

# SYNTHESIS OF BIOETHANOL FROM CORN AS A PETROL SUBSTITUTE

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## ABSTRACT

With the increasing prices of gas, petrol, diesel and the concern about the environmental pollution, the demand of ethanol as substitute of gasoline is rapidly increasing. Basically 5 steps are there in ethanol production including grinding, cooking, fermentation, distillation, and hydration. Bioethanol is mainly produced by the sugar fermentation process so we can use the any plant contains sugar and starch. The best choice is sugar cane, but you can also use potatoes, corns, barley, wheat etc.

## INTRODUCTION

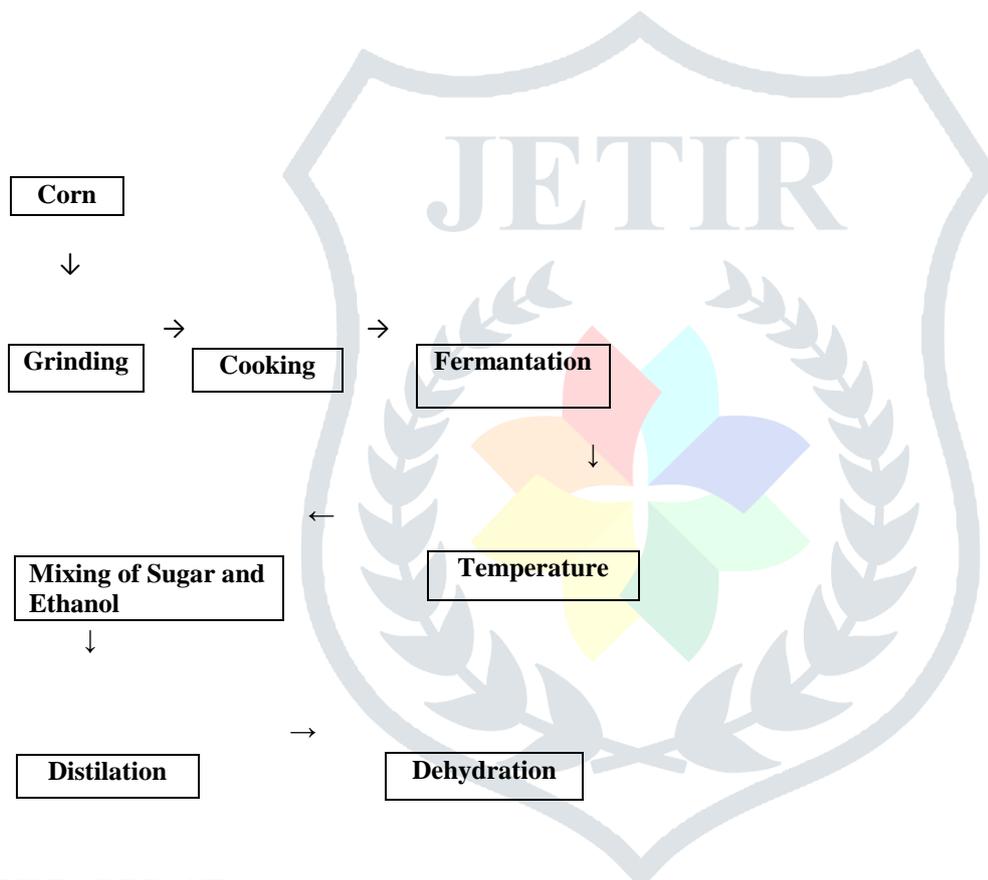
[1]Humans have been producing ethanol for thousands years. According to the time flow, the area of ethanol has been extending dramatically.[2]The very first time, ethanol existed only in alcoholic drinks. After some purification methods were established, the usage of ethanol highly extended.[3] Then, now, ethanol is at the new step. [4]The current increase in the gas price and interest in environmental problems, ethanol becomes highly attractive again.As the environment is being degraded day by day because of the use of conventional fossil fuels, the need to use alternatives is also gaining the focus of whole world. [5] The amount of petroleum is some what fixed and use of the conventional fuels is being increased day by day.[6]In this situation Ethanol can be a alternative to this. It can be made from various types of crop so essentially it can be proved a renewable source. [7]Production of ethanol can be less expensive than extraction and refining of petroleum. Thus use of ethanol can benefit us in aspects related to economy, environment and ecosystem.[8] Production of ethanol has less complicated structural and procedural requirements. However, to use ethanol as a substitute of Petrol, there are so many problems on it.[9] We have to establish large industrial ethanol plant. Also, an increase in the productive efficiency will be required. [10]On this stand point, in this paper we examine the industrial process of ethanol production and the new studies to achieve more effective production.

