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Experimental investigation on fermentation of fruits and vegetables waste for ethanol production

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ABSTRACT

Increase in the need of petroleum products results a remarkable rise in prices. Therefore require to discover alternative cheaper sources for fulfillment of worldwide demand. Here main objectives is to develop easier techniques by using cheaper source for the production so that the common people can also produce it by themselves. For this purpose fruit and vegetable wastes were taken as a substrate for the ethanol production with use of microorganism saccharomyces cerevisiae also added. The results indicates that the ethanol production rate through fermentation of fruits waste yields is optimal at ph 5.5, temperature 32°c, specific gravity 0.865 conc of about 6.21%. after distilling the product, higher concentration of ethanol can be obtained. It is a clean and good for the environment because releases no toxic gases, and not harmful to human health too. The waste materials after the fermentation can be used as a soil fertilizer. The results of this study shows that wastes fruits not to be discarded into our environment because they contains fermentable sugar. These can be converted into bioethanol that can be use as an alternative energy source.

Keywords: Fruits waste, Saccharomyces cervisiae, Fermentation, Distillation

INTRODUCTION

Ethanol is the product obtained by fermentation of biomass of agricultural crops, rich in carbohydrates. Ethanol production for bio fuel utilizes the feed stock that are rich in cellulose. The fruits and vegetables are more prone to spoilage than cereals due to their nature and composition and this spoilage occurs at the time of harvesting, handling, transportation, storage, marketing and processing resulting in generation of wastes. Efficient management of these wastes can help in preserving vital nutrients of our foods and feeds, and bringing down the cost of production of processed foods, besides minimizing pollution hazards. Since large quantities of fruit and vegetables waste and agro wastes are available from fruit plantations, vegetables growing fields and wastages during transportations, their disposal is a problem.

OBJECTIVES & SCOPE

Isolation of microorganisms from fruit and vegetable wastes and characterization for scarifying activity. Optimization of growth conditions for the fermentation process. Selection of efficient bacterial and yeast strains for alcohol production.

Ethanol fermentation offers promising alternatives as it can be produced from various sources of raw materials. This process are higher productivity, higher dissolved oxygen in the medium, decreased fermentation time and reduced toxic effects of the medium components, which are present at higher concentrations

METHODOLOGY

The materials used in this study are as follows:

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- Fruits and vegetables waste (banana, orange, papaya, pineapple,
- potato, beans,onions),
- Potassium permanganate,
- Urea,
- Sucrose,
- Bewers yeast (saccharomyces cervisiae).

For this purpose different fruit waste and chemicals (50 gm sucrose, 5%potassium permanganate, 1 gm urea) with saccharomyces cerevisiae strain, were collected. Some equipment's like

1. Incubators
2. Distillation unit.

Incubator

Incubator is a device used to grow and maintain microbiological cultures or cell cultures. The incubators maintains optimal temperature, humidity and other conditions such as the CO (CO2) and oxygen content of the atmosphere inside

Distillation unit

Distillation is the process of separating the components or substances from a liquid mixture by using selective boiling and condensation. Distillation may result in essentially complete separation (nearly pure components), or it may be a partial separation that increases the concentration of selected components in the mixture.

Preparation of the substrate and fermentation

Around 50gm of each fruit waste were weighed and mixed to make 200gmcontent then washed with 5% potassium permanganate and after that flushed with distilled water. After that fruit waste crushed, taken in a beaker. Now in separate beaker,1.5gm of urea, 50gm of sucrose, and 10gm of saccharomyces cerveisie take with warm water. After the inoculums development, mixed both beakers contents and made final volume up to 1000ml by adding distilled water. The fermentation process started after the initial specific gravity measurement by using hydrometer. The flask containing fruit was maintained at 32ºC and 100rpm incubator after covering with dark papers. At the time of fermentation process, zymase enzyme from saccharomyces cervisiae changes the basic sugars into ethanol and CO2. During incubation, specific gravity of the sample was noted frequently by using hydrometer. At the point when the particular gravity achieves a stabilize value, it shows the end of the fermentation process.

Figure 1. Before fermentation

Recovery of the product

After the 36 hours fermentation processes little sum each on sample was taken and centrifuged. The supernatant was gathered and the volume of the alcohol was dictated by the specific gravity method. At the point whatever is left of the sample

was distilled by using batch distillation unit to collect thee ethanol from distinctive fruit wastes. The distillation unit comprised of three parts:

1. A reboiler
2. Condenser funnel
3. A distillate flask.

RESULT ANALYSIS

Effect of temperature

Temperature plays a major role in the production of ethanol, since the rate of alcoholic fermentation increases with the increases in temperature. The optimum temperature of ethanol ranges between 25ºC to 40ºC which depends on room temperature. When temperature goes below the optimal range, their ability to catalyze the intended reaction slows down. On the other hand, when the temperature increases, enzymes begin to denature or unfold and thus become inactive. Each enzyme will have a different temperature range where it becomes inactive. Even if one essential enzyme stops working, the organisms fails to grow.Hence, the first essential enzyme that gets deactivated defines the maximal temperature at which that organisms can grow.

