Production of Biofuel from Biomass: A Review

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Abstract **:** ***The project focuses on production of biofuel from biomass waste commonly encountered in nature. The major target being on production of greener fuel by effective utilization of biomass to reduce environmental pollution and divert the focus towards usage of renewable energy. Initiating with identification of various types of biomass the project then focuses on the route to convert it into biofuel. The work aims at learning, exploring and applying the concepts of biofuel production for the betterment of society and creating a step towards spreading awareness regarding renewable energy and pollution abatement.***

Keywords – Biofuel production, Biomass, renewable energy, Ethanol

I. Introduction

Nowadays fuel is very much costly and the sources of the fuel are very much less with compare to its use. After some years there will be no source of fuel is available. So we have to find some another way for fuel production. Biofuel is the best version of fuel which we can use in today's engines, infrastructures and vehicles without the need to make changes. Biofuel is burned, stored, and pumped the same way as petroleum diesel fuel. The main goal of making biofuel is to provide energy security and benefit the local communities. Biofuel is proven less toxic that diesel as its attributed makes it less likely to harm the environment and cost less damage. It's also proven to be safer to handle than petroleum fuel due to its low velocity.

Air pollution is one of the main environmental issues nowadays. There are many reasons behind regularly increasing this air pollution. Most of the air pollution is caused by the combustion of fuel. The release of several harmful gases or dangerous elements from such sources is causing the whole atmospheric air pollution. Ozone layer is also getting affected too much by the air pollution which causes serious disturbances to the environment.

Advances in technology have allowed the conversion of biomass into fuel ethanol as a potential source of energy. Ethanol is a renewable energy source and can be produced in response to today's high-energy demand. The production of biofuel from agricultural waste materials, forest residues and municipal solid wastes is an alternative to the depleting crude resource Ethanol as well as other bio-fuels produced from plant biomass is alternative to fossil fuels. Ethanol does not add to a net carbon dioxide atmospheric increase thus there is in theory no contribution to global warming. Combustion of ethanol results in relatively low emissions of volatile organic compounds, carbon monoxide and nitrogen oxides. The limitations of 1st-generation biofuels produced from food crops have caused greater emphasis to be placed on 2nd-generation biofuels produced from ligno-cellulosic feedstock.

II. Generation Of Biofuel

i. First-generation biofuels:-

"First-generation" or conventional biofuels are made from food crops grown on arable land. With this biofuel production generation, food crops are thus explicitly grown for fuel production, and not anything else. The sugar, starch, or vegetable oil obtained from the crops is converted into biodiesel or ethanol, using transesterification, or yeast fermentation.

ii. Second-generation biofuel:-

Second generation biofuels are fuels manufactured from various types of biomass. Biomass is a wide-ranging term meaning any source of organic carbon that is renewed rapidly as part of the carbon cycle. Biomass is derived from plant materials, but can also include animal materials.Whereas first generation biofuels are made from the sugars and vegetable oils found in arable crops, second generation biofuels are made from lignocelluloses biomass or woody crops, agricultural residues or waste plant material .

This has both advantages and disadvantages. The advantage is that, unlike with regular food crops, no arable land is used solely for the production of fuel. The disadvantage is that unlike with regular food crops, it may be rather difficult to extract the fuel. For instance, a series of physical and chemical treatments might be required to convert lignocelluloses biomass to liquid fuels suitable for transportation.

iii. Third-generation biofuels

These oil-rich algae can then be extracted from the system and processed into biofuels, with the dried remainder further reprocessed to create ethanol. The production of algae to harvest oil for biofuels has not yet been undertaken on a commercial scale, but feasibility studies have been conducted to arrive at the above yield estimate. In addition to its projected high yield, alga culture — unlike crop-based biofuels – does not entail a decrease in food production, since it requires neither farmland nor fresh water. Many companies are pursuing algae bioreactors for various purposes, including scaling up biofuels production to commercial.

iv. Fourth-generation biofuels:

Similarly to third-generation biofuels, fourth-generation biofuels are made using non-arable land. However, unlike third-generation biofuels, they do not require the destruction of biomass. This class of biofuels includes electro fuels.