## RAW MATERIALS

- Peel of corn
- Water
- Yeast
- Endoenzyme *Alpha-amylase*
- Exoenzyme *Glucoamylase*

## WORK DONE

- ABSTRACT
- INTRODUCTION



## WORK TO BE DONE

### RESEARCH METHODOLOGY:

#### EXPERIMENTAL AND OBSERVATION METHOD :

### 1 Grain Grinding

First, starch should be exposed from the peel of corn to contact with water. Also, grinding makes corn small pieces, which can increase its surface area. Then, the increase in its surface area can enhance the contact between starch and water. Two types of mills, a roller mill and a hammer mill, are usually employed. For an industrial use, a hammer mill is mostly used because of its accuracy and its application for large amount.

A roller mill has some roll pairs consisting of two rollers. Corn is pressed by two rollers and crushed into small pieces. Around the rolls there are some trenches to improve the effectiveness of the crush. Also, the rotating speeds of two rollers are different in order to generate more stress on the corn. Finally, screening is implemented at the bottom of the mill. Then, the fine particles can pass the screen, and the big particles, which cannot match the required size, become the subject of the grinding again.



Although the set up cost of a roller milling is relatively expensive, it consumes less energy than a hammer mill. However, it is less used than a hammer mill in a dry mill industry. There are some reasons. First, the maintenance of the appropriate roller gaps is very costly. Also, a roller mill has a difficulty to grind a small and grain with hard shell such as corn. Thus sometimes, it is not appropriate to grind corn.

## 2 Cooking

At the grinding step, the outer shell of grain is almost completely removed. Also, this step increases the surface area of each particle. These results make water penetrate through grain easily. However, there is still some undesirable area, which is hard to absorb water. To achieve effective enzymatic action, this micro-crystalline area should be removed. This is typically accomplished with two hot water processes.

First, grain is treated with hot water, typically 85°C for between 20 to 60 minutes. Then, super heated water, typically 110°C, is introduced with high pressure.

With the first mixing with hot water, the starch absorbs water. Then, the structure of the micro-crystalline area becomes weak. Then, after introduction of super heated water with high pressure, this area is completely broken. Without this water treatment, this area cannot be broken, which means the efficiency of the enzymatic action is lost.

During the cooking step starch is hydrolyzed into fermentable sugars. In an ethanol industry, two enzymes are usually employed, endoenzyme *alpha-amylase* and exoenzyme *glucoamylase*. *Alpha-amylase* attacks the alpha-1, 4 linkages of

starch. The longer incubation time and the higher concentration of *alpha-amylase* make it possible to obtain shorter dextrin with short time.

The length of the dextrin chain is well controlled. This is because it affects the productive efficiency. The shorter dextrin chain causes the lower viscosity. The lower viscosity can reduce the reaction time or electric cost.



After the first hydrolysis with *alpha-amylase*, *glucoamylase* works. *Glucoamylase* removes one glucose from dextrin. Thus, *glucoamylase* cuts linkage of dextrin from its end. This reaction is much slower than *alpha-amylase*. Generally, the enzymatic action of *alpha-amylase* is over 10 times faster than one of *glucoamylase*.

