



MANUFACTURING OF POWER ALCOHOL FROM MOLASSES BY FERMANTIOAN PROCESS: A Review

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Abstract:

India ranks 3rd in world for consumption of fuel. and hydrocarbon based conventional fuels are considered as fast depleting and harmful to the environment as they release poisonous chemical to the atmosphere. The alternative for this is power alcohol which is blending of petrol and ethanol with ratio of 80:20 power alcohol is good anti knocking agent and releases less carbon in atmosphere. And it is a biofuel which is made from agricultural waste like corn .sugarcane (molasses) etc. the process used for manufacturing is by fermentation process

keywords: hydrocarbons, power alcohol, knocking agent, biofuel, fermentation process

1. Introduction:

Ethanol first use was to power an engine in 1826, and in 1876. Nicolous Otto, the inventor of the modern four-cycle internal combustion engine , used ethanol to power an early engine. The first ethanol blended with gasoline for use as an octane booster in the 1920s and 1930s, and was high demand during world war II because of the fuel shortages. It was 1st introduced in Brazil in 1978 India is favourably situated so far as the availability of the raw material is concerned, for in addition to an inexhaustible supply of cheap cereals, molasses are now available in country at a nominal cost to the extent of about 2,00,000 tons per year. Use of ethanol in place of tetraethyl lead which acts as anti-knocking agents will prevent dangerous and poisonous emissions containing lead from petrol. Engines of cars do not need any change to use petrol with up to 24 % ethanol in it. Gasoline with ethanol as anti-knocking agent will not cause any damage to the engine

Indirect Hydration Process: it was Developed in 1930 by Union Carbide Corporation. Also called as strong Sulfuric acid ethylene Process. there are two major steps in this process 1)Absorption of ethylene in concentrated sulfuric acid to form mono and Di-ethyl sulfate 2) Hydrolysis of ethyl sulfates to ethanol. The limitation of this process are The re-concentration of dilute (50-60%) sulfuric acid is one of the more costly operations in the manufacturing of ethanol by this process. Acid concentration also presents corrosion problems

Direct Hydration Process : this process was Developed in 1970. It is Designed to eliminate the use of Sulfuric Acid. There are two major processes for the direct hydration of ethylene to ethanol. Are 1) Vapor-phase contacts a solid a liquid catalyst with gaseous reactants. 2) Mixed - phase processes contact a solid or liquid catalyst with liquid and gaseous reactants limitation for this are Higher hydrocarbons are formed by the polymerization of ethylene. Any higher unsaturated hydrocarbons present are converted to the corresponding alcohol by hydration.

Fermentation process : this process is also known as alcoholic fermentation process. It is biological process which convert sugar such as glucose, fructose, and sucrose in to the cellular energy producing ethanol and carbon dioxide as a by product. For the process the yeast is used for fermentation and then the fermented mixture is distilled and 95% pure ethanol is obtained for 100% pure ethanol it is passed through molecular sieves

2. Process Equipment's

Heat exchanger: -

A heat exchanger is a system used to transfer heat between two or more fluids. Heat exchangers are used in both cooling and heating processes. in this process we are using heat exchanger for cooling the ethanol vapours coming from the distillation column which are cool down to liquid at temp (25°C-30°C)

Distillation column:-

A distillation column is an essential item used in the distillation of liquid mixtures to separate the mixture into its component parts There are many types of distillation columns, each designed to perform specific types of separations batch and continuous we have used continuous distillation. The fermented solution is preheated and sent to the distillation column where by continuous distillation ethanol is separated at the temperature 78°C to 80°C And the purity of ethanol is 95%

