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BIO-ETHANOL PRODUCTION FROM BANANANA PEELS BY FERMENTATION PROCESS

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Abstract

Banana peels are lignocelluloses agricultural waste that has the potential to produce Bio-ethanol as a renewable form of energy. Our aim is to make best from waste so that we are producing Bio-ethanol from banana peels and also selection of biomass content higher value of sugar content. Our study determined the efficiency of fermented product i.e. bio-ethanol. We have started fermentation of banana peels using bakery yeast for 3 days in which we get CO2 as by-product. After 3 days we have carried out filtration of fermented yield and started distillation to get ethanol. After carrying out distillation, we got our main product i.e. ethanol. After testing the pH of ethanol are 7.2, density 926 kg/m3, ethanol concentration 80 % by volume and 20 % water content in sample.

Keywords: *lignocelluloses, Banana Peels, Bio-ethanol, Fermentation, bakery yeast.*

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1. INTRODUCTION

1.1 Ethanol Fermentation

Ethanol fermentation, also called alcoholic fermentation, is a biological process which converts sugars such as glucose, fructose, and sucrose into cellular energy, producing ethanol and carbon dioxide as by-products. Because yeasts perform this conversion in the absence of oxygen, alcoholic fermentation is considered an anaerobic process. It also takes place in some species of fish (including goldfish and carp) where (along with lactic acid fermentation) it provides energy when oxygen is scarce. Ethanol fermentation has many uses, including the production of alcoholic beverages, the production of ethanol fuel, and bread cooking.[8]

Fermentation is a metabolic process that consumes sugar in the absence of oxygen. The products are organic acids, gases, or alcohol. It occurs in yeast and bacteria, and also in oxygen-starved muscle cells, as in the case of lactic acid fermentation. The science of fermentation is known as zymology.

In microorganisms, fermentation is the primary means of producing ATP by the degradation of organic nutrients an aerobically. Humans have used fermentation to produce drinks and beverages since the Neolithic age. For example, fermentation is used for preservation in a process that produces lactic acid as found in such sour foods as pickled cucumbers, kimchi and yogurt (see fermentation in food processing), as well as for producing alcoholic beverages such as wine (see fermentation in winemaking) and beer. Fermentation occurs within the gastrointestinal tracts of all animals, including humans Biochemical process of fermentation of sucrose.

The chemicalequations below summarize the fermentation of sucrose ($C_{12}H_{22}O_{11}$) into ethanol (C_2H_5OH). Alcoholic fermentation converts one mole of glucose into two moles of ethanol and two moles of carbon dioxide, producing two moles of ATP in the process.[9]

The first chemical formula for alcoholic fermentation is

$$C_{12}H_{22}O_{11} + H_2O + \text{yeast} \longrightarrow 2\ C_6H_{12}O$$

SucroseWaterFructose

The second chemical formula for alcoholic fermentation is

$$C_6H_{12}O_6\ 2\ \cancel{C_2H_5OH + 2CO_2}\blacktriangleright$$

FructoseEthanolCarbon Dioxide

1.2 Ethanol

Ethanol also called alcohol is a colourless, flammable, volatile liquid with a molecular formula of C2H5OH. It has a molar

mass of 46.07 g/mole, a density of 0.789 g/cm3 at 20oC, a melting point of −114°C, and a boiling point of 78.37°C. It is widely used as a solvent, a fuel, and as a raw material for the production of other useful chemicals that have wide applications in the industry. It is also consumed as alcohol beverage, for household heating, and applied as an antiseptic. It is produced from ethylene hydration and fermentation of sugars, starch, lignocelluloses materials, or hydrocarbon-based ethanol production. The use of lignocelluloses biomass for bio ethanol production is a recent alternative with great promise and still under research.[1]

1.3Simple Distillation

Simple distillation is a procedure by which two liquids with different boiling points can be separated. Simple distillation (the procedure outlined below) can be used effectively to separate liquids that have at least fifty degrees difference in their boiling points. As the liquid being distilled is heated, the vapours that form will be richest in the component of the mixture that boils at the lowest temperature. Purified compounds will boil, and thus turn into vapours, over a relatively small temperature range (2 or 3°C); by carefully watching the temperature in the distillation flask, it is possible to affect a reasonably good separation. As distillation progresses, the concentration of the lowest boiling component will steadily decrease. The temperature will continue to increase until the boiling point of the next-lowest-boiling compound is approached. When the temperature again stabilizes, another pure fraction of the distillate can be collected. This fraction of distillate will be primarily the compound that boils at the second lowest temperature. This process can be repeated until all the fractions of the original mixture have been separated.[2]

2. METHADOLOGY

2.1 Materials

2.1.1 Banana Peels

The Banana peels have been obtained from local market of Yavatmal then it washed with water. After washing with water banana peels has been cut by knife into small pieces then blend with water.[4]

