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Original Research Article

Experimental Synthesis of Ethanol from Sugar Cane Juice Molasses

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ABSTRACT

Ethanol synthesis by using raw feed stock is being widely explored. Production of ethanol from waste food grains, fruit wastes, vegetable wastes, and sugar industry byproducts is being carried out on experimental, pilot plant and in some cases industrial scale. Ethanol has huge potential as fuel and is main compound in alcoholic beverages. It is most often used as a motor fuel, mainly as a bio fuel additive for gasoline. Bio ethanol can be made from very common crops such as sugar cane, potato, manioc and corn. In current research sugar molasses is used for ethanol synthesis.

Key words: Bacteria, molasses, purity, incubation, slant, fermentation.

INTRODUCTION

Synthesis of compounds by biological pathways is very widely explored area of research. Ethanol is one of the most common research topics for biological synthesis from raw feed stock. This is due to its increasing acceptability as fuel. Ethanol is classified as a primary alcohol, meaning that the carbon its hydroxyl group attaches to, has at least two hydrogen atoms attached to it as well. Ethanol is a colorless liquid having a pleasant smell and a burning taste. Ethanol used as fuel, is ethanol (ethyl alcohol), the same type of alcohol found in alcoholic beverages. It is most often used as a motor fuel, mainly as a bio fuel additive for gasoline.

Bio ethanol can be made from very common crops such as sugar cane, potato, manioc and corn. Many investigations for biological synthesis of compounds have been reported. Enzymatic hydrolysis for glucose and cassava was carried out with considerable success by investigators. [1,2] Compounds like amino acid, lactic acid, oxalic acid, vinegar, citric acid are being produced by using biological methods. An investigation on factors affecting biological synthesis of these compounds has been reported. [3-8]

Investigations are reported on ethanol production from various feed stocks. [9-10] Also an investigation on ethanol production from waste of fruits such as banana, papaya, cashew nut, pineapple etc has been reported. [11-15] In the current investigation molasses is used as a feed stock for exploring its possibility for ethanol synthesis.

METHODOLOGY

Step 1: 500 ml of fresh sugarcane juice was taken and it was pasteurize at 70 degree Celsius for 5 minutes (Fig 1A).

Step 2: It was then cooled down to room temperature in a cold water bath (Fig 1B).

Step 3: Saccharomyces slant was removed out of the incubator and it was allowed to attain room temperature (Fig 1 C)

Step 4: 25ml of the pasteurized sugarcane juice was pipetted out and poured into the saccharomyces slant. 1gm of urea was added along with few granules of magnesium sulphate to the test tube as a feed.

Step 5: The cotton plug was reinserted onto the test tube. The mixture was incubated for a period of 12 hours at 32 degree Celsius.

Step 6: After a period of 12 hours a slightly turmeric turbid color was observed in the test tube with no bubbling action on the surface of the mixture. This proves that the bacterial action has come to a halt, since all

the sucrose ($C_{12}H_{22}O_{11}$) content in the sugarcane juice has been converted to ethanol and CO_2. (Fig 1H)

Now 500 ml of sugarcane juice was taken and it was pasteurized at 70 degree Celsius for 5 minutes. Then it was cooled down to room temperature. (Fig 1 F)

Step 7: Now at a temperature of around 40 degree Celsius, attained with the help of a burner, slant was transferred from the test tube into the 500 ml flask juice for a scale up. (Fig G)

Step 8: The mixture was stirred gently and incubated for a period of 36 hours. The stoppage of bubbling action on the surface of the mixture is a pure indication of the completion of the reaction. Fig H)

Step 9: The next step is to filter the given slant with a filter cloth. (Fig I)

Step 10: The filtered mixture is distilled in a simple distillation unit at a temperature of about 80 degree Celsius. (Fig J)

Step 11: 150 ml of distillate was collected in a flask.