Table 1.Effect of temperature

S.No	Temperature(ºC	Concentration (%)
1	28	4.60
2	30	5.40
3	32	6.10
4	34	4.30

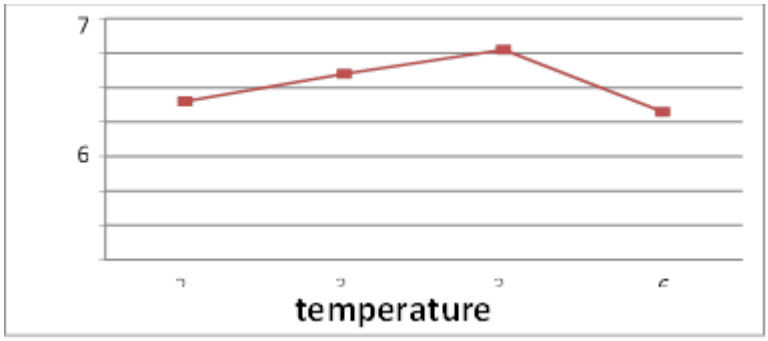

Figure no 1. Variation of concentration of ethanol w.r.t temperature

Effect of pH

pH value has significant influence on alcoholic fermentation. The pH values of ethanol produced by the process of fermentation ranges from 4 to 6. Yeast surives in a slightly acidic environment with pH ranges from 4 to 6. Among this range ethanol produced from fruits wastes had on higher alcoholic content at pH 5.5.

Table 2. Effect of pH on concentration

S.No	pH	Concentration (%)
1	4.5	4.60
2	5.0	5.40
3	5.5	6.10
4	6.0	4.30

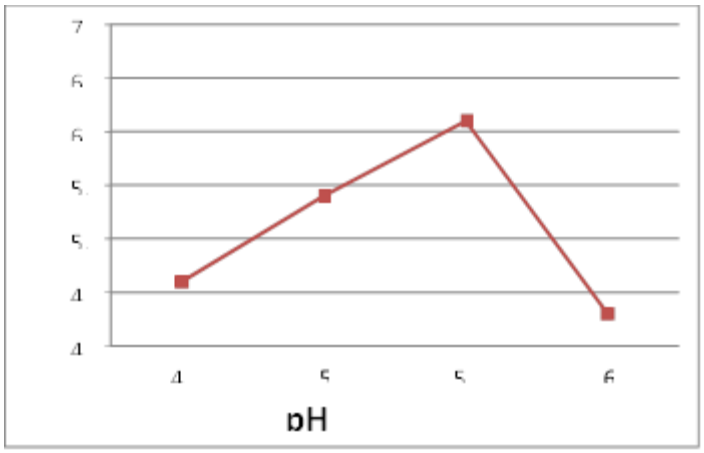

Figure 2.variation of concentration of ethanol w.r.t pH

Effect of specific gravity

Specific gravity is used to measure the sugar content. As the fermentation progressed, the specific gravity considerably decreased and reached a value of 0.865 at 36 hrs and remained constant. The decrease in specific gravity is clear indication of yeast fermenting the sugar resulting in ethanol production. The specific gravity reaching a constant value after incubation period is the indication of end of fermentation.

Table 3. Effect of specific gravity on concentration

S.No	Specific gravity	Concentration (%)
1	0.885	4.60
2	0.875	5.40
3	0.865	6.10
4	0.880	4.30

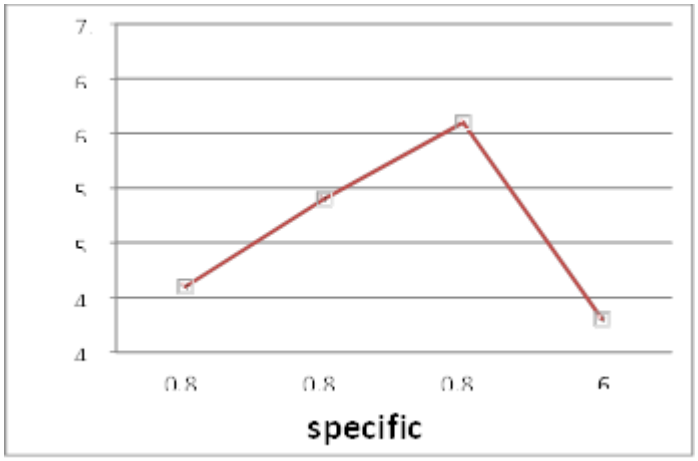

Figure 3. Variation in concentration of ethanol w.r.t specific gravity

CONCLUSION

The result of this study has shown that how the different parameters affect the production of bioethanol.

From this study, it is clear tht the maximum yield of ethanol was obtained at temperature 32ºC,pH 5.5andspecific gravity0.865The above approximately close the constant value of ethanol. From the study we conclude that the process is cheaper and does not produce any toxic residues.

This bio ethanol production process can be used for small and large scale production because raw fruit waste can be obtained from fruit industry continuously. The method used is a simple, reliable process for economical bioconversion of a given fruit waste toethanol. The waste part of the fruit is easily available at a large amount and they obtained at free of cost compare to whole fruit which help to reduce the cost ofbiofuel.

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