

# Ethanol Production by Catalytic Hydration of Ethylene

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## Background:

Ethanol is very important organic chemical in industries. It is generally used as a solvent and also with the help of Ethanol we can produce various chemicals. It is generally used in manufacturing of plastics, lacquers, perfumes, cosmetics and drugs. Ethanol is generally produce through fermentation.

Here we are using catalytic ethylene hydration for production of Ethanol. 7% of total Ethanol production is through this method. It is generally an expensive method due to fluctuation of price of ethylene raw material.

## Description:

In this flowsheet, ethylene with 5% of acetylene at 1822 kmol/h and water of 4154.16 kmol/h is used as a raw material with water/ethylene mole ratio of 2.4 feed into the plug flow reactor with temperature 246.5 C and 60.9977 bar pressure both in vapor phase. Reaction parameters like Activation energy and Arrhenius constant is used when Zirconium tungstate is used as a catalyst Ethanol is produce with conversion rate of 8.45% of ethylene. The product is flashed in the Gas-Liquid separator at operating temperature of 85 C with Ethanol and Water in the liquid side and Unreacted Ethylene, Acetylene and some amount of Ethanol on vapor side. The liquid side product is used as a feed in the distillation. In distillation Ethanol been more volatile component is extracted from the top product with about 82 molar percentage purity and water as a bottom product

## System of Units:

Temperature: C

Pressure: bar

Molar flow: kmol/h

Mass flow: kg/h

## Property Package:

Peng-Robinson-Stryjek-Vera 2

## Reactions:

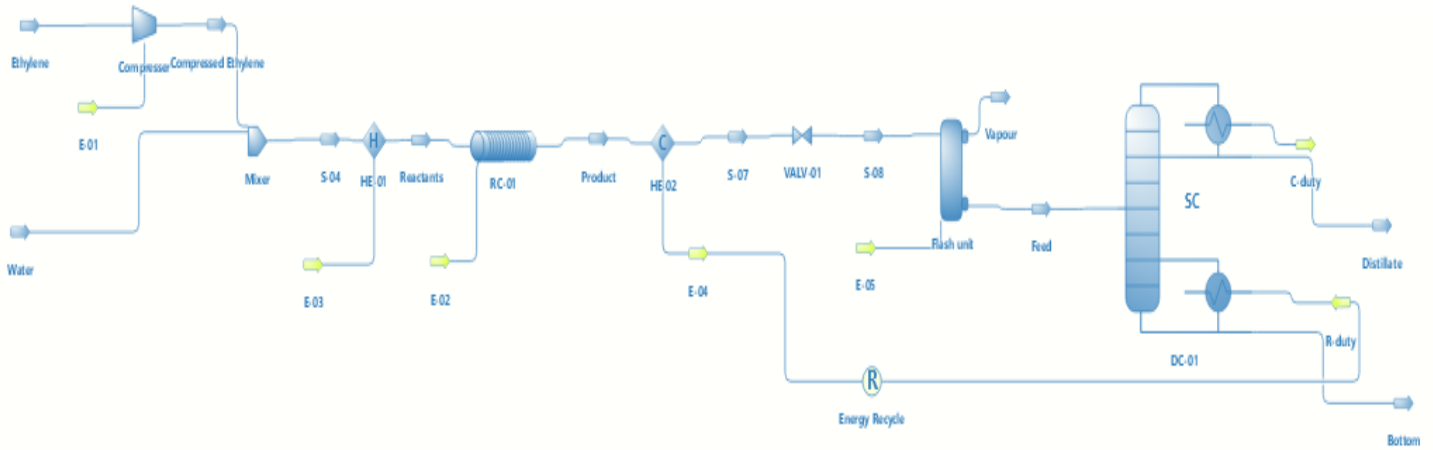
Ethylene + Water  $\xrightarrow{-k}$  Ethanol  $A = 9.65 \times 10^8$ ,  $E = 30000$  Cal/mole

## Dimension of Plug Flow Reactor:

Length: 17.5 m

Diameter: 3.358 m

## Flowsheet:



## Results:

Object	Water	Ethylene	Distillate	Bottom
Temperature (C)	99.9823	-102.397	91.0173	83.7587
Pressure (bar)	1.01325	1.01325	1.01325	1.01325
Molar Flow (kmol/h)	4154.16	1822	152.244	3910.17
Molar Fraction (Ethylene)	0	0.95	0.0067437	9.32501E-22
Molar Flow (Ethylene)	0	1730.9	1.02669	3.64624E-18
Molar Fraction (Water)	1	0	0.168	0.998996
Molar Flow (Water)	4154.16	0	25.5771	3906.25
Molar Fraction (Ethanol)	0	0	0.823777	0.001
Molar Flow (Ethanol)	0	0	125.415	3.91017