Methanol Synthesis From Syngas

Pragneshsinh J Sindha

Department of Chemical Engineering,

Pacific School of Engineering, Surat

Background:

In presents day methanol is considered as important fuel because it may provide various petroleum based-liquid fuels and its extensive used is done because of its availability. It can be form by any renewable biomass hydrocarbon source by partial oxidation to produce synthesis gas, which is then converted into methanol.

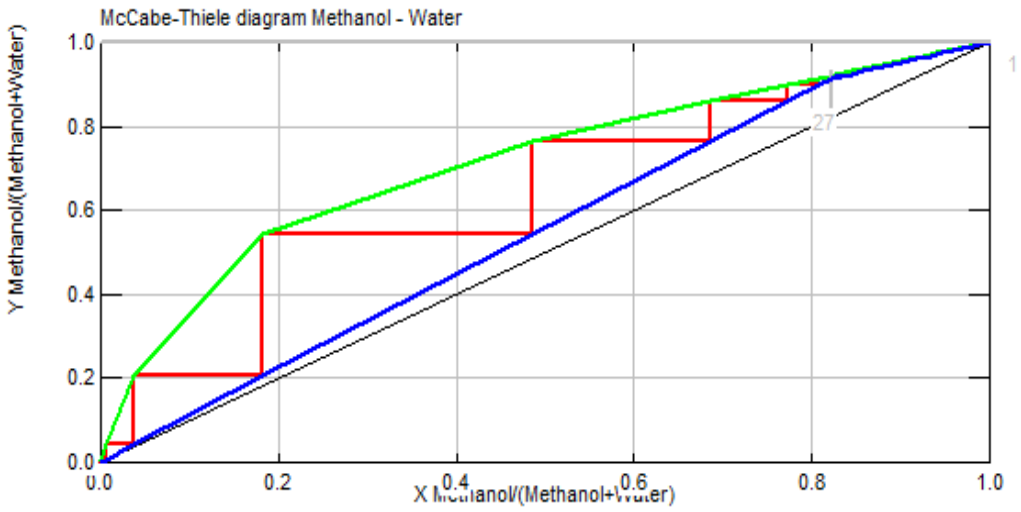
Here, simulation carried out for a process which converts synthesis gas into methanol. In process conversion reactor is used to react hydrogen with the carbon monoxide and carbon dioxide in the synthesis gas to produce methanol.

Flowsheet Description:

Herein, process fixed amount of synthesis gas is used for feed. In process, "Peng-Robinson" property model is used except distillation column. The process can divided into four section,

(1) Compression and Reactor Preheating
(2) Reactor
(3) Separator, Recycle, and Vent
(4) Flash and Distillation

In compression, synthesis gas at 51.2 bar is compressed in a two-stage compression system to 110 bar. Then three recycle gas streams are added, and the gas stream enters in heat exchanger at 53°C. Here, for reaction conversion reactor is used, in which two reactions carried out with 64% and 17% conversion of carbon monoxide and carbon dioxide respectively. After complete reaction reactor effluent is cooled to 174°C in heat exchanger, it is further cooled to 38°C. Then most of vapor stream is compressed back to 110 bar and fed up into high pressure separator, from which a small fraction is vented off at a flow rate of 840 kmol/h. For removing light components from the stream flash separator is used which operated at 2 bar. The liquid from the separator is fed up in 42-stage distillation column on stage 27. The column operates at 1 bar; a small vapor side stream from the column is recycled and is compressed back up to 110 bar. From the column at top High pure methanol about (99%) is obtained and as bottom (99%) water obtained. From the process simulation following graph and results obtained.



Results/ Conclusion:

- From the simulation, high pure methanol is obtained about (99%) at rate of 3313.5996 kmol/h as a top product and water as bottom product at rate of 711.31917 kmol/h.
- In conversion reactor, about 64% and 17% conversion of carbon monoxide and carbon dioxide is achieved respectively.

Methanol Column		
Top product	Bottom product	Sidestream
Flow rate= 3313.5996 kmol/h	Flow rate= 711.31917 kmol/h	Flow rate= 0.6689988 kmol/h
Methanol= 0.9904012	Water= 0.999	Methanol= 0.3765008
Temperature= 41.40°C	Temperature= 110.26°C	Temperature= 42.078°C

Recommendation:

During simulation, it's noted that process having sensitivity towards pressure and temperature change and one has knowledge regarding selection of property package during distillation simulation because it's observed that different property packages gives difference in molar flow and composition of distillate.

System of Units:

Herein, process flowsheet following system of units used:

Temperature	°C
Molar Flow	Kmol/h
Pressure	bar

References:

Flowsheet : http://www.chemsep.com/downloads