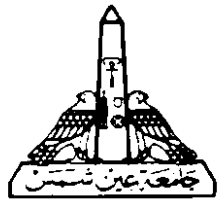

Study of Alternative Green Energy Resources from Agricultural Residues

A Thesis
Submitted to the Public Works Department
Faculty of Engineering
Ain Shams University
For the Fulfillment of the Requirements of M. Sc. Degree
in Civil Engineering (Sanitary and Environmental)

Prepared by

Nehad Ahmed Hassan Mohamed

B.Sc. in Civil Engineering, July 2014
Faculty of Engineering, Ain Shams University

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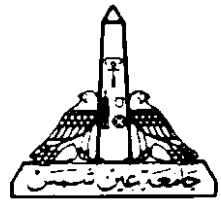

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Date: …../…../ 2019

DEDICATION

This work took a part of my life. I wish to dedicate it to who suffered to educate, prepare and help me to be as I am,

TO ***MY Beloved***

MOTHER AND ***FATHER***

Also, I wish to dedicate my thesis

to my sister and my colleagues

for their encouragement and help to complete this work.

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Statement

This dissertation is submitted to Ain Shams University, Faculty of Engineering, Public works department for the degree of M. Sc. in Civil Engineering (Sanitary and Environmental).

The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University, and Sanitary Engineering Department in Housing and Building National Research Center from 2017 to 2018.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Date: 19 / 1 /2019

Signature: ……..

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the most beneficent and merciful of all.

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Abstract

Seeking alternative resources of energy has become a necessary requirement all over the world because of the rising of energy lack problems. Most of world's consumption of energy counts on fossil fuel sources that became very limited. Therefore the search for renewable resources has become a must.

One of the most controversial technologies is the anaerobic digestion process. A lot of researches are being conducted to investigate the best methods for improving the performance of this process in order to increase its economic value in terms of producing biogas rich in methane, solids effluent that is rich in organics that can be used as fertilizer, liquid effluent rich in nutrients and be an effective way of solid waste disposal to decrease the dependency on landfills.

Agricultural waste forms a huge amount of total waste generations that exceeds almost 50% of municipal solid waste in some countries. More than half of these amounts are not being utilized in proper way. After the crops harvest, the problem appear because the farmers seek to get rid of residues to prepare the field for the new cultivate. Therefore, the crop residues are being thrown in drains or canals or even being burnt which is considered a big economical loss of this amount of biomass and organics in addition to the resulting harmful effects like spread of diseases, harmful emissions and attraction of pests and pathogens.

Egypt is one of the main countries that has a problem of agricultural waste, especially its five highest crops producing waste (rice, corn, wheat, cotton and sugar cane). Lately, Corn has the highest percentage of these waste. The corn residues have high amount of cellulosic materials which is considered the best biomass from crops to be used in biogas production technologies.

Therefore, this study was conducted to investigate effective procedures to improve the degradation rate of lignocellulosic biomass inside the anaerobic digester in solid state. This was concerned with increasing the microbial activity during the hydrolysis step through applying two steps of biological treatment. Corn stover was used as the lignocellulosic substrate in this study that was inoculated with sewage sludge to have anaerobic degradation process. The treatment started with biological pretreatment of substrate either with isolated strains of bacteria (*Pseudomonas aerginosa* and *staphylococcus aureus)* or with isolated strains of fungi (*Apergillus flavus and trichoderma virdi)*, then followed by bio-augmentation with the same type of microorganism (bacteria or fungi) as a second step of treatment with a reactor having mix of corn stover and sewage sludge without any biological treatment as a control reactor under two different temperatures 37 and 55°C.

The results showed better performance for the reactors pretreated and bio-augmented with the white rot fungi (*A. flavus and t. virdi)* under the two different conditions of temperature. Under 37°C, fungal treated reactor increased the biogas production by 44.5% in comparison with control reactor with reduction in total solids by 45.5%. Sequentially,

bacterial treated reactor increased biogas production by 27% in comparison with control reactor with 30% reduction in total solids. Furthermore, under 55°C fungal treatment increased biogas production by 56.9% with 55.1% total solids reduction. Nevertheless, the bacterial treatment caused a decline in biogas production by 35.7% with 35.7% total solids reduction.

Key words: Anaerobic digestion, Biological treatment, Bio-augmentation, Corn stover, Biogas.