Fig.1C: Step 3

Fig: 1 D: Step 4

Fig1 a: Step 1

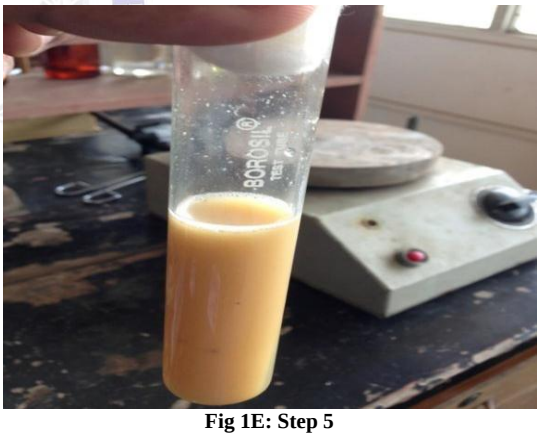

Fig 1E: Step 5

Fig 1B: Step 2

Fig 1F: Step 6

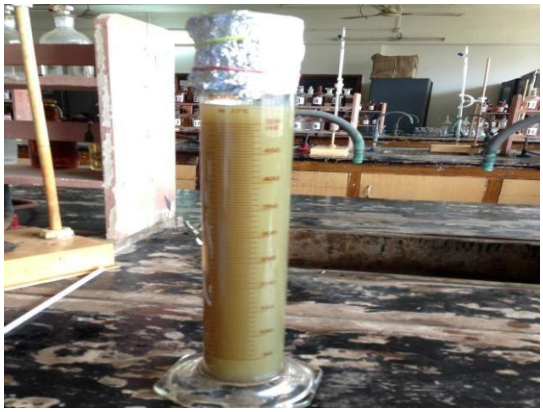

Fig 1 G: Step 7

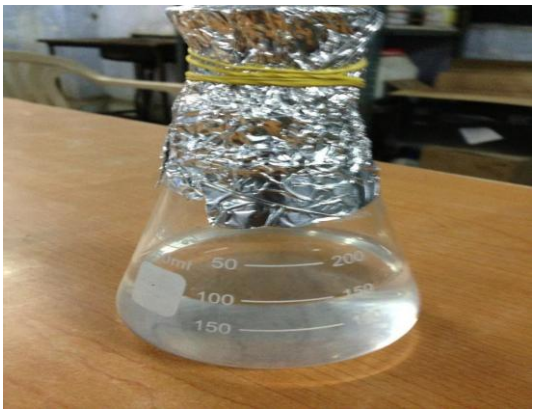

Fig 1 K: Step 11

Fig 1H: Step 8

ANALYSIS

Weight of the empty clean and dry pycnometer, was recorded. Then 10g of a dry ethanol sample was placed. (afer passed through the sieve No. 10) in the pycnometer. The weight of the pycnometer containing the ethanol was noted. Distilled water was then added to fill about half to three-fourth of the pycnometer. The sample was soaked for 10 minutes. A partial vacuum was applied to the contents for 10 minutes, to remove the entrapped air.

Fig 1 I: Step 9

Fig 2 A: Analysis

Fig 1 J: Step 10

Fig 2 B: Analysis

The vacuum was stopped and carefully the vacuum line was removed from pycnometer. The pycnometer was filled with distilled water to the mark. Exterior surface was cleaned of the pycnometer with a clean, dry cloth. The weight of the pycnometer and contents was determined. Pycnometer was emptied and cleaned. It was then filled with distilled water only (to the mark). The exterior surface of the pycnometer was cleaned with a clean, dry cloth. The weight of the pycnometer and distilled water was determined. Then again the pycnometer was emptied and cleaned. Fig 2 A and B shows instruments used for analysis. The purity of the ethanol sample was calculated from the specific gravity.

RESULT

Purity of ethanol sample obtained was 77 %. This indicates that the sugar cane juice molasses can be used for the production of ethanol.

CONCLUSION

Saccharomyces cerevisiae is efficient in the conversion of sucrose to ethanol thereby, increasing its productivity. Easily available raw material can be used for ethanol production. Molasses residue can be used as a soil fertilizer. The process of ethanol synthesis from cane sugar juice molasses provides satisfactory yield. The ethanol obtained can be purified further according to requirement.

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