

PREPARATION OF ABSOLUTE ALCOHOL FROM RECTIFIED SPIRIT

Absolute alcohol is named to 100% conc. ethanol with chemical formula C_2H_5OH . And rectified spirit is a mixture with a composition of 95% ethanol and 5% water. To attain a pure form of absolute alcohol, one more separation step is required, so that the water content in rectified spirit is removed completely. Based on the chemical nature of ethanol and water, their concentration in the liquid mixture does not alter when heated to its boiling point. Whatever the composition present in the liquid mixture is equal to the concentrations of the component in the vapour obtained from the ethanol and water liquid mixture when heated to its boiling condition. The situation of the solution is called as Azeotropic mixture and the boiling point of this ethanol and water mixture is $78.13\text{ }^\circ\text{C}$, which is near to the boiling point of pure ethanol $78.3\text{ }^\circ\text{C}$.

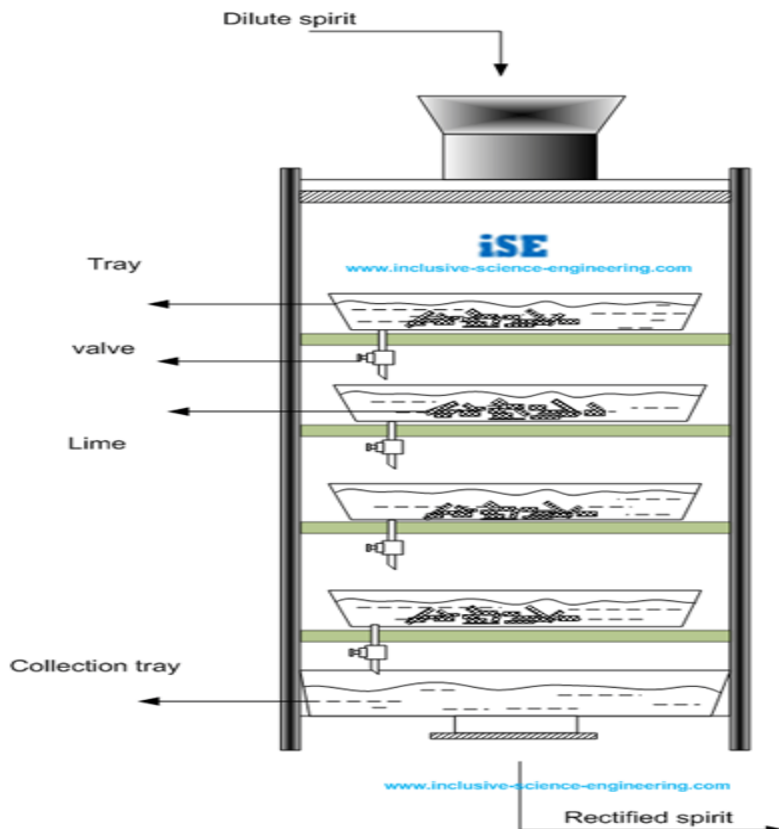
Rectified Spirit conversion technologies:

Distillation operation is not good enough to separate water from rectified spirit. Two selective processes are operational to get the job done.

One was using quicklime to absorb water content and finally contacting the solution with anhydrous copper sulphate removes the leftover traces of water. The second method uses a third component like benzene, toluene, carbon tetrachloride and diethyl ether in azeotropic distillation operation. These dehydrating agents alter the boiling point and partial pressure of ethanol and water so that when heat supplied to the solution, one of the components boiling point range is changed and so we can separate them using distillation method. In recent, another method called anhydrous salt method is preferred from the above two.

1. Oldest method to make rectified spirit and its conversion by lime:

It is a somewhat long-term process in small scale. In 1828, an article published about producing rectified spirit using dry muriate lime. It is method still followed by some of the individual spirit makers. Dilute spirit that has an excess amount of water taken as raw material.



In a box, they made trays and filled with dry muriate lime bed. For each tray, a downcomer arranged with a valve to make the connection from upper tray to lower one.

