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PREPARATION AND CHARACTERIZATION OF BIO FUEL FROM WASTE BANANA PEEL

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***Abstract*— The scarcity of fuel resources and degradation of environment due to excessive use of fossil fuels have led to brain storm our mind to explore the field of bio fuels as low-cost and cleaner alternative for fossil fuels which are degraded from the olden time. It has major implication to select biomass which has higher extraction value along with high contents of sugar at cheaper price, so major constraint is to reduce the price of ethanol production. In present work banana peels were taken as a major ingredient for production of ethanol by using chemo biological methods. Cerevisiae yeast was used for carrying out the fermentation of oil into bio fuel and then the distillation was carried out and it was found that yield of bioethanol from banana peels was 16-20%. it has overcome the traditional fuel due to some unique characteristics. it is decomposable, less toxic and causes very little harm to the environment if split. Biofuel has high octane number, higher flame velocity and having high latent heat than gasoline. It is much cleaner and releases no toxic gases.**

Keywords— **Banana Peels, Trans esterification, Biofuels, Carbohydrates, Fermentation, Saccharomyces cerevisiae**

I. INTRODUCTION

As the population of the world is going to be increasing day by day there is a need of more and more resources to fulfill the requirement of the masses. As a result of which our conventional fossil fuels were started to exploit which would result in environmental pollution and scarcity of the fossil fuels. These reason led the human being to think about the alternative of fossil fuels to meet the requirement of increasing demand on earth. It led to development of biofuel, various researchers reported the preparation of biofuel by using different bio resources such as potatoes, sunflower, fruits, vegetables and algae. The biodiesel is prepared by using bio resources which are highly rich in oily content. The oil was firstly converted into biodiesel by trans esterification particularly with methanol or ethanol. These fuels are known as carbon neutralizer as they have an ability to absorb the Co_2 which is evolved by the combustion of these bio fuels. As a result of which there is no significant incremental factor in the CO_2concentration which led to global warming in the atmosphere. Bioethanol is also extracted by using biological resources that contain substantial amount of carbohydrate which can be further converted in to bioethanol [5, 6]. Now a days it has been emerging field for the researchers to study out the ways by means of which the production o0f bioethanol can be increased. It was also found by the earlier studies that bioethanol emit lesser amount of toxic and greenhouse gases in comparison to conventional fuels. Now day's researchers are also trying to use biofuels after mixing with gasoline as fuels [8].

In present study an attempt will be carried out to prepare biofuels by using waste banana peels. Banana peels were taken for the production of bio fuel, as the fuels obtained from vegetable oil and other edible resources is not viable due to scarcity of food grains as well as economically not viable due to high production cost. Therefore there is greater need to identify the solution to this problem, so that some alternative bio resource can be used for the conversion into biofuel.so in present study an attempt was made to convert waste to energy so as to save the eatable resources. In addition to it, it also leads to reduction in the environmental pollution. These characteristics of waste banana peels lead us to use it for the production of biofuels. Banana (Musa paradisiacal) is an edible fruit which belongs to the Musacease family. It is having two parts outer cover known as peels and inside of it there is edible part known as pulp. The waste banana peels also act as main pollutant of our environment because all the bio wastes release toxic gases when they undergo decomposition and biodegradation. To overcome this problem, the best alternative is to reuse this waste banana peels to consume it for the production of biofuels [9]. Banana peels contain carbohydrates (60.20%), proteins (4.86%), metals and oily contents [10-12]. Production of bioethanol has previously been reported from the banana peels by the process of fermentation in biocontrol fermenter using five different strains of Saccharomyces cerevisiae [13].

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II. EXPERIMENTATION

Biodiesel production

Waste Banana peels around 3.5 kg were taken from different fruit shops located in Ropar, Punjab. They were cut by knife into pieces of about 4-6 cm length for drying and grinding. Sample drying was carried out in an oven (100^{o}c for 72 -80 hrs) to obtain easily crushable material. After drying each of the samples was milled separately. The peel obtained after drying seems to be crispy and were ground into the powder form (1000 g) and maximum particle size of the grounded powder was not more than 2mm. powder particles having size more than is crushed again and again until they were reduced to a size of 2mm. the sample was kept at low temperature until the next state of experiment.

Pretreatment of Sample

The fruit peel powders were treated and feed as batches contains 50g of screened fruit peel powder with 10:1 (v/w) ratio of water to the sample. The temperature was applied as 121^{o}c, and then released the pressure until the pressure becomes0bars.The retention time for each batch was 15min. Finally the sample was kept in furnace for the given pretreatment time and temperature was allowed to cool. The sample was separated into soluble and non-soluble parts.

Hydrolysis of sample

Non soluble sample was mixed with 500 ml of 1% (v/v) dilute sulphuric acid and soaked for 24 h. Then the sample was hydrolyzed for 25 minutes at 100oc.the hydrolyzed sample was then neutralized with 10M NaOH until Ph become around 7.the sample was centrifuged to separate solid from liquid portion. Then the liquid portion was boiled for 20 minutes. Finally the liquid portion was mixed with the soluble component from the pretreatment step.

Preparation from Inoculums

Yeast was collected and was mixed with 100 ml nutrient broth prepared in a 250 ml flask. The flask containing the YPD media and the yeast was properly sealed with cotton plug and covered with aluminum foil. Then the flask was kept for 24 hours incubation at 37 ^{o}C in shaker.

Fermentation

The prepared sample was mixed with the media using sterilized pipette. The parameters for fermentation i.e. Fermentation time, yeast.

Transesterification

The step by step approach used in the production of the biodiesel is given below.

