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BIOETHANOL AS AN ALTERNATIVE ENERGY RESOURCE

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ABSTRACT

Bioethanol is widely recognized these days as a very promising alternative source of energy Biomass is considered as an safe and clean material with unlimited availability and high potential to be used as a renewable source for the production of energy and alternative fuels. Biofuel derived from renewable feed stocks are environmentally friendly fuels. The process of turning coal into liquid produces more carbon dioxide emissions than conventional gasoline does. This work suggests that bioethanol produced from potato peel is the best alternative fuel and this also avoid the environmental pollution problem.

KEY WORDS: Alternate Fuels, Global Warming , Potato peel, bioethanol

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INTRODUCTION

Fossil fuel combustion releases carbon dioxide, nitrogen oxide, methane and other emissions in the air the trend threatens to continue as populations grow, causing an increased dependency on fossil fuels, according to the Bureau of Oceans, International Environmentalist. The primary sources of pollution caused by fossil fuels are industry and vehicle exhaust. Coal production is a lucrative and important source of revenue for the United States and other coal-producing countries. One of the more serious consequences of pollution caused by fossil fuels is global warming or climate change. Fossil fuel combustion introduces the So-called greenhouse gases into the air. Fossil fuel combustion directly impacts the air, causing widespread pollution. However, chemical reactions in the atmosphere can also lead to harmful effects on land and in water resources. Acid rain, for example, is the product of a chemical reaction involving sulfur dioxide and atmospheric moisture[1]. Biodiesel is a well known alternative, renewable fuel which provides less harmful emissions when compared with the conventional fossil-based diesel fuel. Fuel produced from bio degradable materials obtained from industry, agriculture, forestry and household sources called Biofuel. The kinetics required for the same was studied in detail. The Government of India has made it mandatory for all petroleum refineries to blend 10% ethanol with refined petroleum products out of which 5% with immediate effect[2]. To fulfill this requirement it is an uphill task for the government to provide and supply bulk ethanol to petroleum industries at affordable rates. At present bio-fuel is being produced in India only by converting sugar molasses to ethanol at industrial level, which is not even sufficient to cope up with the demands of chemical industries and breweries. Thus the time has come to increase the production of alcohol using agricultural wastes, in addition to molasses and grains, as agricultural wastes are abundantly available. With these facts in mind we would like to work upon a microorganism which can convert agricultural wastes to bio-fuel. Biofuel will be very useful in cutting on the green house gas emission. The European Commission plans to substitute progressively 20% of conventional fossil fuel with alternative fuels in the transport sector by 2020, with an intermittent goal set at 5.75% in 2010. In the USA, the Energy Policy Act of 2005 requires blending of 7.5 billion gallons of alternative fuels by 2012.

MATERIALS AND METHODS

Potato Peels as Biomass

Potatoes are the second most used food in the world. Potato peel is one such product which is abundant and of very low utility and low price. Potato peels are the waste products in chips and wafers industries, burgers and food joints etc. They are produced in abundance and discarded or in some cases used as feedstock for cattle. The enzymatic process has been found to give better yield of alcohol. The enzyme culture used in the process needs to be processed under controlled conditions. These conditions are mentioned .The enzyme used in the enzymatic treatment is S. Cervisae. Before Inoculation it needs treatment which is mentioned below[3]. The *S. cerevisae* cultures were maintained by sub Culturing them every 15 days on sabaurauds agar slants, followed by 24 hr. incubation at 25 ^{o}C. The cultures where there after stored at 4 ^{o}C for further use Inoculums Preparation A loopful of 24 hr. old culture was inoculated in YPD both and incubated at 25 ^{o}C for 24 hr. These inoculums were used to inoculate sterilized potato peel both. Optimization of the culture conditions involves optimization of media and operating conditions. They are discussed below. Optimization of the media was done by observing the growth pattern of *S. cerevisae* on various media like glucose (5%), sucrose (5%) and then YPD was analyzed. Optimization of pH of *S. crevice* was inoculated at different pH like 4,5,6,7 and optimum growth was checked by measuring the absorbance at 620 nm in digital colorimeter before and after incubation at 24 hr., 48hr and 72 hrs. respectively.

Optimization of Temperature

The *S. cerevisae* cultures were incubated at different temperature of 20 ^oC, 25 ^oC, 30 ^oC, 35 ^oC. Optimum growth was checked by measuring the absorbance at 620 nm in digital colorimeter before and after incubation at 24 hrs.

Study of Sugar Tolerance

Different concentration on sugar 30%, 40%, 50%, 60%, 70% were taken. 24 hr old inoculum (0.1 ml) of yeast was added for the study of sugar tolerance of yeast *S. cerevisae*. pH was adjusted to 5. Optical Density was taken after 48 hr on digital colorimeter at 600 nm.