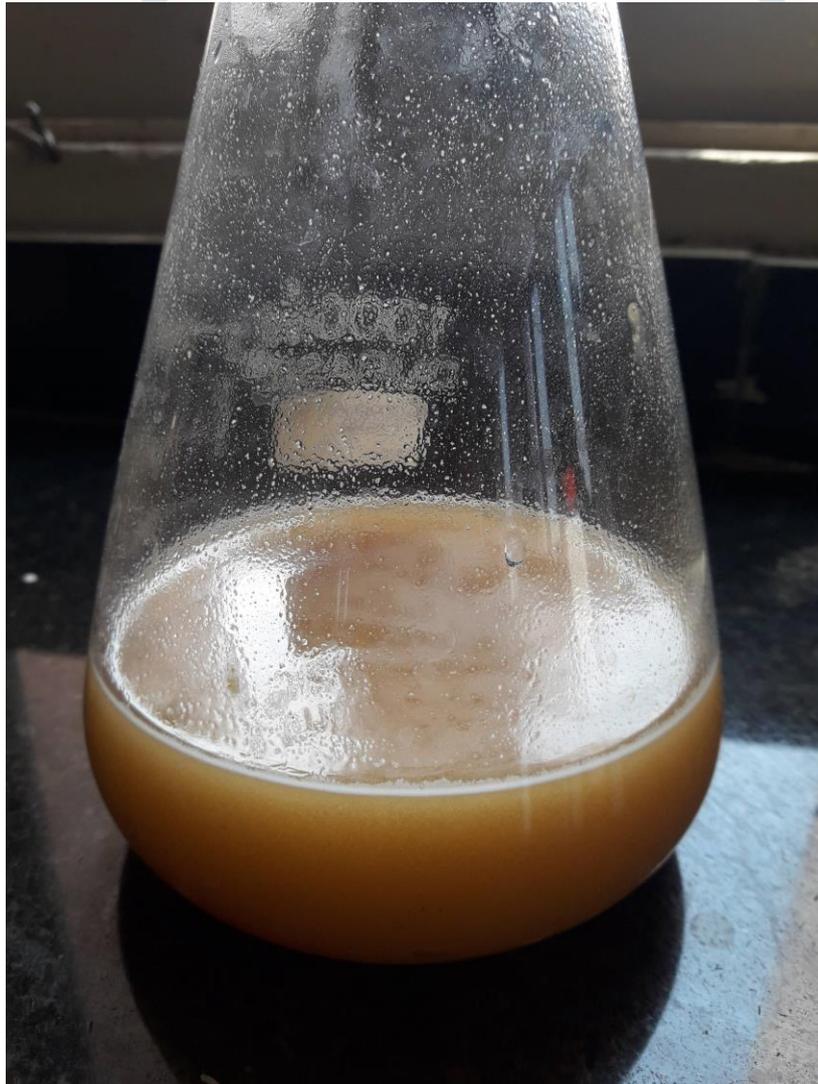
As stated above, *Alpha-amylase* attacks the alpha-1, 4 linkages of starch, so it does not have any effect on 1, 6 linkages. However, this will not be a big problem because the amount of 1, 6 linkages are much less than 1, 4 linkages. When 1, 6 linkages become the subject of hydrolysis, another kind of enzyme is employed.

### 3 Fermentation

Yeast is a facultative anaerobe. In an aerobic environment, it converts sugars into carbon dioxide and water. In an anaerobic environment, it converts sugars into carbon dioxide and ethanol. Thus, for an ethanol industry, it is important to exclude significant oxygen from its system.

A propagation tank is employed. In this tank, mash, water, enzymes, nutrients, and yeast are mixed to re-hydrate the yeast. The purpose of this tank is to get highly activate yeast. Preparing two propagation tanks, the activate yeast can be provided constantly.

If the propagation tank is not employed, a significant time lag will occur in the fermenter. This is very time consuming and causes losing an economical efficiency. Also, a propagation tank has a role to grow yeast in it, so using a propagation tank, producers can save the amount of yeast they have to buy from suppliers.



