Separation of Acetone and Water using solvent 3-Methylhexane

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Background:-

Acetone is an organic compound with the formula C_3H_6O. It is a colorless, highly volatile and flammable liquid with a characteristic pungent odor. Acetone is miscible with water and serves as an important organic solvent in industry, home, and laboratory. Acetone is most commonly used in pharmaceuticals to producing pills and liquid medicines to have proper density. Acetone denatures certain alcohol and is used as an additive in makeup and skin creams. One of the primary ingredients of nail paint remover is acetone.

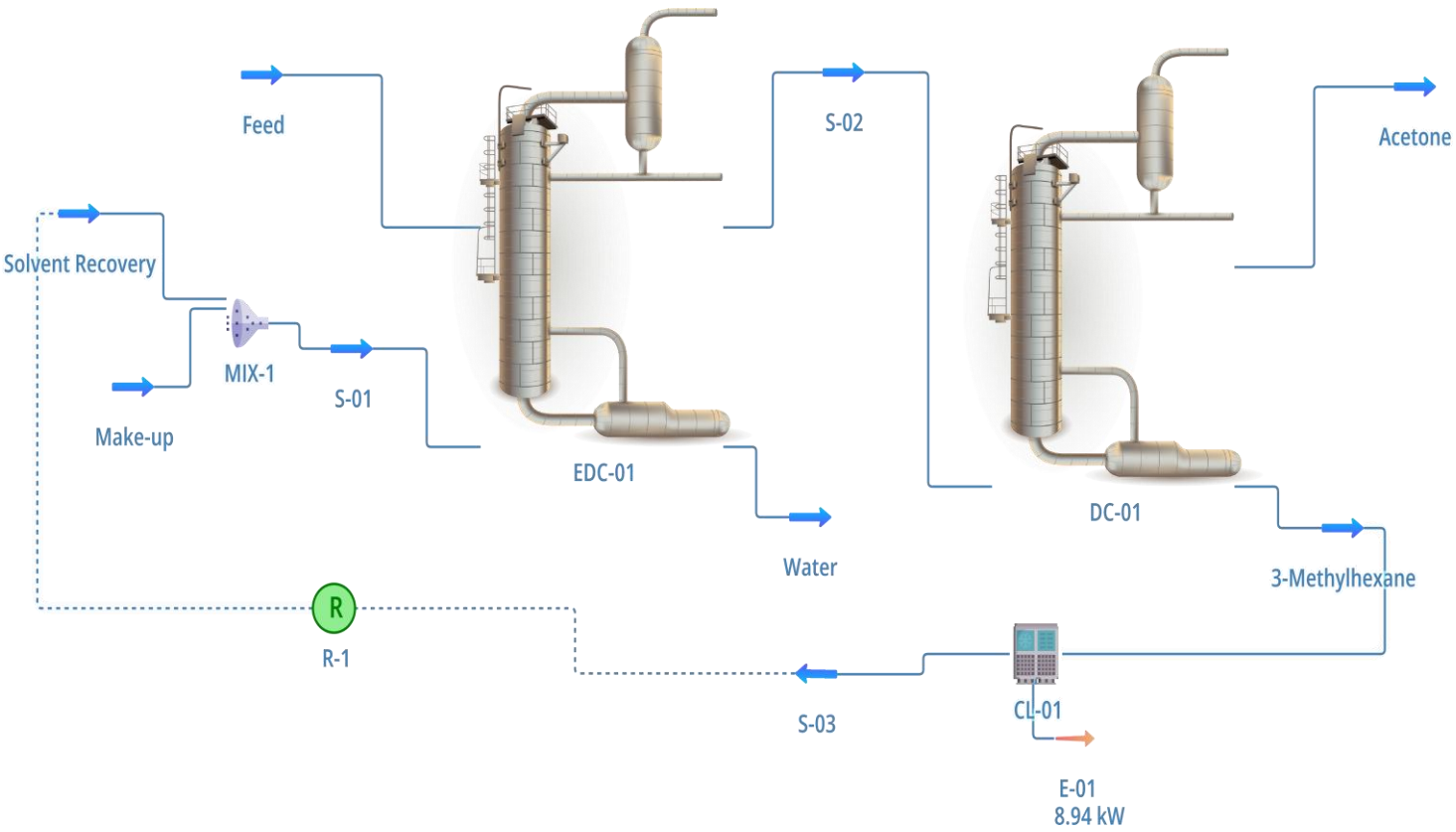
3-Methylhexane is an organic compound with the formula C_7H_{16}. 3-Methylhexane is an alkane and a volatile organic compound. It is a colorless liquid with a gasoline-like odor and is commonly used as a solvent in various industries such as pharmaceutical, chemical, and polymer. It is primarily produced through the catalytic hydrogenation of linear or branched aldehydes or ketones.

