

Review: Synthesis of Ethanol by Fermentation Process

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Abstract:- Ethanol or Ethyl Alcohol, $\text{CH}_3\text{CH}_2\text{OH}$, is one the most versatile oxygen containing organic chemicals because of its unique combination of properties as a solvent, a germicide, a beverage, a fuel, etc. The present literature survey shows the detail of manufacturing process of ethanol using different methods. Among all the methods fermentation process seems to be cost effective. The use of ethanol by different industries and its application are detail discusses in literature survey.

Keywords:- Ethanol, Fermentation Process, Material Balance.

I. INTRODUCTION

Ethanol, also called alcohol, ethyl alcohol, grain alcohol, and drinking alcohol, is a [chemical compound](#), a simple [alcohol](#) with the [chemical formula](#) $\text{C}_2\text{H}_5\text{OH}$. Its formula can be also written as $\text{CH}_3\text{-CH}_2\text{-OH}$ or $\text{C}_2\text{H}_5\text{-OH}$; it is a [psychoactive substance](#) and is the principal type of alcohol found in [alcoholic drinks](#).

II. PROPERTIES OF ETHANOL

(a) Physical Properties:

- Chemical Formula: - $\text{C}_2\text{H}_5\text{OH}$,
- IUPAC name Ethanol,
- Density (gm/m^3):- 0.7893,
- Molecular weight: - 46.07 g/mol ,
- Appearance: - Colorless Liquid

(b) Chemical Properties:

1. Reaction with Sodium: $2\text{C}_2\text{H}_5\text{OH} + 2\text{Na} \longrightarrow 2\text{C}_2\text{H}_5\text{ONa} + \text{H}_2$
2. Reaction with Phosphorous Halides: $\text{C}_2\text{H}_5\text{OH} + \text{PCl}_5 \longrightarrow \text{C}_2\text{H}_5\text{Cl} + \text{POCl}_3 + \text{HCl}$

Use of ethanol in different fields

It is use in various fields like Low-temperature liquid, Solvent, Medical, Recreational, Fuel, etc.

Industries producing ethanol

Sr. No.	Name	Location
1	Shree Chalthan Vibhag Khand Udyog Sahakari Mandli Ltd.	Chalthan ,Gujarat
2	Shree Madhi Vibhag Khand Udyog Sahakari Mandali Ltd.	Madhi, Gujarat
3	Shree Sayan Vibhag Sahakari Khand Udyog Mandali Ltd	Sayan ,Gujarat
4	Sahakari Khand Udyog Mandli Ltd.	Navsari, Gujarat
5	HPCL Bio-fuels Ltd.	East Champaran, Bihar

Table1 Industries producing ethanol

III. LITERATURE SURVEY FOR SYNTHESIS OF ETHANOL

Various processes of Manufacturing:-Ethyl Alcohol may be derived from four classes of raw materials:

- (a) Saccharine materials:-Containing sugar; such as molasses, sugar beets, sugarcane.
- (b) Starchy Materials:-Cereal grains, potatoes etc.
- (c) Cellulosic materials:-Wood, agricultural residues and the waste sulfite liquor from paper-pulp mill, which contains sugars from hydrolysis of cellulose.
- (d) Hydrocarbon gases:-Ethylene.

Synthesis of methanol by fermentation of Starchy material

- In this process, enzymes necessary for converting the starch to fermentable sugar is provided by malt.
- Malt is prepared by Barely to germinate during which process the desired enzymes are formed.
- In the manufacturing of industrial alcohol, 8-10% of malt is used based on the Barley.
- After grinding the grain, the bulk passes 10-30mesh then it is cooked at about 100°C – 157.2°C which is followed by addition of water.
- The slurry is then heated with steam at up to 40-50 psig in a batch pressure cooker equipped with a motor-driven agitator.

-The cooking process takes 2.4 – 3 hours.
 -After cooking, the mash is cooled to 60°C – 68.33°C the saccharifying temperature and the malt is added in large vessels.
 -60-70% of starch in the grains is converted to maltose in about 1 – 2 hours.