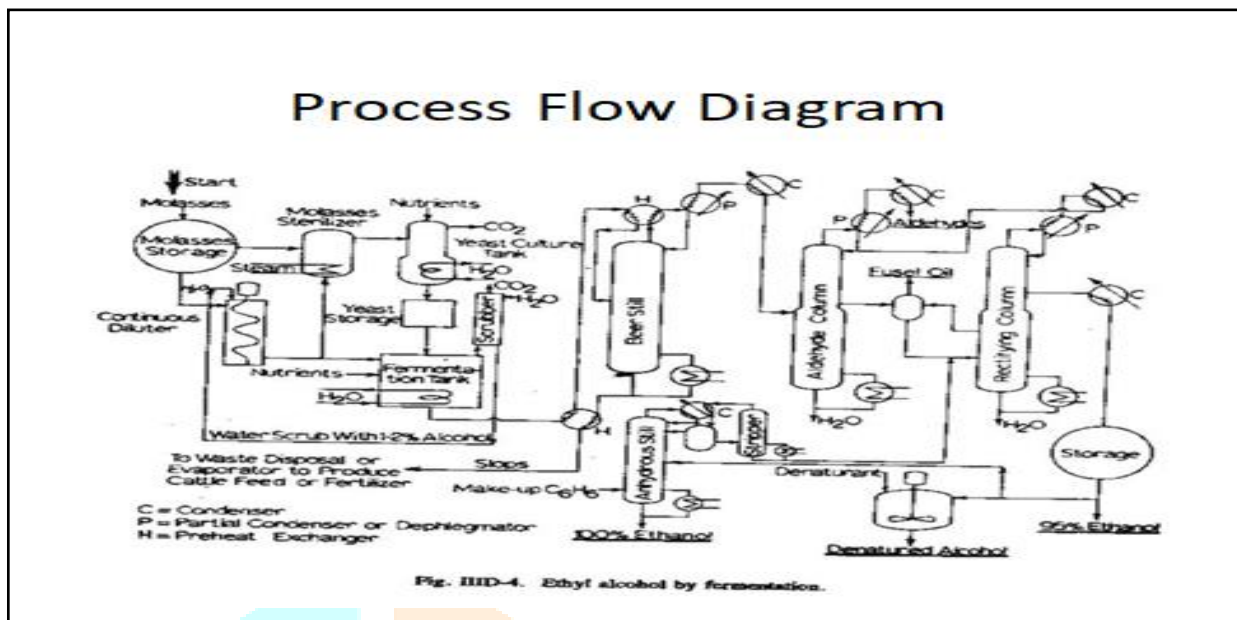
Fermenter :-

Fermenter is tank where fermentation process take place. The diluted molasses and yeast is added to the fermenter tank. And this is the batch process the reaction time required is 42 hrs. while reaction takes place carbon dioxide is released as a by product which can be purified by using scrubber and can be sold. after reaction is over the solution is sent to the distillation column for separation of ethanol

3.Process Description:-

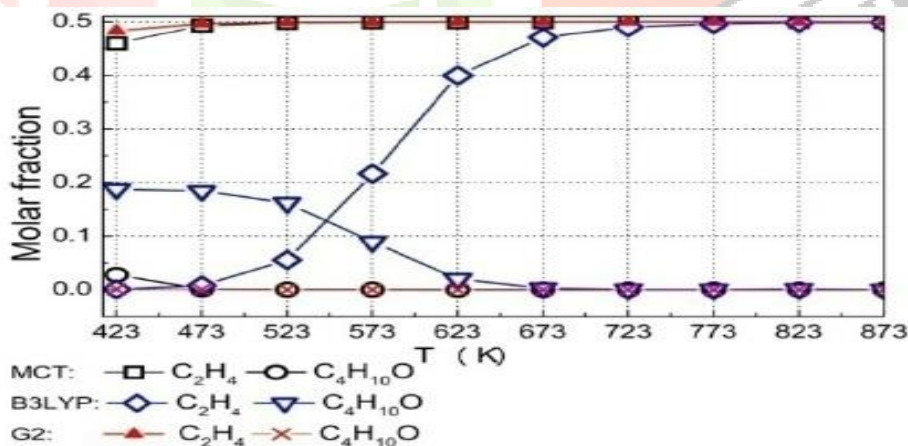
At the beginning of the process, molasses is formed in sugar industry than it is passed through two different parts. one of them dilute with water and it is passed through fermentation tank and the second one is added with yeast and stored in molasses sterilizer and further will be passed with yeast culture tank here yeast is produced by addition of nutrients after that pass to the fermentation tank. In this fermentation tank the ethanol is produced. Time required for the reaction is 54 hrs and temperature is around 32-35 degree Celsius Further it will be pass through the preheater, partially condense with help of the condenser. after In which the concentration of ethanol increases and further will be passed to the multiple distillation column where the ethanol is separated from water. and then ethanol vapour is cooled down to the liquid we get 95% of pure ethanol. In the rectifying column water molecule and ethanol molecule formed azeotropes. In rectifying column concentration of ethanol become 95% they have stored in storage tank. For getting 100% ethanol we have to pass through the anhydrous still column. In which we have add benzene for removing of present of water in ethanol and get 100% alcohol and then it is blended with petrol with ratio of 20:80

Process Flowsheet:-



4 .Thermodynamics and kinetics:

In this study, we have used ultraviolet (UV) and γ -ray induction to get a cataboliterepression resistant and thermotolerant mutant with enhanced ethanol production along with optimization of sugar concentration and temperature of fermentation. Classical mutagenesis into two consecutive cycles of UV- and γ -ray-induced mutations evolved one best catabolite-resistant and thermotolerant mutant *Saccharomyces cerevisiae* MLD10 which showed improved ethanol yield ($0.48 \pm 0.02 \text{ g g}^{-1}$), theoretical yield ($93 \pm 3 \%$), and extracellular invertase productivity ($1,430 \pm 50 \text{ IU l}^{-1}\text{h}^{-1}$), respectively, when fermenting 180 g sugars l⁻¹ in molasses medium at 43 °C in 300 m³ working volume fermenter.



THERMODYNAMIC FEASIBILITY

Overall reaction:



To find out feasibility of a reaction we need to first find out the heat of formation and Gibbs free energy of an overall reaction

Calculation:

$$\Delta H^{\circ}f(\text{reactants}) = 1 * (-1273.3) = -1273.3 \text{ kJ/mol}$$

$$\Delta H^{\circ}f(\text{products}) = 2 * (-277.7) + 2 * (-393.5) = -1342.4 \text{ kJ/mol}$$

$$\Delta H^{\circ}R(\text{reaction}) = \Delta H^{\circ}f(\text{products}) - \Delta H^{\circ}f(\text{reactants}) = -1342.4 - (-1273.3) = -69.1 \text{ kJ/mol}$$

Since $\Delta H^{\circ}R$ is negative,

Therefore, the reaction is exothermic

5. Conclusion:-

Many different processes have been investigated for the manufacture of Ethanol. A many of them manufacturing of ethanol from sugarcane (molasses) was considered for commercial and economic production. Production of Ethanol from sugarcane (molasses) was designed with capacity of 75,000 kg per day of Ethanol with a conversion of 95.4%..

6. Future Scope: -

As day by day fuel resources are depleting it will be the great alternative as fuel in auto mobile further 100% ethanol can also be used as a fuel and it will be cheaper, less pollution will be generated and it is biofuel

COMPOUND	H ^o f (kJ/mol)	G ^o (kJ/mol)
Glucose	-1273.3	-910.56
Ethanol	-277.7	-174.8
Carbon dioxide	-393.5	-394.4

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