### 4 Controlling Factors

There are some factors for yeast which have to be controlled by producers such as sugar concentration, ethanol concentration, temperature, bacterial infection, mycotoxins, and nutrient levels. Yeast is strong enough to tolerate each factor only

if the stress is only one for example if the sugar concentration becomes higher than the desired level, the activity of yeast will slow down. However, as soon as the sugar concentration is recovered in the required range, its activity will recover. The most concerning situation is the case that two or more stresses appear simultaneously. In this case, yeast cannot tolerate the environment. The damage on yeast will be significant, which means if the stresses are removed, its activity will not come back again. In this sense, the stress management is very important.

#### **4.1 Temperature**

Too high temperature kills yeast, and low temperature slows down yeast activity. Thus, to keep a specific range of temperature is required. However, fermentation is exothermic, so in this sense, only a cooling system can be on the issue.

#### **5 Mixing of Sugars and Ethanol**

Simultaneous stresses on yeast should be avoided for fermentation, which means simultaneous increases in sugars and ethanol concentrations are not a good situation for yeast. As one of the ways to avoid this situation, sometimes the simultaneous saccharification and fermentation (SSF) method is employed.

#### **6 Distillation**

After fermentation, we have to make the purity of ethanol higher. Distillation is one of the steps of the purifications. Distillation is the method to separate two liquid utilizing their different boiling points. However, to achieve high purification, several distillations are required. This is because all materials have intermolecular interactions with each other, and two materials will co-distill during distillation. This means that proportion between two materials, in this case ethanol and water, can be changed, still, there are two materials in both layers, the liquid and the vapor layers.



## 7 Dehydration

About 5% of water remains in ethanol. Especially, this water is a big problem for fuel ethanol because the presence of this amount of water enhances the molecular polarity of ethanol. For example, ethanol and gasoline are mixed, they separate into two phases, ethanol phase and gasoline phase. It is easy to imagine that this inhomogeneous fuel is not acceptable. Thus, dehydration can be another issue.

### PHYSICAL PROPERTIES OF ETHANOL

#### Appearance, Odour and Taste

At room temperature, ethanol is clear, colourless, volatile liquid with characteristic odour. When diluted, it is somewhat sweet, but concentrated alcohol has a strong, burning taste.

#### Solubility

Ethanol is highly soluble in water and organic solvents, but poorly soluble in fats and oils.

## pH

Pure ethanol is neutral (pH~7). Most alcoholic beverages are more or less Acidic.

## Boiling point

Boiling point of ethanol is 78.5 degree C

## Observation:

## ADVANTAGES

Bioethanol comes from a renewable resource i.e. crops and not from a finite resource. Through the use of bioethanol, some of the greenhouse gas emissions will be reduced as the fuel crops absorb the CO<sub>2</sub> they emit through growing. Blending bioethanol with petrol will help extend the life of the diminishing oil supplies and ensure greater fuel security, avoiding heavy reliance on oil producing nations. By encouraging bioethanol's use, the rural economy would also receive a boost from growing the necessary crops. Bioethanol is also biodegradable and far less toxic than fossil fuels. Bioethanol is produced using familiar methods, such as fermentation, and it can be distributed using the same petrol forecourts and transportation systems as before.

## DISADVANTAGES

Disadvantages of bioethanol include lower energy density than gasoline, its corrosiveness, low flame, luminosity, lower vapour pressure, miscibility with water and toxicity to eco system. Scientists report that ethanol may end up contributing to global warming more than fossil oil because it requires large amount of land during its production which will result into destruction of some natural habitats like rainforest. There is concern that due to commercial purpose for earning farmers may sacrifice food crops which in turn results into rising food prices.

## Conclusion

Bioethanol helps to reduce greenhouse gases and thus prevents environmental pollution. As it doesn't emit toxic substances and harmful gases, it prevents and reduces the health problems. The maintenance cost is much less than other fuels. As it is cost effective and environment friendly it can be a good petrol substitute and it adopted as much as possible.

## Result

Amount of bioethanol obtained :- 30gm

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