III. Mehodes If Biomass Prodution

There are meanly tow routs are there:

1. biochemical method{acid hydrolysis+ fermentation}
2. Biological methods {Pretreatment +Enzymatic hydrolysis + fermentation}

Biochemical method:

Biochemical route mainly consists of two steps:-

- Acid hydrolysis
- Fermentation

In chemical process concentrated acids such as H2SO4 and HCl have been used to treat lignocelluloses materials. Although they are powerful agents for cellulose hydrolysis, concentrated acids are toxic, corrosive and hazardous and require reactors that are resistant to corrosion. Dilute acid hydrolysis has been successfully developed for pretreatment of lignocelluloses materials. The dilute sulfuric acid pretreatment can achieve high reaction rates and significantly improve cellulose hydrolysis. At moderate temperature, direct saccharification suff ereds from low yields because of sugar decomposition. Thereby researches have been conducted in optimizing acid hydrolysis of various biomass. Fermentation is a metabolic process that converts sugar to acids, alcohol. It occurs in yeast and bacteria.

Fermentation:

A form of cellular respiration done in an environment without oxygen. Yeast and bacteria are frequently used as fomenters. They consume sugars for energy and release byproducts such as ethanol and carbon dioxide.

Biological method:

Biological route mainly consists of three steps:-

1. biological pretreatment
2. Enzymatic hydrolysis
3. fermentation

In biological processes, microorganisms such as brown-, white- and soft-rot fungi are used to degrade lignin and hemicelluloses in waste materials .Brown rots mainly attack cellulose, while white and soft rots attack both cellulose and lignin. White-rot fungi are the most elective for biological pretreatment of lignocelluloses materials. In order to prevent the loss of cellulose, cellulose -less mutant of Sporotrichum pulverulentum was developed for the degradation of lignin in wood chips. Fermentation is a metabolic process that converts sugar to acids, alcohol. It occurs in yeast and bacteria.

Fermentation:

A form of cellular respiration done in an environment without oxygen. Yeast and bacteria are frequently used as fermenters .They consume sugars for energy and release byproducts such as ethanol and carbon dioxide.

