BIODIGESTION OF CASSAVA PEEL WASTE, COW DUNG AND OIL PALM FUEL ASH FOR BIOGAS PRODUCTION

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ENGINEERING (M.ENG) DEGREE IN CIVIL ENGINEERING IN THE DEPARTMENT OF CIVIL ENGINEERING, COLLEGE OF ENGINEERING, COVENANT UNIVERSITY.

OCTOBER, 2021

ACCEPTANCE

This is to attest that this dissertation was accepted in partial fulfilment of the requirement for the award of Master of Engineering (M.Eng.) degree in Civil Engineering, Department of Civil Engineering, College of Engineering, Covenant University, Ota.

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(Dean, School of Postgraduate Studies) Signature and Date

DECLARATION

I, **FAGBENLE, EMMANUEL OLABAYO (13CI015209)** declares that I carried out this research work under the supervision of Professor David O. Olukanni, of the Department of Civil Engineering, Covenant University. I also solemnly declare that to the best of my knowledge, no part of this report either wholly or partially has been submitted here in Covenant University or elsewhere in a previous application for the award of a degree. All sources of data and scholarly publications have been duly acknowledged.

FAGBENLE, EMMANUEL OLABAYO

Signature and Date

CERTIFICATION

We certify that this dissertation titled "**BIODIGESTION OF CASSAVA PEEL WASTE, COW DUNG AND OIL PALM FUEL ASH FOR BIOGAS PRODUCTION**" is an original research work carried out by **FAGBENLE, EMMANUEL OLABAYO (13CI015209)** in the Department of Civil Engineering, College of Engineering, Covenant University, Ota, Ogun State, Nigeria under the supervision of Professor David O. Olukanni. We have examined and found this work acceptable as part of the requirements for the award of Master of Engineering in Civil Engineering.

Prof. David O. Olukanni
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(Head of Department) **Signature and Date**

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(External Examiner) **Signature and Date**

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) **Signature and Date**

DEDICATION

I dedicate this research work to God Almighty, for his wisdom and strength given to me to carry out this research. I also want to dedicate this research to my parents, for their love and support towards fulfilling my goals and ambitions.

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LIST OF ABBREVIATIONS

C:N	Carbon to Nitrogen ratio
COD	Chemical Oxygen Demand
NPK	Nitrogen Phosphorus and Potassium
PHAs	Polyhydroxyalkanoates
PPM	Particle per million
SDGs	Sustainable Development Goals
TS	Total solid
TVS	Total volatile solids
VFA	Volatile fatty acid
TC	Total carbon

ABSTRACT

Biogas, especially those obtained from cassava peels and cow dung have been discovered to contain a low concentration of methane when the cassava peel is not pretreated with chemical compounds or does not contain any buffer in its slurry. To this end, efforts towards achieving a higher concentration of methane have led to the co-digestion of cassava peel, cow dung and oil palm fuel ash under anaerobic conditions. In this project, two 235L digesters were used for this experiment with the first digester (digester A) containing 30 kg of cassava peel, 30 kg of cow dung and 120kg of water in the ratio 1:1:4, respectively. The second digester (digester B) contained 30kg of cassava peel, 30 kg of cow dung, 120 kg of water and 2.4kg of oil palm fuel ash in the ratio 1:1:4:0.08, respectively. The slurries obtained were digested anaerobically under mesophilic conditions. A retention period of 30 days was set for gas production. A comparative study of the biogas yields was conducted to determine if oil palm fuel ash influenced methane production. The overall result shows that digester B containing oil palm fuel ash produced more biogas and had higher methane concentration than digester A. Digester A produced 1070.3L of biogas with a maximum methane concentration of 33.6%. In contrast, digester B produced 1178.1L of biogas with a maximum methane concentration of 60.1%. Outcome from the study indicates that oil palm fuel ash is a suitable buffer for cassava peel and cow dung biogas production. The by-product of the anaerobic process is also useful as manure to grow agricultural produce. The significance of this study is to reduce the environmental and health hazards associated with inadequate waste management of cassava peel in Nigeria by turning waste to wealth through biogas production.

Keywords: anaerobic digestion; cassava peel; cow dung; oil palm fuel ash; environmental pollution; sustainable technology; biogas production; environmental sustainability.