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## INTRODUCTION

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Pak Ethanol (Pvt.) Ltd. is a Distillery Plant. In this particular chemical plant the main product is **Ethanol**. The daily production of this plant is 100 m-tons of alcohol. A grade production 94% and 6% B grade.

In Ethanol Plants, the process used for the production of alcohol is fermentation. Raw material used is called molasses and the main source of sugar cane molasses is sugar mill. After crushing of sugarcane juice in the sugar mills the crystals of sugar are made and almost 53% of sugar is crystallized but the remaining of the sugar cannot be crystallized and the this juice is called molasses and it still have up to 47% sugar. This molasses is the raw material for the production of ethanol by fermentation process.

The molasses stored in the big storage tanks. From these tanks molasses sent to the Pre fermentation and Fermentation Section. In Fermentation Section the first step is cleaning molasses; maintain the pH 4.2 to 4.5 and it is done by settling tanks.

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## PROCESS

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### Pre-fermentation

In this section diluted molasses is send to the Pre-fermenters with brix of 14 to 16 and then to the Fermenters with brix of 26 to 28. In Pre-fermenter yeast is added for making culture as well some chemicals urea, Phosphoric acid and sodium fluoride is also added to the Pre-fermenter to grow the yeast cells and kill to the anti-bacteria. Pre -fermentation is aerobic reaction therefore air necessary for pre-fermenters.

### Fermentation

Fermentation sends feed brix 26 to 28 and to keep control brix between 13to14. Fermenter filling time is 18 to 20 hours and reaction time given about 20 hours. Fermentation is anaerobic reaction. At the end of reaction time (6 – 9) % of alcohol is obtained. During the reaction CO<sub>2</sub> evolve to air.

### Distillation

Distillation is a separation technique in which different components of liquid are separated by heating and condensation at their boiling point. Distillation section having three column C510, C520 and C540.



Fermented mash with (6 – 9) % alcohol is the feed of primary distillation column C-510. The vapors of alcohol will go to C520 and while the remaining un-vaporized material called **Spent Wash** will come down side at the bottom.

C520 maintain the strength of 82 to 85% and send to the C540. This is the rectifier column, the maintain strength 95.8 to 96.2% Of C540. It is the column of under pressure, Bottom side inject of steam and extract the RS production with strength of 96.0 to 96.2 % ( v/v). C540 in to the Extract the different impurities, low oils, high oil.

### Dehydration unit

First feed is send to C-580 at the top and steam inject at the bottom of column through reboiler. The vapor produced in C-580 then first passed through the super heater in which the alcohol is heated using high of pressure steam. The alcohol in vapor phase passes through the molecular sieve adsorber in which the water portion in vapor form is retained through vacuum. The dehydrated alcohol leaves at the bottom of column and then condensed then passes through heat exchanger to make product cool and sent to storage tank with the strength 99.99% v/v.

### Steam Turbine

Steam Turbine is one of the major industrial sections in overall world. In our plant steam turbine having capacity of 1.5 Megawatts which operate at 22 to 24 kg/m<sup>2</sup> pressure of steam. Our steam turbine capacity is 1.5 Megawatt but operate at 1 Megawatt.

### Boiler

Boiler (water tube) of capacity 20 tons/hr is in operation to generate steam 18 tons/hr at 25 Bar. Main fuel for the boiler is baggas and supplement fuels are rice husk.

Power is generated by using that steam turbine at power house and remaining exhaust steam of 1.5 bar use to operate the distillation plant and to pre heat the feed water for boiler.

### Power House

Total load of the plant is 1200 to 1400 kW, where all the Electric supplies are controlled from power house.



# ALCOHOL MANUFACTURING PROCESS

