MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR (M.P.)

(A Govt. Aided UCG autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

REPORT ON

Creative Problem Solving

TOPIC - "PRODUCTION OF HYDROGEN FROM ORGANIC WASTE"

Guided by -

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DEPARTMENT OF CHEMICAL ENGINEERING

MITS, GWALIOR

Submitted by -

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DEPARTMENT OF CHEMICAL ENGINEERING

SESSION 2023-2024

CERTIFICATE

This is to clarify that the work in the project is completed by Khushi Shrivastava (0901CM201022), Ram Sharma (0901CM201030), Shivam Yadav (0901CM201035) is a record of work carried out under my supervision and guidance in partial fulfilment of the requirement for the minor project of the Degree Bachelor of Technology in Chemical Engineering.

UNDER GUIDANCE OF -

PROF. ANISH P JACOB
DEPARMENT OF CHEMICAL ENGINEERING

28/4/2023

SUBMITTED BY -

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CANDIDATES DECLARATION

We hereby declare that report entitled "PRODUCTION OF HYDROGEN FROM ORGANIC WASTE" Which is being submitted to the Madhav Institute of Technology & Science, Gwalior in the Department of Chemical Engineering is a record of our own work carried out by under the supervision Prof. Anish P Jacob, Department of Chemical Engineering, MITS, Gwalior.

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We have taken an effort in this project. However, it would not have been possible without the Kind support and help of many individuals and organization. We would like to extent my sincere thanks to all of them.

We would like to take the opportunity to express my humble to my faculty Prof. Anish P Jacob under whom we have done this project. His constant guidance and willingness to share his vast knowledge made us understand this project and manifestations in great depth and helped me to conquer the assigned tasks. We would like to thank all faculty members and Head of the Department of Chemical Engineering MITS, Gwalior for their generous help in various ways for completion of this project.

We would like to express my heartfelt thanks to my friends, classmates and teachers for their help and wishes for the successful completion of this project.

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Abstract

As a sustainable energy source and a source of raw materials for some businesses, hydrogen is a valuable gas. As a result, the requirement for Production of hydrogen has grown significantly in recent years. While electrolysis of water, the steam reforming of hydrocarbons, and auto-thermal processes are well-known techniques for producing hydrogen gas, their large energy requirements make them unfeasible. When producing hydrogen gas, biological processes offer a number of benefits over chemical ones. The two main biological processes that produce hydrogen gas are the dark and photo fermentation of organic materials (typically carbohydrates) by bacteria and the bio- photolysis of water by algae. The process of photo-fermentation followed by darkness is a relatively novel method for producing biohydrogen. The cost of raw materials is one of the main issues with dark and photo-fermentative hydrogen production. Utilizing the right bioprocess technologies, hydrogen can be produced from carbohydrate-rich, nitrogen-deficient solid wastes like cellulose and starch-containing farming and food industry wastes, as well as from some food industry waste water like whey from cheese making, olive mill, and baker's yeast industry waste water. The production of hydrogen from the aforementioned wastes offers low-cost energy production and concurrent waste treatment.

Keywords: Hydrogen, Electrolysis,Photo fermentation, Organic waste materials.

1. Introduction

The world's energy needs have been increasing rapidly, fossil fuel supplies are running out, and burning fossil fuels releases CO2, which is bad for the environment. Numerous researchers have been inspired by these reasons to look into new environmentally friendly energy sources that could displace fossil fuels. Hydrogen is one "energy carrier" of the foreseeable future that shows promise. Hydrogen gas is an ecological fuel that produces no CO2 and is easily used by fuel cells to generate energy. Moreover, at 122 kJ/g, hydrogen has an energy yield 2.75 times greater than hydrocarbon fuels. The primary problem with using gaseous hydrogen as fuel is that it needs low-cost production methods and is not easily found in the environment. Hydrogen can be produced by anaerobic and photosynthesis-producing bacteria using non-toxic, carbohydrate-rich source sources. As organic wastes break down into organic acids, which are then utilized to produce methane, a byproduct in anaerobic environments is hydrogen. Anaerobic waste digestion's acidogenic phase can be regulated to boost hydrogen production. When CO2 and H2O react, algae that are photosynthetically active produce hydrogen gas. Organic acids are used by certain photo-heterotrophic bacteria. which includes butyric, lactic, and acetic acids to produce H2 and CO2. The latter approach has the advantage of producing more H2gas and using waste materials during production. Nevertheless, the current rate of the generation of H2 is low, and further technological developments are needed for this process. Because it uses waste materials and generates clean energy, biological production of hydrogen is a creative and promising solution to meet the world's expanding energy needs in place of fossil fuels.