Study of alcohol tolerance

Study of alcohol tolerance of yeast was performed. Alcohol (absolute ethanol) was added in different concentration. This experiment was performed in order to find out the tolerance of yeast strain (*S. cerevisae*) towards alcohol. Alcohol in different concentrations was added along with the YPD media.0%, 5%,10, 15%, 20%, 25% and 30% alcohol (ethanol) was added in the media. pH was adjusted to 5. Inoculums (0.1 ml) was added in each test tube and incubated at 25 ºC. O.D. was taken after 24, 48 and 72 hrs on digital colorimeter at 600nm[4].

Methods of Analysis

The analysis of potato peels was carried out to assess the contents of the various **c**omponents in them.

A) Reducing Sugar Analysis

Reducing sugar was estimated by using DNS (dinitrosalicilyc acid) method (Miller, 1959). It involves preparation of the standard reference curves the method for which is given below.

Preparation of standard curves

20 mg D- glucose was dissolved in 100 ml distilled water. Aliquots of triplicates of 0.2, 0.4, 0.6, 0.8, 1ml of glucose solution were taken and volume adjusted to 1ml using distilled water. To each tube 2ml of DNS reagent was added and boiled for 10 min. The absorbance was measured at 540 nm by using a digital photo calorimeter. See the fig.1

B) Alcohol Estimation by Potassium Dichromate Method

Alcohol content of the extract was estimated by the Potassium Dichromate Method. The standard reference curve was prepared for this.

Preparation of standard curve

Aliquots of triplicates of 0.2, 0.4, 0.6, 0.8, 1 ml of absolute alcohol (ethanol) were taken and volume adjusted to 3ml by adding distilled water. To each tube 4ml of dichromate reagent was added followed by 1ml of conc. Sulphuric acid. Absorbance was measured at 620 nm by using spectrophotometer. Moisture was estimated by hot air oven method. 15 gm of fresh peels were weighed& it was dried in hot air oven at 100ºC, the peels were weighed again drying. See fig.2.

Estimation of moisture contents in potato peels

It was carried out till a constant weight is obtained; loss in weight was calculated and expressed as percent moisture. Estimation of total solids after calculating the moisture content remaining amount of potato peels was considered as total solids. Estimation of reducing sugar By using 10% potato peels suspension the reducing sugar was analysis by DNSA method.

Enzymatic Treatment

In this method the different enzymes were used at different Conditions to hydrolyze the starch molecules in potato peels. The potato peels after being collected from Hot Chips, were washed 2 to 3 times with water & then dried in hot air oven for 24 hours at 60 ^0C. The peels were then ground to the powder form. Suspensions were made by taking 10gm, 15gm, 20 gm peel powder by weight in three 500 ml Erlenmeyer flasks respectively. Distilled water was added in each flask to maintain the volume up to 100 ml.Now the mixture was heated at 100 ^0C.The suspensions got gelatinized. The suspensions were cooled to 40 ^{0}C., pH was observed to be 7.9.The suspensions gave a positive test to the Iodine confirming test to the presence of starch. pH was then adjusted to 7 and analyzed after this added in all three flasks. The flasks were incubated for 1 hour at 40 ^{0}C.After 1 hr the suspensions were boiled for 2 minutes and cooled to 40 ^{0}C. Liquefaction was clearly observed in all the three flasks confirming the conservation of starch. The suspension gave brownish color with iodine confirming the hydrolysis of starch to dextrin. pH was adjusted to 4.5 in all the flasks. Then glucoamylase, cellulose and pectinase were added and suspensions were incubated for 24 hrs at 55 ^{0}C After 24 hrs the suspension were boiled for two minutes to denature enzymes and then cooled. The suspensions were centrifuged at 10000 rpm for 10 minutes at 40 ^{0}C and supernatant was collected[5].

