Bioethanol Production from Waste Banana Peel

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Abstract—The resources od fossil fuels or the conventional fuels are now decreasing .To meet the needs of the fuel an altenative source is required which can be accomplished by bioethanol.The production of Bioethanol as a renewable form of energy is produced by using banana peel.The lignocellulosic agricultural waste has a potential to produce Bioethanol. The vital steps in bioethanol production are pretreatment and hydrolysis. Both the techniques are applied. Hydrolysis technique was followed by using H_2SO_4.S. Cerevisiae is the active strain used for conversion of sugar to bioethanol by the process of fermentation. The percentage of bioethanol was detected by absorption spectra using potassium dichromate method at 600nm. Production of bioethanol is mainly depending upon pretreatment step. Banana peels are the waste which are easily available during all the seasons and Bagalkot is found to have many farms with banana plantations and its waste is easily available and is economically feasible.

Keywords-Banana peels,Bioethanol,Fermentation,Hydrolysis,Pretreatment,S.Cerevisiae.

1. INTRODUCTION

Fossil fuels are the major source of energy worldwide. The use of fossil fuel is associated with global warming, climate change and variety of energy and security problems. The requirement of these fuels can be replaced by bioethanol. Bioethanol is a result of fermentation of carbohydrate rich source employing different types of yeast and bacterial cells. The Ethanol is also called alcohol. It is colorless, flammable, volatile liquid. The molar mass of ethanol is 46.07g/mol,0.789g/cm^3 is the density, -114º C is the melting point and boiling point of 78. 37°C.It also used in production of useful chemicals and widely used as solvent, fuel, antiseptic. Bioethanol is a result of fermentation of carbohydrate rich source employing different types of yeast and bacterial cells.

A. *Production of banana*

India is the largest producer of banana in Asia-Pacific, from an area of 0.84 million hectares it produce 29.7 million metric tons of banana will produce. China and Indonesia are the other major banana producing countries.

B. *Why Bioethanol*

- It can be made available at low cost for consumers.
- Increasing the income of the farmers and rural employment.
- Reduces the carbon emission.

C. *Use of fossil fuels in world*

Every year 15billion metric tons of fossil fuels are consumed. China, United states and India are the three countries use more fossil fuels then the rest of other countries. According to the Global Material Flow Database (developed by UN Environment Program) these countries consume 54% of the world's fossil fuel by weight.

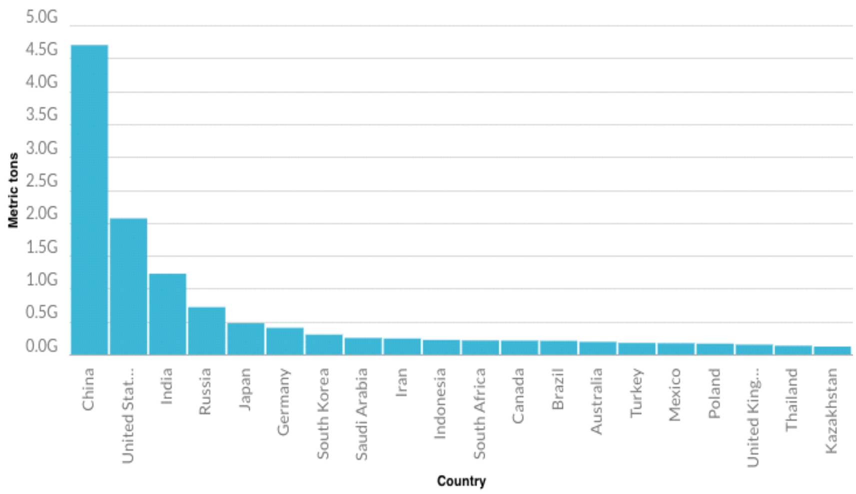

Fig:1Use of fossil fuel in world

D. About Bioethnol from waste banana peel

The use of bioethanol as alternative for octane enhancer to reduce the problems associated with fossil fuel. It is efficient, cost effective and alternative to the food security. The substance used for production bioethanol is waste banana peel. The waste banana peel consistsof lignocellulose which is characterized by its carbohydrate. The biomass constituents are cellulose, hemicellulose and lignin. The dominant polymer among the three components is cellulose. The study here aimed to produce Bioethanol by using the least expensive pretreatment technologies and the substrate selectedis banana waste which is easily available and accessible. To overc*ome the problem arising from non-renewable energy and to produce cost effective,eco friendly bioethanol from waste banana peel*.