Description:-

A feed mixture consisting of Acetone and Water is fed to the Extractive Distillation column at 25 ºC and 1 bar with a flowrate of 100 kg/h. Solvent 3-Methylhexane is also fed to the Extractive Distillation column at 30 ºC and 1 bar with a flowrate of 150 kg/h. Extractive Distillation column has 32 stages with Condenser and Reboiler at 1 bar pressure.

In Extractive Distillation column, Water is separated from Acetone and obtained from the bottom of the column. The top product (Acetone and 3-Methylhexane) is sent to the Simple Distillation column (Solvent Recovery column) for further separation where pure Acetone is obtained from the top of the column and 3-Methylhexane is obtained from the bottom of the column at 95.7 ºC which is cooled by cooler at 25 ºC & recycled to the solvent recovery stream for reuse.

Flowsheet:-



Result:-

Master Property Table										
Object	Water	Solvent Recovery	S-03	S-02	S-01	Make-up	Feed	Acetone	3-Methylhexane	
Temperature	12.3335	25	25	61.0551	25.0011	25	25	57.7331	95.7602	C
Pressure	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	bar
Mass Flow	20.0582	173.272	173.272	389.252	309.31	150	100	215.979	173.272	kg/h
Molar Flow	1.06482	2.80861	2.80861	5.61721	4.05372	1.49698	2.62831	2.80861	2.80861	kmol/h
Volumetric Flow	0.0201646	0.215989	0.215989	0.526433	0.410688	0.219095	0.113715	0.304737	0.231667	m3/h
Density (Vapor)	0	0	0	0	0	0	0	0	0	kg/m3
Molecular Weight (Vapor)	0	0	0	0	0	0	0	0	0	kg/kmol
Dynamic Viscosity (Vapor)	0	0	0	0	0	0	0	0	0	Pa.s
Heat Capacity (Vapor)	0	0	0	0	0	0	0	0	0	kJ/[kg.K]
Compressibility Factor (Vapor)	0	0	0	0	0	0	0	0	0	
Molar Fraction (Vapor)	0	0	0	0	0	0	0	0	0	
Mass Fraction (Vapor)	0	0	0	0	0	0	0	0	0	
Volumetric Fraction (Vapor)	0	0	0	0	0	0	0	0	0	
Density (Liquid 1)	994.725	802.227	802.227	739.414	753.15	684.636	879.388	708.74	747.936	kg/m3
Molar Weight (Liquid 1)	18.8371	61.6934	61.6934	69.2963	76.3027	100.202	38.0472	76.8992	61.6934	kg/kmol
Dynamic Viscosity (Liquid 1)	0.00122402	0.000605165	0.000605165	0.000293164	0.000507337	0.000347326	0.000602427	0.00025203	0.000233766	Pa.s
Heat Capacity (Liquid 1)	0	0	0	0	0	0	0	0	0	kJ/[kg.K]
Molar Fraction (Liquid 1)	1	1	1	1	1	1	1	1	1	
Mass Fraction (Liquid 1)	1	1	1	1	1	1	1	1	1	
Volumetric Fraction (Liquid 1)	1	1	1	1	1	1	1	1	1	
Molar Fraction (Vapor) / Acetone	2.12621E-12	1.07349E-12	1.07349E-12	0.731687	6.69034E-13	0	0.897742	0.754535	4.7154E-13	
Molar Fraction (Liquid 1) / Acetone	9.39876E-15	2.19234E-14	2.19234E-14	0.233952	1.77051E-14	0	0.5	0.467904	2.19234E-14	
Molar Fraction (Vapor) / Water	0.97027	0.253471	0.253471	0.0630818	0.136373	0	0.102258	0.0127444	0.402308	
Molar Fraction (Liquid 1) / Water	0.99	0.46855	0.46855	0.256136	0.290792	0	0.5	0.0437225	0.46855	
Molar Fraction (Vapor) / 3-methylhexane	0.0297297	0.746529	0.746529	0.205231	0.863627	1	0	0.232721	0.597692	
Molar Fraction (Liquid 1) / 3-methylhexane	0.01	0.53145	0.53145	0.509912	0.709208	1	0	0.488374	0.53145	