Figure 1
Sugar estimation for various % of potato peel

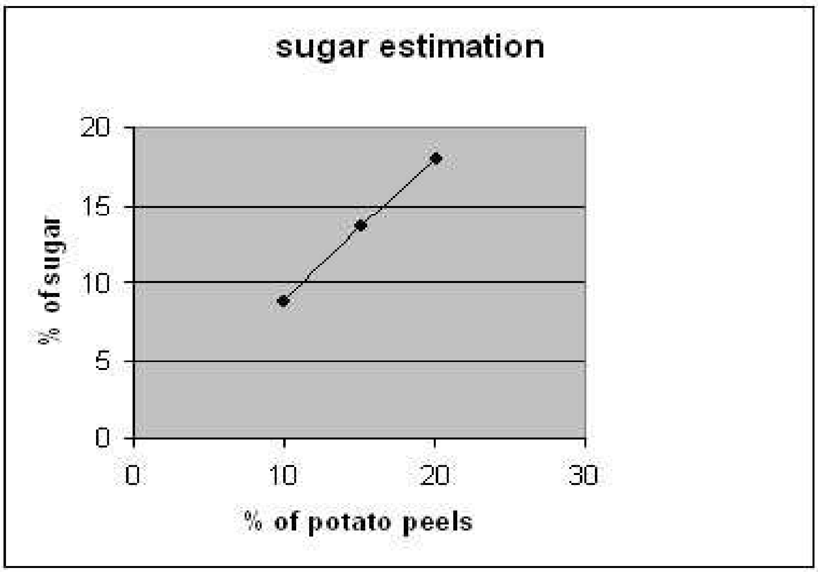
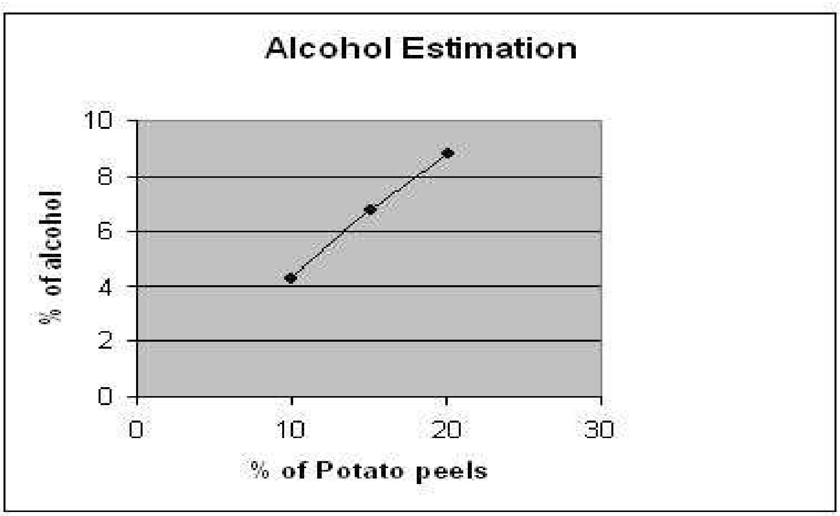


Figure 2
Alcohol estimation for various % of potato peel



CONCLUSION

To reduce the cost on fossil fuels, conservation is still the primary strategy. There is no instant weaning on conventional petroleum/diesel sources. As a matter of fact, bioethanolhas a very promising potential. As an alternative to this "traditional" diesel or gasoline fuel, it is expected to yield the significant energy security and environmental advantage to its potential utilization for future prospective.

REFERENCES

1. Ganapathy Sivakumar, Daniel R. Vail,Jianfeng Xu, David M. Burner, Jackson O. Lay Jr., Xumeng Ge, Pamela J. Weathers Bioethanol and biodiesel: Alternative liquid fuels for future generations, Engineering in *Life Sciences*, 10(1): 8–18, (2010).
2. Mir Naiman Ali, Mazharuddin Khan Mohd And Majid Mohiuddin, "Ethanol Fuel Production Through Microbial Extracellular Enzymatic Hydrolysis And Fermentation From Renewable Agrobased Cellulosic Wastes, *International Journal of Pharma and Bio Sciences,* 2(2):321-330,(2011).
3. S. Prasad , Anoop Singh , H.C. Joshi, Ethanol as an alternative fuel from agricultural, industrial and urban residues**,** Resources, Conservation and Recycling,50(1): 1–39,(2007)
4. José Goldemberg, Ethanol for a Sustainable Energy Future, *Journal of Science* , 315 (5818): 808-810(2007)
5. Yan Lin, Shuzo Tanaka, Ethanol fermentation from biomass resources: current state and prospects, *Applied Microbiology and Biotechnology*, 69(6):627-642(2006)
6. J.L. Fortman, Swapnil Chhabra, Aindrila Mukhopadhyay, Howard Chou, Taek Soon Lee , Eric Steen, Jay D. Keasling, Biofuel Alternatives To Ethanol: Pumping The Microbial Well, *Trends in Biotechnology*, 26(7): 375–381(2008)
7. Marcelo E. Dias De Oliveira, Burton E. Vaughan, And Edward J. Rykiel Jr. Ethanol As Fuel: Energy, Carbon Dioxide Balances, And Ecological Footprint,*Bioscience,*55(7): 593-602(2005)