2. METHODOLOGY

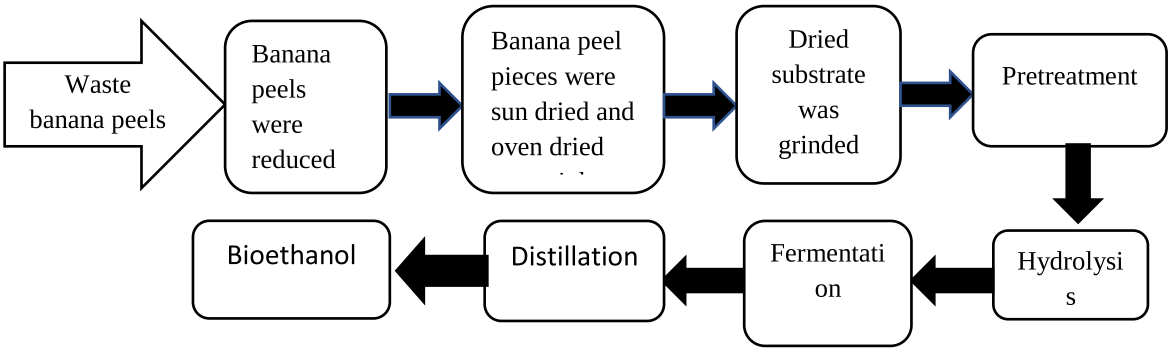

Fig: 2 Flow chart for methodology

E. Preparation of raw material

Waste banan peels are collected from local fruit juice center (Sangamesh fruit juice centre).The fruit peels were reduced to small pieces to make it easier to handle.They were sun dried and oven dried over night at 60ºC .The dried substrate was grinded into powdered, packed in polyethylene bag and stored at 0°C temperature for further analysis.

Fig:3 Banana peels were cut into small pieces and sun dried for 2days

Fig: 4 Oven dried Banana peels at 60°C

Fig: 5 Powdered banana peel

F. Pretreatment of waste banana peel

The endeavour of pretreatment is to reduce compactness, strength, crystal nature of fiber(cellulose).Banana peel powder (20gram) was soaked in water (200ml) for 30-180 min and then autoclaved at 120°C for15 min.The pretreated waste was filtered and filtrate is obtained.

Fig:6 Pretreated banana peel solution

G. Hydrolysis

The aim of hydrolysis is to further break down polysaccharides into monosaccharides components.10% of sulfuric acid was prepared and mixed with pretreated solution. Sulfuric acid was used with the filtrate in the ratio of 6:1, then solution is treated at 120°C for about 6 hour and allowed to cool.

The Benedict test is carried to confirm the presence of reducing andnonreducing sugars before fermentation process.

Fig:7 Hydrolysed banana peel solution

H. Benedict test

Confirming the presence or absence of sugar prior to fermentation, saves a considerable amount of time and effort. Benedict test was carried out to determine the amount of sugar generated.

I. Performance of Benedict test

In the test tube 1ml of sample solution, 2ml of Benedict reagents mixed thoroughly and keep in boiling water bath about 15min. The change in color from blue to green color indicates the presence of reducing sugar.

Fig: 8 Benedict test

J. Fermentation

TheFermentation is the final stage of bioethanol production. *Saccaromyces cervisiae*was used to convert the monosaccharides and disaccharides produced during hydrolysis into bioethanol with help of invertase and zymase enzyme. These enzymes are found to be present in *Saccaromyces cervisiae*. The yeast cells with glucose is added into hydrolyzed solution. The fermentation process started and was allowed to continue for 8-9 days and finally the sample was centrifuged and then the distillation of the fermented bioethanol was carried out.

