Methyl tertiary butyl ether production

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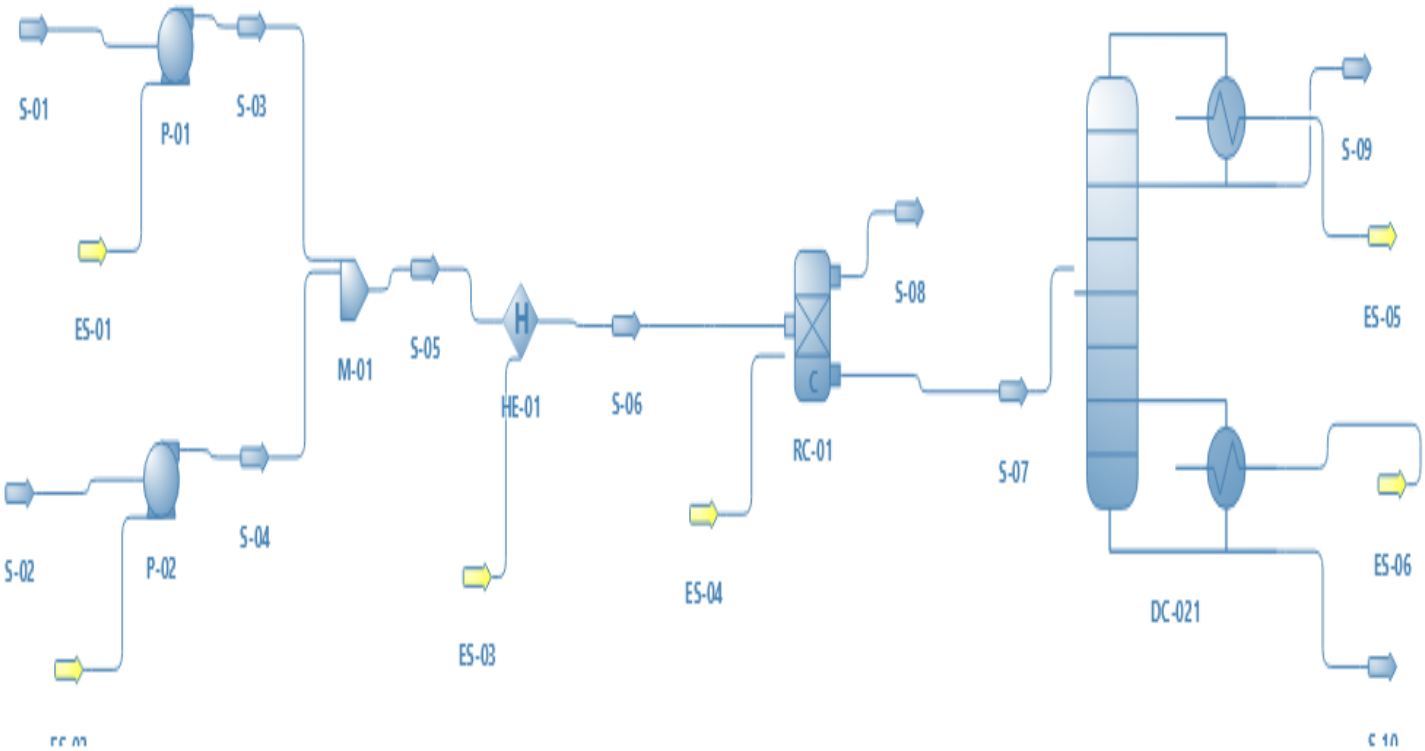
Introduction: Methyl Tertiary Butyl Ether ($(CH_3)_3COCH_3$) is mainly used as an additive in gasoline since 1980s. This chemical is a colorless liquid with a distinctive disagreeable odour. It is a flammable liquid. MTBE is manufactured by blending chemicals like methanol and isobutene. Addition of MTBE in unleaded gasoline leads to efficient burning increasing its octane number .this chemical is an ether with two alkyl groups of methyl and tert-butyl. MTBE is also used as a fuel additive, metabolite and a non – polar solvent. The vapors of MTBE are heavier than air and narcotic. The chemical is sparingly soluble in water and highly soluble in organic solvents such as alcohol and ether.

Process Description: A process for manufacturing methyl tertiary butyl ether (MTBE) from methanol and isobutene. MTBE is used as an additive in gasoline for complete fuel combustion, resulting in reductions of CO and ozone forming emission. Methanol and Isobutene reacts in reversible manner .The methanol and isobutene are pumped and mixed with methanol in excess quantities. The reaction takes place in reversible phase. Reactants are heated below 90^0c in reactor. Pressure inside the reactor is maintained at 30 bar for the liquid phase reaction. Methanol is fed in excess to prevent other side reactions. MTBE is separated as bottom product in distillation column which is further purified to remove traces of water. Methanol is recovered from mixed butelenes and recycled. The product stream contains 78% MTBE.

The reaction is carried out at lower temperature range of $35\text{-}90^0$ which gives more complete conversion. The conversion rate of reactants is nearby 80%.

$$CH_3OH + (CH_3)_2C{=}CH_2 \rightarrow (CH_3)_3)\ COCH3$$

Flowsheet :



Flowsheet of methyl tertiary butyl ether production

Results :

Stream wise results								
Object	S-10	S-09	S-08	S-07	S-05	S-02	S-01	
Temperature	319.862	267.375	284.407	284.407	284.305	298.15	298.15	K
Pressure	101325	101325	3.2E+06	3.2E+06	3.5E+06	390000	400000	Pa
Mass Flow	3.69931	3.92614	0	7.62556	7.62556	6.07	1.55556	kg/s
Molar Flow	48.3328	69.5637	0	117.897	156.735	108.187	48.5477	mol/s
Molar Fraction (Mixture) / Methanol	0.184748	0.011205 8	0	0.0823562	0.309744	0	1	
Molar Flow (Mixture) / Methanol	8.92939	0.779517	0	9.70955	48.5477	0	48.5477	mol/s
Mass Flow (Mixture) / Methanol	0.286114	0.0249772	0	0.311112	1.55556	0	1.55556	kg/s
Molar Fraction (Mixture) / Methyl tert-butyl ether	0.77642	0.018815	0	0.329425	0	0	0	
Molar Flow (Mixture) / Methyl tert-butyl ether	37.5265	1.30884	0	38.8382	0	0	0	mol/s
Mass Flow (Mixture) / Methyl tert-butyl ether	3.3079	0.115372	0	3.42352	0	0	0	kg/s
Molar Fraction (Mixture) / Isobutene	0.0388324	0.969979	0	0.588219	0.690256	1	0	
Molar Flow (Mixture) / Isobutene	1.87688	67.4753	0	69.3493	108.187	108.187	0	mol/s
Mass Flow (Mixture) / Isobutene	0.105305	3.78579	0	3.89093	6.07	6.07	0	kg/s