

THE HOLY QURAN VERSES

القرآن الكريم

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

نُورُ السَّمَوَاتِ وَالْأَرْضِ مِثْلُ نُورِهِ كَمِشْكَاةٍ فِيهَا مِصْبَاحٌ
أُحِ فِي زُجَاجَةٍ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ دُرِّيٌّ يُوقَدُ مِنْ شَجَرَةٍ
زَيْتُونَةٍ لَا شَرْقِيَّةٍ وَلَا غَرْبِيَّةٍ يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ
سَهُ نَارُ نُورٍ عَلَى نُورٍ يَهْدِي اللَّهُ لِنُورِهِ مَنْ يَشَاءُ وَيَضْرِبُ اللَّهُ
الْأَمْثَالَ لِلنَّاسِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ (35))

سورة النور

صدق الله العظيم

Dedication

I dedicate my dissertation work to my family and many friends. A special gratitude to my loving parents, I also dedicate this work to my wife who encouraged me to finish this work.

Acknowledgement

Thanks much to Allah, AL-Rahman AL-Rahim that his grace is righteous and overflowing blessings which enabled me to complete my project. I wish to express my sincere thanks to College of Engineering of Graduate Studies of Sudan University of Science & Technology for first initiative to launch Mechatronics program in Sudan and also all members. My great thanks extend to my colleagues from the White Nile and Assalaya Sugar Factories for their valuable suggestions throughout the project. Also my sincere thanks to project coordinator Dr. El Hadi Badawi for his expert guidance and effort to bring out this research. Lastly but not least, I want to thanks my family, small and large for their motivation and contribution.

مستخلص الأطروحة

الغاز الحيوى هو الغاز الناتج عن التحلل الحيوى لمادة عضوية عند إنعدام الأوكسجين ويتكون من نسبة كبيرة من الميثان تقدر بحوالى 70% والباقى ثانى أكسيد كربون ونسبة ضئيلة من غازات أخرى حسب نوعية الكتلة الحيوية المستخدمة.

يعتبر الغاز الحيوى من مصادر الطاقات النظيفة و المتجددة ويمكن إستخدامه فى أغراض الطبخ وتوليد الكهرباء ، كما يساهم المشروع فى الحد من ظاهرة الإحتباس الحرارى وتحسين البيئة خاصة فى المناطق الريفية .

يتناول هذا البحث توليد الغاز الحيوى من المخلفات العضوية وألتى تشمل روث المواشى بصورة رئيسية كما يمكن إستخدام مخلفات المطبخ (بقايا الخضروات والفاكهة الفاسدة) و مخلفات الصرف الصحى.

تتم عملية الهضم اللاهوائى للمخلفات العضوية فيما يعرف بالهاضم الحيوى ، وفى هذا البحث تم تصميم هاضم حيوى ينتج 38.4 متر مكعب من الغاز الحيوى فى اليوم ويستوعب كل المخلفات العضوية الناتجة من مزرعة الأبقار بمصنع سكر عسلاية وألتى تقدر بحوالى 960 كيلوجرام فى اليوم .

Abstract

Biogas is produced gas from biodegradable organic material in the absence of oxygen and consists of a large percentage of methane which is estimated at about 70%, the remaining is CO₂ and other gases as small percentage depending on the type of biomass used.

Biogas is clean and renewable energies source and can be used in cooking and generating electricity, the project also contributes to reducing global warming and improving the environment, particularly in rural areas.

This research deals with the generation of biogas from organic waste which include livestock manure, kitchen waste can also be used (remains of rotten fruits and vegetables), and sewage.

The anaerobic digestion of organic waste is processed at the anaerobic digester; this research designed of anaerobic digester produces 38.4 cubic meters of biogas per day and absorbs all organic waste from cattle farm at Assalaya sugar factory, which is estimated at about 960 kg per day.

Table of Contents

الأية.....	ii
Dedication.....	iii
Acknowledgement	iv
مستخلص الأطروحة.....	v
Abstract	vi
CHAPTER ONE.....	1
Introduction	1
1.1 Background.....	1
1.2 Importance of Study.....	1
1.3 Problem Formulation.....	2
1.4 Scope and Objectives.....	2
1.4.1 Scope.....	2
1.4.2 Objective.....	2
1.5 Methodology.....	2
1.6 Thesis Structure.....	3
CHAPTER TWO.....	4
Literature Review.....	4
2.1 History of Biogas.....	4
2.1.1 Period from 1970 to 1983.....	4
2.1.2 Period from 1984 to 1991.....	5
2.1.3. Period from 1992 to 1998.....	5
2.1.3.1. “A pit with three rebuilding’ s”.....	6

2.1.3.2. “4 in 1”.....	6
2.1.3.3. “Pig - biogas - fruits”.....	7
2.1.4 .Period from the year 1999 onwards.....	7
2.2 Biogas Concept.....	8
2.3 Biomass Sources.....	9
2.4 Biogas Commercial Analysis.....	10
2.5 Biogas Plant Type.....	12
2.5.1 Constant Pressure or Floating Dome Digester.....	16
2.5.1.1 Advantages of Floating Dome Digester.....	17
2.5.1.2 Disadvantages of Floating Dome Digester.....	17
2.5.2 Constant Volume or Fixed Dome Digester.....	18
2.5.2.1 Advantages of Fixed Dome Digester.....	20
2.5.2.2 Disadvantages of Fixed Dome Digester.....	20
2.5.3 Comparison between floating dome digester and fixed dome digester.....	22
2.6 Chemical Reaction Process.....	24
2.7 Measuring and Test Program.....	24
 CHAPTER THREE.....	 28
 Plant Design.....	 28
 3.1 Design of Fixed Dome Type Digester.....	 28
3.1.1 Biomass Movement in a Fixed Dome Type Digester.....	29
3.1.2 Design Calculations.....	31
3.1.3 Case Study: Cow Farm at Assalaya Sugar Factory.....	37
3.1.4 Material Estimation for the Plant.....	39
3.1.4.1 Concreting.....	39
3.1.4.2 Brickwork.....	41
3.1.4.3 Plastering and Filling.....	44

CHAPTER FOUR.....	50
Results and Discussion.....	50
4.1 Results.....	50
4.2 Discussion.....	51
CHAPTER FIVE.....	52
Conclusion and Recommendations.....	52
5.1 The Conclusion.....	52
5.2 The Recommendations.....	53
References	54