

Biofuel from Banana Peel: One Step ahead in Sustainable Development

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Abstract:

Production of green energy from waste material has played an important role in recent years due to the depletion of non renewable energy sources. Starchy materials, especially maize, are widely used for the ethanol production, but banana peels are waste materials and generated in large quantity every day. The present study was done to investigate optimum parameters for bio-ethanol production from waste banana peels by *Saccharomyces cerevisiae*. Ethanol was produced from banana peels at different pH ranges from 5.0 to 8.0 and using temperature range from 25 °C to 55 °C. Liberated sugars were measured using 3, 5-dinitrosalicylic acid and product was determined by iodometric method. Highest ethanol was found to be produced at pH 6.5 with temperature of incubation 30 °C.

Key words: *Saccharomyces cerevisiae*, waste banana peel, bio-ethanol

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Introduction:

As we know that banana is one of the major cash crops of this country and it produces a huge amount of waste peels after consumption of fruit. Also biofuel is emerging as a very promising renewable fuel against conventional fossil fuels. Because of burst in population over the last century, fossil fuel consumption increased steadily resulting into depletion of same at alarming rate. So, it is very much required to find the alternative source of fuel. Production of bioethanol is a true effort in this direction. Work was carried out for “Ethanol” production using “banana peel” as a substrate employing strain of *Saccharomyces cerevisiae*. Banana peel is an agricultural byproduct. According to the report (Banana Market Review and Banana Statistics 2012-2013) worldwide production of banana is about 16.5 million tones while in Asia.

Methods and Materials:

- **Materials:** Waste banana peels were collected from local market in Surat city. They were washed with the help of distilled water and chopped into small pieces.

- **Inoculum Preparation:** *Saccharomyces cerevisiae* was used for the fermentation of ethanol from waste banana peels. For the preparation of inoculum GYE (Glucose Yeast Extract) broth was used. GYE broth contains (g %) Glucose; 2, Yeast Extract; 1, Peptone; 2 and pH was set to 6.5 with the help of concentrated HCl.

- **Protocol Set-up:**
 - 5 g of waste chopped banana was taken into 100 mL of distilled water.
 - pH was set to 6.5 with the help of HCl and NaOH.
 - 5 mL sample was collected to measure the sugar concentration before autoclaving.
 - Broth was autoclaved at 121 °C and 10 psi pressure for 15 minutes.
 - 10% inoculum was used to inoculate fermentation media for production of ethanol.
 - After every 24 h, 5 mL sample was withdrawn to check the sugar concentration and ethanol concentration.

- **Effect of Temperature on Ethanol Production:**

To determine the temperature parameter, inoculated broths were kept at different temperature v/z 25 °C, 37 °C, 45 °C, 55 °C and at room temperature.

- **Effect of pH on Ethanol Production:**

To check the effectivity of pH on Ethanol production, various pH was selected ranges from 5.5 to 7.5. pH was adjusted with the help of 0.1 N HCl and 0.1 N NaOH.

➤ **RESULTS & DISCUSSION:**

Composition of banana peel:

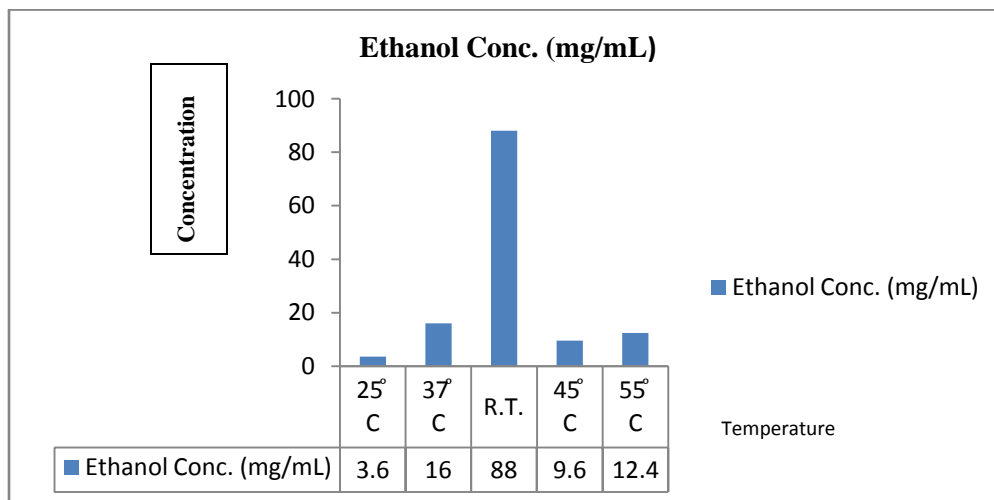
The average composition of banana peel is summarized in Table 1.

Constituents	% of wet weight
Moisture	82.47–86.21
Organic components	Variable
Hemicellulose	12.57 ± 1.4
Cellulose	15.48 ± 0.24
Lignin	11.48 ± 1.67
Crude protein	6.41 ± 0.43
Starch	32.75 ± 0.21

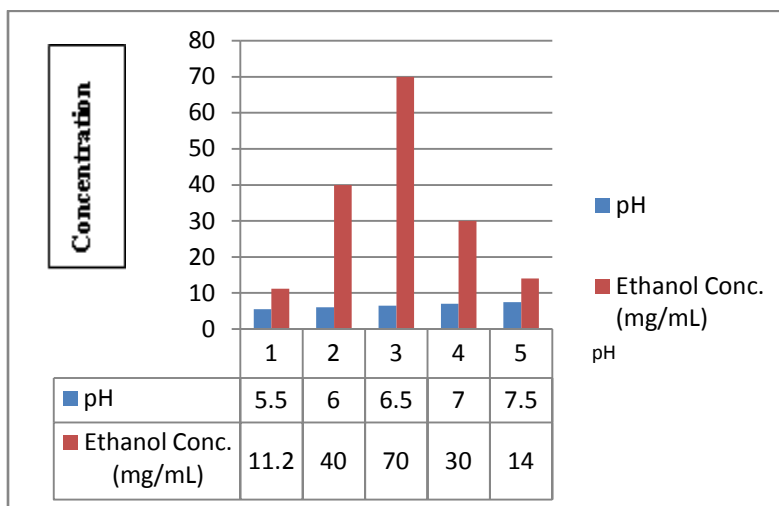
TABLE 1: Average composition of banana peels

Starch, cellulose and hemicelluloses contents of banana peel were relatively high. The result indicated that banana peels could be a good source of carbon source for bioconversion.

- **Optimization of Temperature on Ethanol Production:**



Graph 1: Effect of Temperature on Ethanol Production



Graph 2: Effect of pH on Ethanol Production

It is reported that maximum ethanol production at room temperature was found to be 88 mg/mL (**Table 2**). Highest ethanol concentration i.e. 70 mg/mL was observed at pH 6.5 (**Table 3**).

Conclusion:

Ethanol was efficiently produced from the waste banana peels. Using banana peel reduces the utilization of other food based materials which was earlier used to produce ethanol. In future, there is possibility of large scale utilization of waste banana peels for the high ethanol production by optimizing the various parameters as well as by manipulating the organism to fulfill the recent market demand.

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