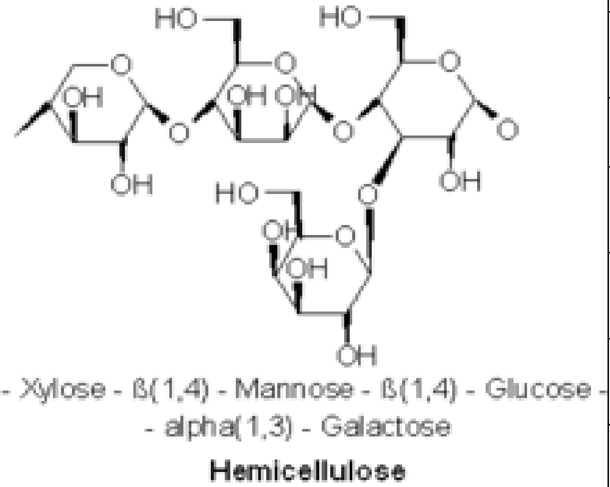

Fig1.structure of hemicelluloses

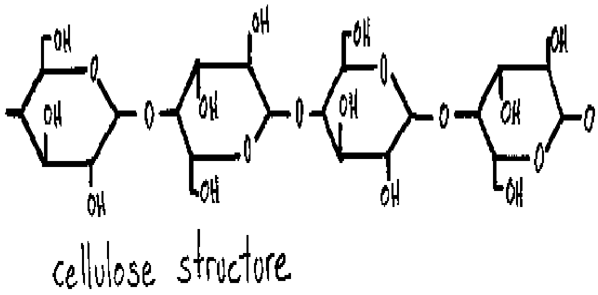

Fig2. Structure of cellulose

IV. Result Of Analusis Of Biomass In India

Sr N o.	biomass	cell ulos e%	Hemi cellulos e%	Ligni n%	Hydrolysis method	product	prod uct %
1	Chips (50%-50%, Hardwood & Softwood)	42-45	27-30	20-28	Acid hydrolysis	ethanol	_
2	prosopis juliflora wood	_	_	_	Enzyme hydrolysis	Bio ethane	_
3	corn	40-50	25-35	15-20	biological	Cellulosic ethanol	_
4	Sugarcane or sugar beet	43.8	28.6	23.5	biological	ethanol	51%
5	Walnut shell	_	_	_	Chemical	ethanol	_
6	Potato peel	_	_	_	Chemical	ethanol	_
7	Grasses	25-40	35-20	15-20	biological	Bio ethane	_
8	Wheat straw	30	50	15	biological	alcohol	_
9	Leaves	15-20	80-85	0	Chemical	Bio ethane	_
10	Cotton seed hairs	80-85	25-20	0	Biochem.	Bio ethane	_

Outcome of Literature Survey

Obtained an idea regarding what research has been carried out in this field. Obtained an idea about the primary and necessary reaction conditions of the reactions. A thorough understanding of the process of conversion of cellulose to biofuel.

V. Experimental work:

Performed an experiment for the production of biofuel (bio ethanol) .Performed firstly the pretreatment of biomass throughAcid hydrolysis of biomass. Further the fermentation of glucose is to be carried out. A leaf of plant from the college campus or other collection sites was selected as the biomass raw material and a source of cellulose.

Pre-treatment: Pretreatment process is done in a three stages:

i. Washing
ii. Drying
iii. Crushing

First we took a leaf from the plumier plant as the biomass and then the pre treatment was carried out by acid hydrolysis.

Acid Hydrolysis:-

For the acid hydrosols process we used 98% H_2SO_4 as the acid catalyst

Materials Required:

1. 5 gm of biomass (leaf powder)
2. 98% H_2SO_4
3. Distilled water

Procedure:-

- Take a 5 no. Of 500ml conical flask.
- Take a 0.2N, 0.4N, 0.6N, 0.8N, 1.0N. Conc. H2SO4 in a conical flask. Add 5 gm of leaf powder in all flasks.
- Heating this all flask at a 65-70 °C . For a 15 min. And give a continues starring. After 15min. separate a liquid and solid particle.

Neutralize the sol. Which one we get it with the help of sodium bicarbonate(NaHCO3).

Cole's Method:

Materials Required:

1) Sample solution 0.5% Glucose.
2) 1.0% $K_3[Fe(CN)_6]$ solution.
3) 2.5 N or 10.0% NaOH solution.
4) 1.0% Methylene blue solution.

Procedure:

1. Take 20.0 ml of $K_3[Fe(CN)_6]$ solution in a 150 ml conical flask.
2. Add 5.0 ml of NaOH solution in the above flask. Heat it gentaly till boiling.
3. Take 10 ml of sugar solution in pipette and add it drop wise in to the flask utill the boiling solution becomes pale yellow.
4. Add a drop of Methylene blue and continue the addition of sugar solution drop wise until the blue color disappears.
5. Record the amount of sugar solution required for Methylene blue decolorization point.
6. Calculate:-

Glucose = 20.12 + [0.035 x Y ml] mg per Y ml.

VI. Conclusion

Production of cleaner fuels is the need in today's time of depleting crude resource Bioethanol is a cleaner fuel whose production is studied and attempted from various biomass feed stocks The concept of this project is a step towards the development of biorefineries .This project aims to provide an alternative to effective utilization of biowaste We get a good extract glucose from the acid hydrolyses process. And after we produce a biofuel from the fermentation process by using this extract glucose .We get a good extract glucose from the hydrolises process at 0.2 N H2SO4.

VII. Acknowledgement

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