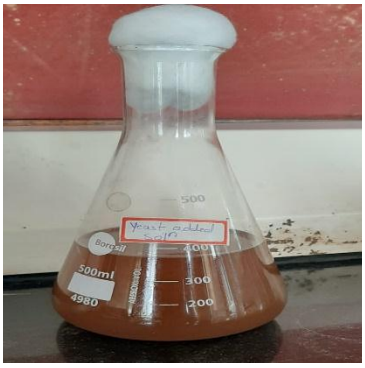

Fig: 9 Yeast added solution

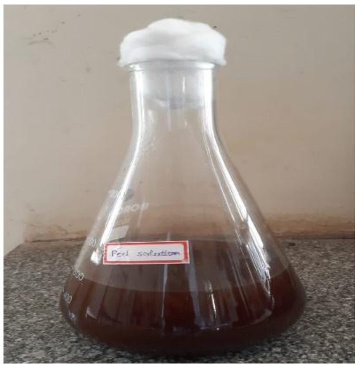

Fig:10 Bioethanol from fermented solution

Fig: 11 Distillation setup

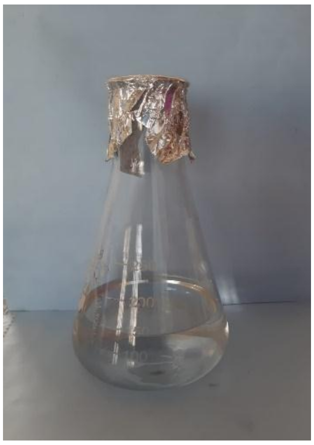

Fig: 12 Distillated bioethanol

3. Result and discussion

Theresult ofthe investigation showed that, the fermented banana peels produced a significant amount of ethanol. The solution was kept for 7-8days for the production of ethanol, regularly note down the changes. The required for the fermentation process decreases dramatically with increase in the concentration of yeast. The Bioethanol estimation done by potassium dichromate method (Five different test tubes were taken and to each test tube ethanol is added in the increasing concentration and then 2ml of potassium dichromate solution is added to each test tube and shaked well. Incubate it for 20min in room temperature and check for O.D. the graph was plotted concentration versus O.D).The graph was plotted ethanol concentration versus O.D and by graph obtained the percentage of bioethanol is 6.5%.

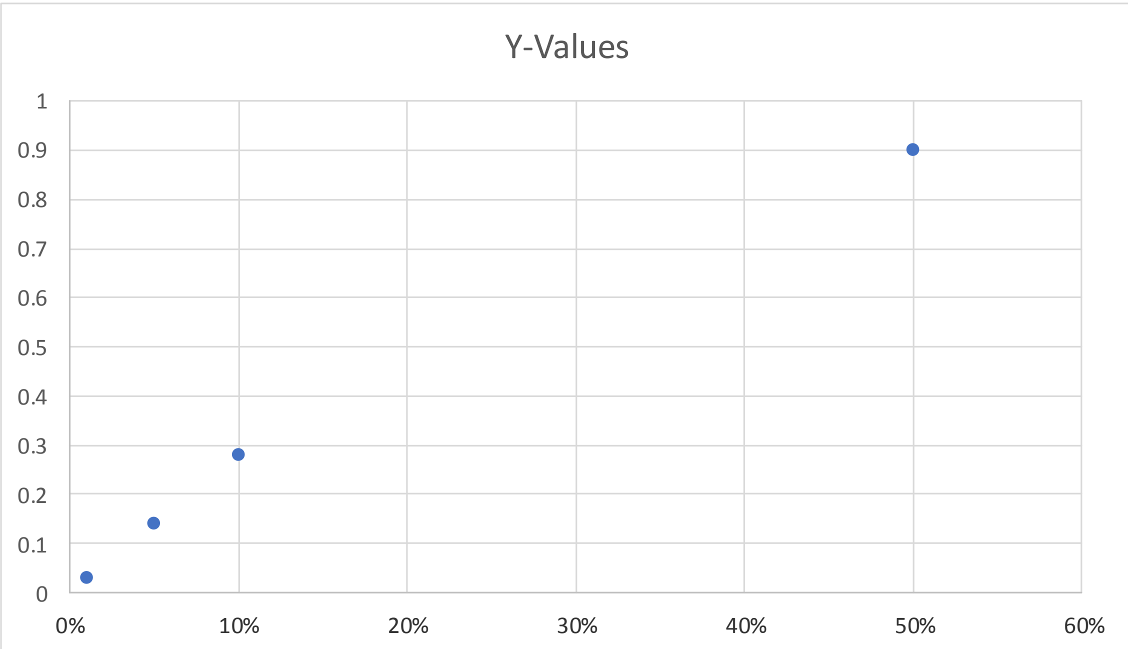

Fig: 13 Estimation of bioethanol

K. Conclusion

The work reveals the possibility of producing bioethanol from fermentation of banana peel and which may serve as cheap alternative source of fuel and energy generation. The use of banana peel is means to reduce the pollution and biological conversion of cellulose to fermentable sugar for the process of bioethanol which ecofriendly.

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