FUEL

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ABSTRACT

This project was to develop a system to utilize Biomethane as a transport fuel. It was started at the Department of Chemical and Process Engineering, University of Moratuwa funded by the Ministry of Science and technology. In this project, initially a suitable process was developed to produce biogas utilizing food waste obtained from university canteens and upgraded as a vehicle fuel. Then the pilot-scale biogas plant was designed and construction of the building and fabrication of equipments were preceded.

Initially laboratory scale experiments were conducted to find out the design parameters such as analysis of food waste, composition for optimum gas production rate, etc. According to that, the total solid content (TS) is 37% and total volatile solid content (TVS) is 23%. The best composition for optimum gas production is 10% solid in the slurry.

The pilot-scale biogas plant was operated and produces biogas utilizing food waste and upgraded using a water scrubber to remove CO_2 and H_2S. After that, the cleaned gas, which is having a composition of 85% CH_4, was used as a vehicle fuel. For the initial trials, biogas was replaced with LPG in a LPG three-wheeler without any modification to the three-wheeler system and it was successfully operated. According to the emission tests carried out for biogas vehicle fuel, it shows that it is operating environment friendly than gasoline.

Keywords: Biogas, Food Waste, Vehicle Fuel, Anaerobic Digestion

DEDICATION

I dedicate this thesis to the two pillars in my life: my parents and my husband. I might not come into this plane without my parents who have dedicated their life for making me an educated and a successful person. In addition, I might not complete this without the love, understanding, support and company received from my husband. I would like to express my love and appreciation for the encouragement and the sacrifices made by both my parents and my husband.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AD	Anaerobic Digestion
ANC	Acid Neutralizing Capacity
CHP	Combine Heat and Power
CNG	Compressed Natural Gas
COD	Chemical Oxygen Demand
HRT	Hydraulic Retention Time
IANGV	International Association of Natural Gas Vehicles
LPG	Liquefied Natural gas
MS – FMSW	Mechanically Sorted Organic Fraction of Municipal Solid Wastes
MOST	Ministry of Science and Technology
MSW	Municipal Solid Waste
PSA	Pressure Swing Absorption
RPM	Revolutions Per Minute
SC – OFMSW	Separately collected Organic Fraction of Municipal Solid Wastes
SLR	Sri Lankan Rupees
SRT	Solids Retention Time
SS – OFMSW	Source Separated Organic Fraction of Municipal Solid Wastes
TS	Total Solids
TVS	Total Volatile Acid
UASB	Up flow Anaerobic Sludge Blanket
VFA	Volatile Fatty Acid

LIST OF APPENDICES