-The remainder being converted to dextrins.
 -The converted mash is cooled to the fermenting temperature of about 21.11°C – 26.67°C and the pH is adjusted.
 -Fermentation complete in about 60-72 hours.

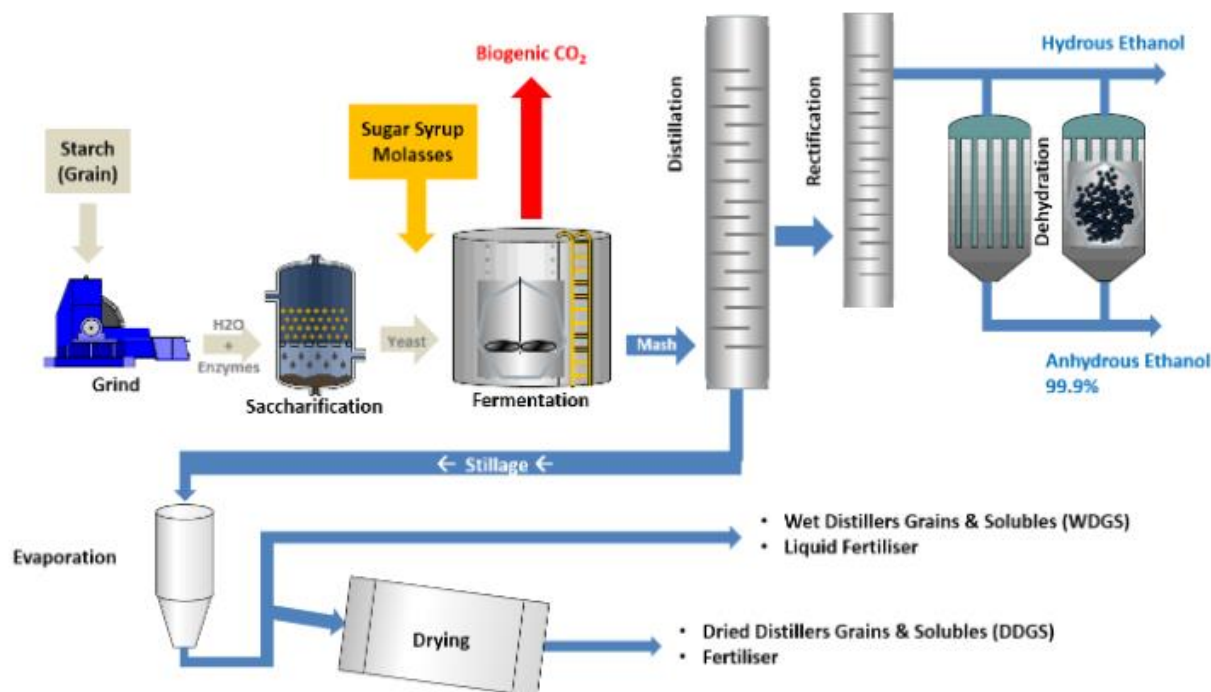
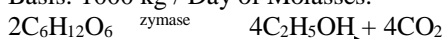


Figure 1 Flow sheet for manufacturing of ethanol

IV. MATERIAL BALANCE AND BASE FOR THE SYNTHESIS OF ETHANOL

Basis: 1000 kg / Day of Molasses.



-Amount of Ethanol Produced = 266.32 kg

-Amount of CO₂ Produced = 254.74 kg

-Water in 10% Ethanol = 2396.853 kg

-Amount of Waste Produced = 1859.50 kg

Economic evaluation of ethanol

Total Capital Investment (TCI) = 1,03,90,625 Rs.

Cost of production (COP) = 76, 41,941.1 Rs.

Gross profit :- (GP) = 42, 97,608.9 Rs.

Net profit :- (NP) = 31, 37,254.50 Rs.

Pay out period: - (POP) = 2.18 years

V. CONCLUSION

From the wide literature survey of the paper we can conclude that fermentation process has many advantages over other methods. From material balance the recovery with high yield was achieved.

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