Fig-2.1.1: Banana Peels

Fig-2.1.2: Cut Banana Peels

2.1.2Dry Yeast

Dry yeast (Bakeryyeast) is obtainedfrom Ranade dairy for the fermentationprocess whichuse as enzyme.[7]

Fig-2.1.3: Dry Yeast

2.2 Method

2.2.1 Fermentation Tank

Fermentation tank has been made of plastic material and capacity up to 10 litres. The fermentation tank provided with stirrer made of stain steel material with maximum 3000 RPM. In fermentation tank 22 numbers of banana peels has been added with 30 gm of dry yeast (bakery yeast) and 2 litre's water with 2 hrs of agitation.[6]

Fig-2.2.1: Fermentationwith Stirrer

2.2.2 Filtration

After3 days of completed fermentation, the fermented biomass has been filtred out byusing filtred cloth for removal of residues then distillation process is carrying out.[3]

2.2.3 Simple Distillation

After filtration of biomass, distillation is carrying out at first run at 90^{o}C and second run at boiling point of ethanol 78^{o}C for obtaining main product i.e. ethanol

Fig-2.2.2: Distillation Unit

2.2.4 Product (Ethanol)

Ethanol is produced after distillation, which is clear liquid with spirit like odour and send for testing i.e. concentration, pH and density.

Fig-2.2.3: Ethanol

3. RESULT AND DISCUSSTION

Initially we are carrying out fermentation of waste banana peels so that fructose, sucrose is converting into ethanol molecule using dry yeast. After distillation of fermented mixture, we have obtained ethanol as our main product and we are obtained 250 ml mixture of ethanol water then we are carrying out testing of ethanol such as pH, density, concentration of bio-ethanol in mixture. Which are shows as follows so that we are compared the obtained date with standard ethanol properties.

3.1 pH

pH of sample (Bio-ethanol) found 7.2.[5]

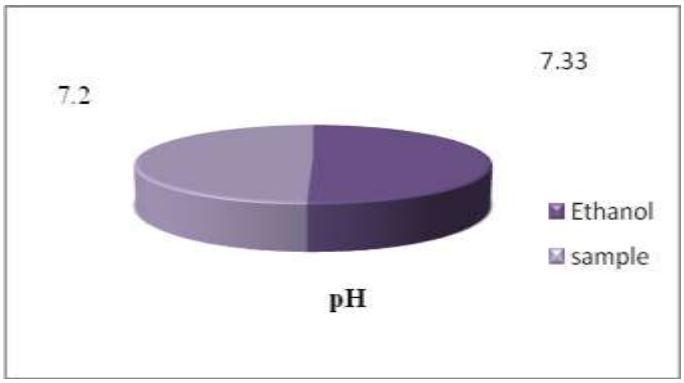

fig-3.1: pHOf Bio-Ethanol

3.2 Density

Density of sample (Bio-ethanol) found at 29 ^{o}C is 0.926 gm/ml or 926 kg/m^{3}

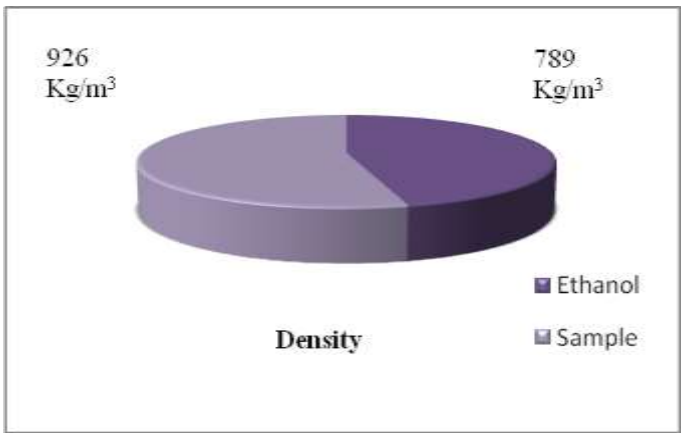

fig-3.2: Densityof Bio-Ethanol

3.3 Concentration

$$\%\text{Concentration} = \frac{volume\ of\ solute}{volume\ of\ solution} \times 100$$

Concentration of bio-ethanol found is 80%.

4. CONCLUSION

Banana fruit waste could be used to produce bio-ethanol effectively. It can be concluded that, produced bio-ethanol from banana biomass was of good quality and can be used in the engine for transportation purpose with producing less emission. In the addition to that, it can be used as environmental recycling process for waste management. We are utilized yeast for ethanol production by fermentation process for obtained good quality product and as from current resources we are use banana peel may be used as resource to obtain bio-fuel. Banana peel is a cheap source of alcohol production so that it can use as a base material for alcohol production.

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