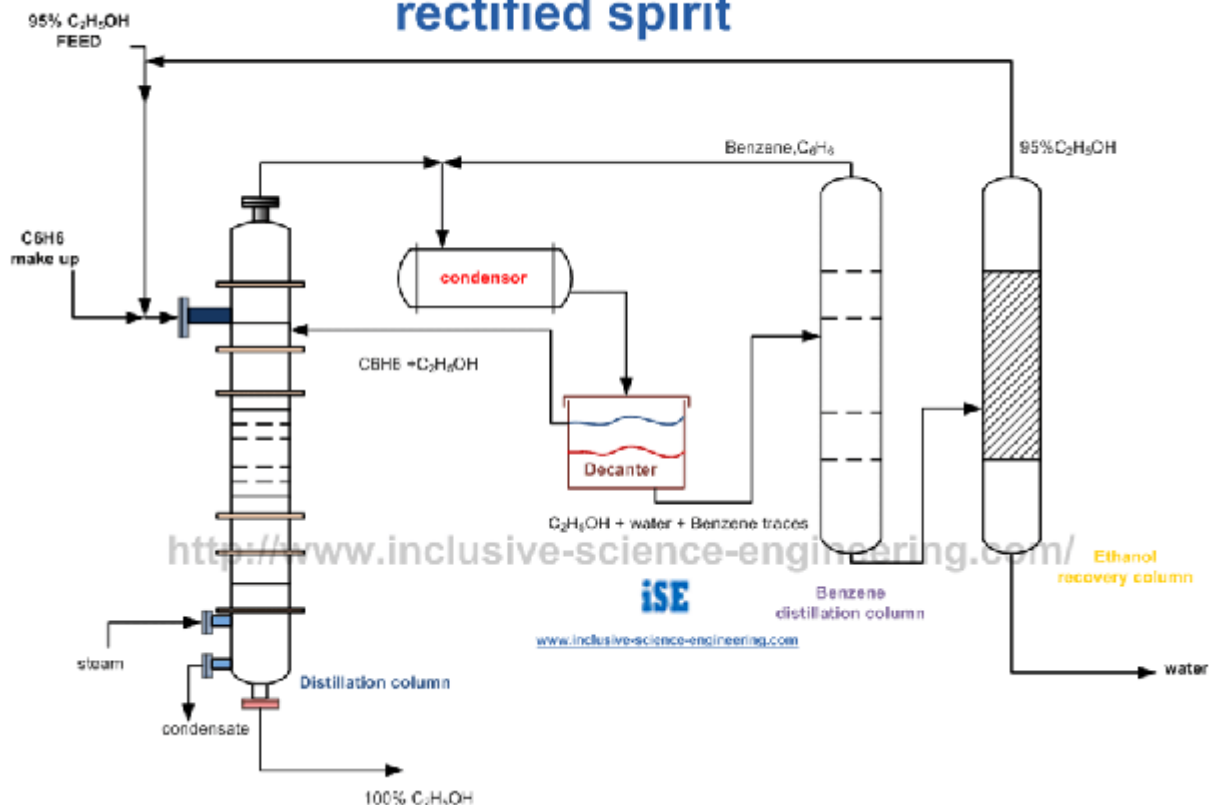
Now the process is very simple. The person uses to pour the required quantity of dilute spirit on the top tray. Now the spirit left to hold until few hours of the day. The dry muriate lime absorbs water in dilute spirit. Then the vale at the downcomer is open allowing the spirit to flow down to the bottom tray. Similarly, the above step of holding and passing is repeated. Finally, at last, bottom tray, the outlet is rectified spirit with less water content. This process is preferred due to no requirement of heat. The only drawback is it takes a long duration of operation depending on water content in spirit and state of lime dryness.

2. Azeotrope distillation using benzene:

Absolute alcohol product, which obtained from azeotropic distillation method, is somewhat complicated when compared to others. Its process description involves distillation column, separators and a decanter as unit operations. Even dehydrating agents selection make the operation differ in its parameters. For instants when a dehydrating agent having low boiling point condition when compared to rectified spirit. Then that particular dehydrating agent which is mainly C_6H_6 , $C_6H_5CH_3$, $C_2H_5OC_2H_5$ and CCL_4 make the partial pressure of alcohol to decrease than water at the same condition. When a distillation operation is performed than the lowered partial pressure, alcohol will rise up to the top of the column and water is drawn out at the bottom of the tower

along with the dehydrating agent. If dehydrating agents like ethylene glycol or glycerol which have a high boiling point are selected then it reverses the situation by lowering the partial pressure of water to lesser value and the operation is same for separation as before. Most ethanol processing industries select this method.

Absolute alcohol prepared from rectified spirit



By using benzene as a third component to break the azeotrope, a process for absolute alcohol can be described as follows. For conversion of rectified spirit, the required amount of benzene is added continuously from the makeup and recycle to the feed line. The mixture is fed to ethanol distillation column. A ternary mixture is formed inside the column. At $64.8^\circ C$ benzene, 74.2%, water 7.4% and alcohol with 18.4% concentration will exist in equilibrium. The vapors from the column are sent to the condenser. Part of the condensed liquid used as reflux and the other part fed to the decanter. In decanter, two layers are separated. One with benzene – alcohol as the top layer and the other with water- alcohol as the bottom. The top layer is recycled to ethanol distillation column. The bottom is sent to aqueous alcohol distillation column to separate the trace of benzene and recycle it. The bottom of aqueous alcohol distillation column is at $78.3^\circ C$ and is fed to another distillation column that removes excess water and sends the rectified spirit as recycle into main feed stream of ethanol distillation column.

3. Anhydrous Salt Method to Produce Absolute Ethyl Alcohol from Rectified Spirit:

Glycerine well known as a dehydrator, it is used to remove the water content in rectified spirit turning it into an absolute alcohol. In small or medium scale industries, an anhydrous salt method is selected as a choice of operation. By using simple scrubbing technique, the rectified spirit vapours are contacted counter-currently so that glycerine vapours absorb the water present in the vapours of rectified spirit. Absolute ethanol vapours collected at the top of the scrubbing column. They are condensed to liquid. The bottom stream of the scrubber contains a mixture of glycerine, water and traces of alcohol. This bottom mixture sent to a distillation column to obtain dehydrated glycerine and recycle it to the scrubber.