Design A Process Of Methyl Ethyl Ketone Production

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Background:

Methyl Ethyl ketone (MEK) is widely used in industrial application, especially as an industrial solvent for plastics, resins, paint, and adhesives. Due to its broad applications, MEK is considered as the most principal commercially manufactured ketone.

Some **important data** regarding methyl ethyl ketone are listed below:

Molecular weight	= 72
Boiling point (^{o}C)	= 79.57
Freeing point (^{o}C)	= -85.9
Density at 20^{0}C (g/lit)	= 804.5
Heat of fusion, (KJ/kg ^{O}k)	= 103.3

Under normal condition and in the absence of atmospheric oxygen MEK is stable but under prolonged storage in oxygen may formed peroxide. It is heat and light stable but not in UV exposure (Yield ethane, methane, carbon monoxide, ethylene, and diacetyl).

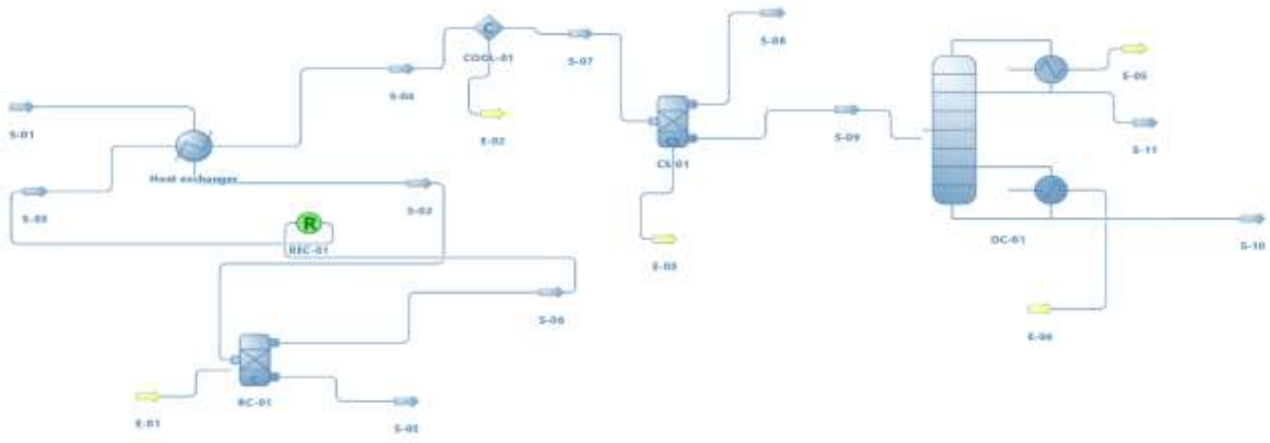
MEK are produced today by several process and widely available in literature but the most important things to consider is **the safety and the pollution for the plant**. MEK is neither highly toxic nor does it exhibits cumulative toxicological property. Inhalation for longer time may leads to the irritation in mucus membrane and cause nausea and eventually leads to unconsciousness. Liquid MEK temporarily irritates the eye and corneas but usually absorbed through the respiratory track and by skins. It is highly flammable.

The use of safety and protective equipment likes gloves, wearing safety shoes, goggles and helmet are used at the time to MEK handling for operation. The water is polluted by the plant effluent and the critical factor operating under such a situation is the biological oxygen demand (BOD). Microorganisms’ process are used for the purification of the plant effluent water.

Description of the flowsheet

MEK produced from 2-butanol by dehydrogenation, entire flow sheet is done in C.G.S unit. 2-Butanol (S-01) is feed to the heat exchanger at 30 ^{o}C in shell side from storage tank. The output stream from a heat exchanger (S-02) is fed to the reactor at 100 ^{o}C at the 90 % conversion rate. After the reaction the product gas (S-06) mixture leaving the reactor at 400^{o}C is fed to the heat exchanger in the tube side (S-03), another output stream (S-05) from reactor has no composition. Stream in tube side (S-03) leaves the heat exchanger at (S-04) at 106.603 ^{O}C and is cooled to 80^{O}C by cooler (S-07). The gas if fed (S-07) to the hydrogen knock out drum (compound separator), where the hydrogen is separated (S-08) from the mixture of 2-butanol and MEK (S-09). The mixture stream (S-09) enter in the distillation column in a given specification and 99.08% of pure MEK obtain from the overhead of the distillation column (S-11) and rest obtain from the bottom stream (S-10).

Flowsheet of the process in DWSIM:



Result:

Parameters of all material streams (in C.G.S unit).

Master Property Table												
Object	S-11	S-10	S-09	S-08	S-07	S-06	S-05	S-04	S-03	S-02	S-01	
Temperature	79.4104	101.913	80	80	80	400	400	106.603	400	100	30	C
Pressure	1	1.1	0.9797	0.9797	0.9797	1	1	0.9797	1	1	1	atm
Mass Flow	584.886	60.8547	645.74	16.2025	661.943	661.943	0	661.943	661.943	661.943	661.943	g/s
Molar Flow	8.10942	0.821077	8.9305	8.03745	16.968	16.968	0	16.968	16.968	8.9305	8.9305	mol/s
Volumetric Flow	786.158	83.9185	200017	237727	501867	937205	0	539673	937205	273434	825.9	cm3/s
Molar Enthalpy (Mixture)	-6271.4	-6769.38	-546.168	379.581	932.56	7990.33	0	1421.9	7990.33	2115.43	-10364.6	cal/mol
Molar Entropy (Mixture)	-17.244	-17.4497	-0.420186	1.20818	17.0641	30.9873	0	18.3997	30.9873	6.4145	-28.114	cal/[mol.C]
Molar Fraction (Vapor)	0	0	0.756435	1	1	1	0	1	1	1	0	
Phases	Liquid Only	Liquid Only	Mixed	Vapor Only	Vapor Only	Vapor Only	Mixed	Vapor Only	Vapor Only	Vapor Only	Liquid Only	
Energy Flow	-183087	-20009.5	-17559.2	10983.1	56965	488086	0	86856.3	488086	68010.7	-333219	kcal/h