(i) 10.5 mL of Banana peels oil was measured and poured into 250 mL conical flask and heated to a temperature of 50°C.

(ii) A quantity of methanol was poured in a round bottom flask and solution was purified by double distillation process.

(iii) The quantity of biodiesel obtained after distillation was measured and recorded.

III. CHARACTERIZATION

Determination of Viscosity

Procedure: The oil sample was filtered through a fritted glass (fine mesh screen) to remove solid particles and impurities dust which were remaining suspended in the liquid solution. In order to determine the viscosity, tube thinner arm was inverted into the liquid sample and suction force was created to suck the liquid to upper timing mark of the viscometer, after it the instrument was turned to its earlier position perpendicular to the resting surface. Further the viscometer was hanged into a holder and placed inside constant temperature bath which is set up at 30°C, then sample was kept for some minutes until it attained 300°C. The suction force was then applied to the thinner arm to draw the sample slightly above the upper timing mark. The afflux time by timing the flow of the upper timing mark to the lower timing mark was recorded.

Determination of Moisture Content

Procedure: The oil sample was weighed and the mass taken as thus was then dried in the oven and the weight after drying was taken as. The percentage moisture in the oil was then calculated using the formula below:

% moisture content = $\frac{w_i - w_o}{w_i}$ X 100

Where: w_i is the weight of oil sample before drying (grams), and w_o is the weight of oil sample after drying (grams).

Determination of Specific Gravity

Density bottle was used to determine the density of the oil. A clean dry bottle of 25 mL was weighed (w_o) and then filled with the oil; a stopper was inserted and then reweighed to give (w_1)

$$\text{specific gravity} = \frac{w_1 - w_0}{w_2 - w_0}$$

Determination of Free Fatty Acid

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Fatty acids are important constituent of any fuel because, when it is metabolized, they yield large quantities of ATP which leads a major contributor for attaining heating effects from fuels. Free fatty test was carried out by titrating it against Potassium hydroxide (KOH) using phenolphthalein as indicator.

Procedure: Conical flask of 250 ml was taken which carries 50 ml of neutral solvent along with 2 ml of oil, 3 to 4 drops of phenolphthalein indicator was then added and titrated against 0.1 m KOH. The solution was continuously stirred until a pink color which continued for fifteen seconds was obtained.

Determination of pH value

PH is the property of a substance which shows the kind of nature of a substance i.e. acidity or basicity. pH value of substance tell us about its chemical affinity, safety and environmental effects. Peoples from chemical background or farmers both are always interested to determine the pH information for a specific substance. As they have to act accordingly. This value also has its own importance in case of biofuels; it determines the effectivity of fuel so it was remain great interest from olden times to know the pH value. The following procedure is followed to know the pH value:

An elico digital pH –meter model LI-127 with ATC probe and combined electrode type (CL-51B-Glass body range 0-14 pH units, 0-100oc automatic/man) with accuracy +0.01 was employed for pH measurement throughout the present work. Before starting observations, the pH meter was calibrated with standard buffer solution of pH= 4.00 and pH =9.20.

Methanolysis and ethanolysis

1. In pipette Ethanol was sucked and single drop was taken from it.
2. 10 drops of methanol were added in test-tube.
3. 10 drops of ethanol was added to the other test-tube.
4. 25 drops of iodine solution was added to each alcohol.
5. 10 drops of sodium hydroxide solution to each alcohol.
6. **Then test were mixed for few minutes.** The dark colour of the iodine should start to fade.
7. After 2 min when the liquid settled, carefully observe the two test-tubes.

After certain period of time it was found that solution in the ethanol test-tube seems to be cloudy and then a yellow precipitate of triiodo-methane (iodoform) should abrupt from the solution. Solution obtained has a distinct 'antiseptic' smell. The methanol test-tube should remain clear.

The iodoform reaction is given by compounds with a methyl group next to a carbonyl group. Secondary alcohols with a CH_3 on the carbon carrying the OH (eg propan-2-ol) that can be oxidised to carbonyl compounds of this type, also give a positive iodoform test. (NB carboxylic acids do not)

IV. RESULTS AND DISCUSSION

In the present work an attempt was made to carry out comparative study between theoretical standardized data and experimental value of important chemical properties like acid value, viscosity, moisture content, specific gravity and Ph value. These values were compared with the standard values. It was found that theoretical results are in complete agreement with the results obtained by the experimentation which shows that if the composition of oil is known we can find out other various properties by using theoretical equations within agreeable error .The fuel properties used for analyzing the of oil were given in Table 1.From the comparison of various properties it was found that the bio fuel was in accordance to the standard prescribed for the fuels.

Table No- 1: comparisons of fuel properties with standard

Property	Bio fuel	ASTM (D6751-02)	DIN (EN 14214)
Moisture content	0.25	<0.03	<0.05
Acid value	0.78-1.80	<0.8	<0.5
pH	5.70	Approx 7	Approx 7
Flash point	70	>130	>120

V. CONCLUSION

In the current investigation, it has confirmed that banana peel may be used as resource to obtain biofuel and the result showed that fruit peels treated with heat, dilute acid (sulphuric acid) and microbial enzymes of saccharomyces showed a potential production of 16-20% ethanol. Utilization of theses waste could solve the disposal problem and reduce the cost of waste treatment which can help us to develop the bio fuel. Biofuel obtained from peels was characterized as per ASTM Standard.it indicates that more waste biodegradable products can be used or recycled for conversion of them into useful product. It will help in mitigating the energy scarcity as well as environmental degradation. More research is needed in this area to a certain there potentiality for commercialization in addition

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