2. Literature Review

The world's energy needs have dramatically expanded due to a rise in human activity and population expansion. Fossil fuels are currently the world's main source of energy, yet their emissions of greenhouse gases pollute and harm the environment. One proven effective energy source is hydrogen, which is obtainable from both not renewable and renewable energy sources. This paper presents an overview of renewable hydrogen generation sources with an emphasis on biomass (biological and thermochemical) and splitting of water (electrolysis, thermolysis, and photolysis). There is a discussion of the mechanisms' limitations. The study also examines a few important issues that are impeding the global expansion of the hydrogen economy. The lack of a clean hydrogen value chain, the storage and transportation of hydrogen, the high cost of production, the absence of international standards, and investment risks are important factors to consider. The study closes with some recommendations for future research that will help researchers improve the technical efficiency of certain manufacturing mechanisms and policy guidance that will help governments minimize financial risks in the industry in order to scale up the hydrogen economy.

3. Working Procedure

First of all we have to fix our setup.

3.1 Labelling –

(1) Inlet for PH tablet and other additional things .

(2) Slurry container

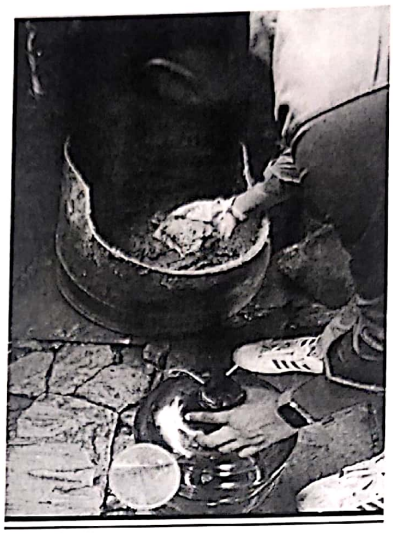
(3) Carrier from one tank to another

(4) Water tank

(5) Final outlet

(6) Gas collection point

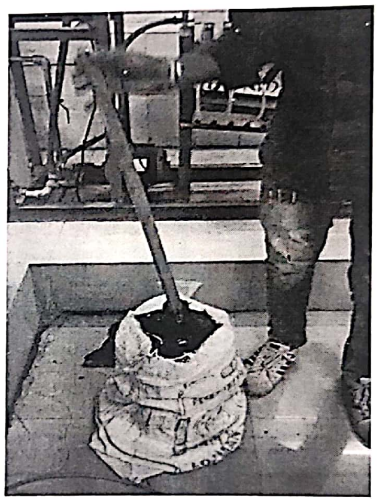
3.2 Raw Material Filling -



We have to fill cow dung as slurry in slurry tank

We use waste flowers as a raw material for making slurry

We have to add water for making a perfect slurry

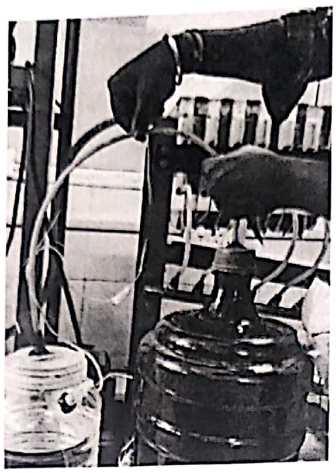


Finally we have to mix uniformly

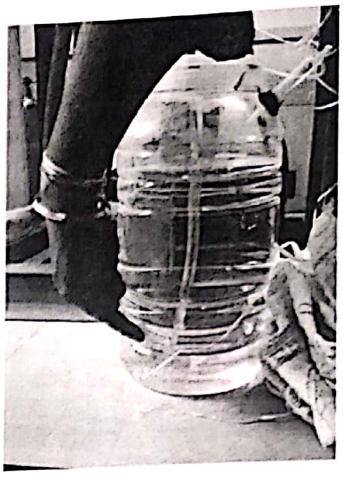
3.3 Slurry Filling and Connection -

Slurry mixture

