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Research article

Production of Ethanol from Fruit Wastes by using *Saccharomyces cerevisiae*

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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 objective 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 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 fruit 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 be discarded into our environment because they contains fermentable sugar. These can be converted into bioethanol that can use as an alternative energy source.

Keywords: Fruit waste; *Saccharomyces cerevisiae*; fermentation; distillation.

Introduction

Ethanol is a critical industrial ingredient, used as a base chemical for organic compounds and utilized as a part of restorative wipes and most usually as anti-microbial hand sanitizer gels and as an antiseptic. Ethanol from biomass-based waste materials is most often used as a biofuel additive for gasoline [1]. World ethanol production for transport fuel somewhere around 2000 and 2007 raised from 17 billion to more than 52 billion liters. Ethanol is mostly used in Brazil and in the U.S., and both nations were in charge of 89 % of the world's ethanol fuel production in 2009. Most autos today in the U.S. can run on mixes of up to 10% ethanol, and the utilization of 10% ethanol fuel is commanded in a few U.S. states and urban areas. Since 1976 the Brazilian government has made it compulsory to mix ethanol with gasoline, and since 2007 the legitimate blending is around 25% ethanol and 75% gasoline. Also, by 2010 Brazil had dart of more than 10 million adaptable fuel vehicles frequently utilizing perfect ethanol fuel [2]. Alcohol is a natural intensify organic compound that has one or more hydroxyl (OH) group joined to a carbon atom. In dilute aqueous solution, it has a sort of sweet flavor, but in more concentrated solution it has a blazing taste [3]. Ethanol manufactured from renewable sources for fuel or fuel added substances is known as bioethanol. Bioethanol, not at all like petroleum, is a type of renewable energy source that can be produced by using agriculture feedstock [4]. The first generation of ethanol production utilized corn as a substrate, later corn was considered as a feedstock lead to the second generation of production of ethanol which utilized microorganisms and different wastes as substrates [5].

The least expensive and easily available raw material for the production of bioethanol is fruit waste. It is a potential source, from which ethanol can be produced. Fruit waste which is discarded has great antimicrobial and cell reinforcement potential. In this study, looking at of the ethanol efficiency produced by maturation process from mix source of diverse fruits, apples, papaya, grapes, and bananas, and study the effect of various parameters like; pH, temperature, specific gravity and concentration. The yield of ethanol added up to more noteworthy than 80% of the fermentable sugar consumed [6]. *Saccharomyces cerevisiae* is utilized as a part of the fermentation process since it changes over sugar with oxygen to give carbon dioxide. As indicated by the International Energy Agency, cellulosic ethanol could permit ethanol fuels to assume a much greater part later on than previously suspected [7].

Materials and Methods

Materials and equipment's

For this purpose different fruit waste and chemicals (50gm sucrose, 5% potassium permanganate, 1gm urea,) with *Saccharomyces cerevisiae* strain, were collected. Some equipments like; incubators, distillation unit used.

Preparation of the substrate and fermentation process

Around 50 gm of each fruit waste were weighed and mixed to make 200gm content 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 cerevisiae 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 waste was maintained at 32°C and 100rpm incubator after covering with dark papers. At the time of fermentation process, zymase enzyme from *Saccharomyces cerevisiae* changes the basic sugars into ethanol and CO_2. During incubation, specific gravity of the sample was noted frequently by using a hydrometer. . At the point when the particular gravity achieves a stabilize value, it shows the end of the fermentation process.

Recovery of the product

After the 36 hours fermentation processes a little sum each one sample was taken and centrifuged. The supernatant was gathered and the volume of the alcohol was dictated by the specific gravity method. At that point whatever is left of the sample was distilled by using batch distillation unit to collect the ethanol from distinctive fruit wastes [8]. The distillation unit comprised of three parts: a reboiler, condenser funnel and a distillate flask. The vapors began to climb into the still head and passed through the condenser channel. The constant dissemination of cold water around the condenser funnel supported in cooling the alcohol rich vapors back to liquid state. The condensed liquid collected in the distillate and iodine test used to check the ethanol presence.