Inlet funnel



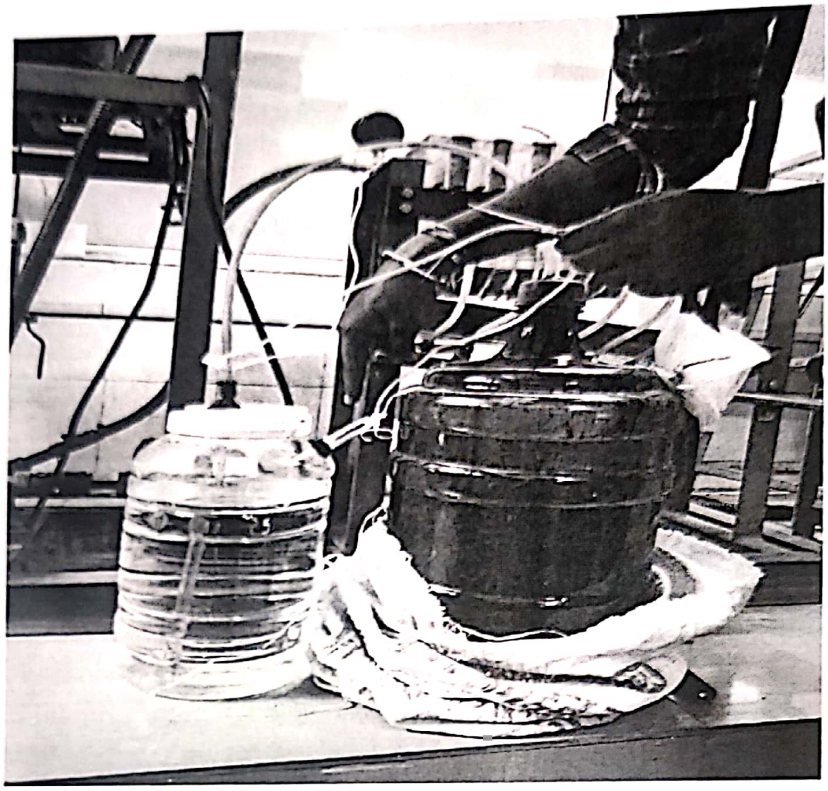
Gas carrier tube



Gas inlet in water tank

Gas outlet from water tank

4. Final Set-up



5. Conclusion

Since hydrogen has a higher energy content than hydrocarbon fuels and is a clean energy source, it referreed tto as the "energy for the future." Hydrogen is not easily found in nature, in contrast to biomass, natural gas, petroleum, and fossil fuels. Therefore, new procedures must be created in order to produce hydrogen at a reasonable price. The following are some of the techniques used to produce bio-hyidrogen: (a) water splitting through photosynthetic algae; (b) dark ferrmentation of wastes rich in carbohydrates; along with (c) photo-fermentation of wastewaters rich in organic acids. The synthesis of hydrogen by algae is sluggish, dependent on sunlight, and inhibited by oxygen. Dark fermentation, the acidogenic stage of the anaerobic breakdown of organic wastes, results in the production of hydrogen as a byproduct. Dark fermentation produces hydrogen at a slow rate and with a low yield. Photo-heterotrophic bacteria have the ability to convert organic acids generated during the dark the fermentation process of waste materials rich in carbohydrates into CO2 and hydrogen. Specialized organisms, light, and stringent environmental control are necessary for the process. For the production of hydrogen from wastes rich in carbohydrates, sequential or combined bio-processes of dark-colored photo-fermentations appear to be the most appealing method yielding high hydrogen yields. Low rates and yields of the hydrogen formation are the main issues with producing biohydrogen from wastes. Low rates of hydrogen production in bio-hydrogen production necessitate large reactor volumes. The "state of the art" in bio-hydrogen production needs to be improved through extensive research and development studies.

6. References

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