Results and Discussion

In this study, it has been demonstrated that ethanol was produced from diverse fruits. Hence the relative study has been done to check the efficiency of ethanol produced from these products of the fruit waste by deciding different parameters. The impact of different parameters on the production of ethanol is presented as follows

Effect of temperature

Temperature plays a major role in the production of ethanol, since the rate of alcoholic fermentation increases with the increase in temperature. The optimum temperature of ethanol ranges between 25°C to 40°C which depends on room temperature. When temperature goes below the optimal range, their ability to catalyze the intended reaction slows down (Table 1). 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 organism fails to grow. Hence, the first essential enzyme that gets deactivated defines the maximal temperature at which that organism can grow.

Table 1: Effect of temperature on concentration

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

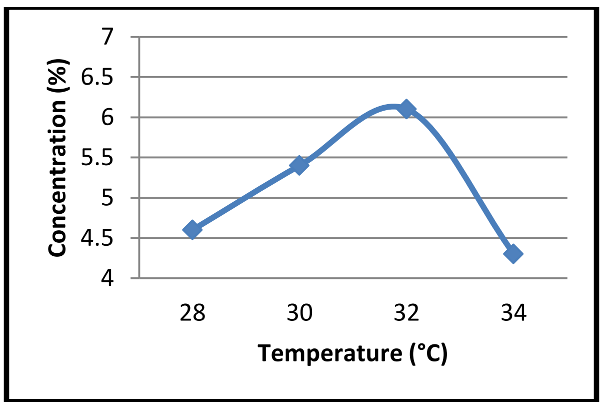

Fig (1) : variation of concentration of ethanol w.r.t. temperature

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 survives in a slightly acidic environment with pH ranges from 4 to 6. Among this range ethanol produced from fruit wastes had on higher alcoholic content at pH 5.5 (Table 2).

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

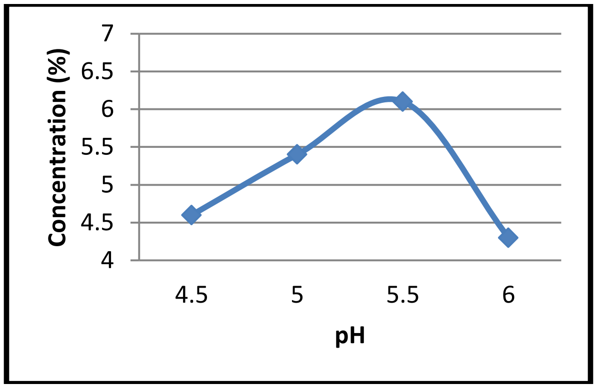

Fig (2): variation of concentration of ethanol w.r.t. pH

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).

Table 3: Effect of 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

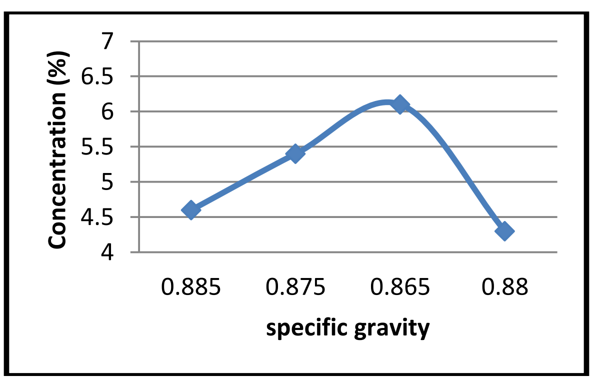

Fig. (3) : variation in concentration of ethanol w.r.t. specific gravity

Conclusion

The result of this study has shown that how the deferent parameters affect the production of bioethanol. From this study, it is clear that the maximum yield of ethanol was obtained at temperature 32°C; pH 5.5 and specific gravity 0.865 which is appropriately close the constant value of ethanol. From this study we conclude that the process is cheaper and does not produce any toxic residues. This bioethanol production process can be used for small and large scale production because raw fruit waste can obtained from fruit industries continuously.

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