Separation of Acetone and Water using solvent 3-Methylhexane

Name:- Pratik Rathod
Institute:- G. H. Patel College of Engineering & Technology

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.

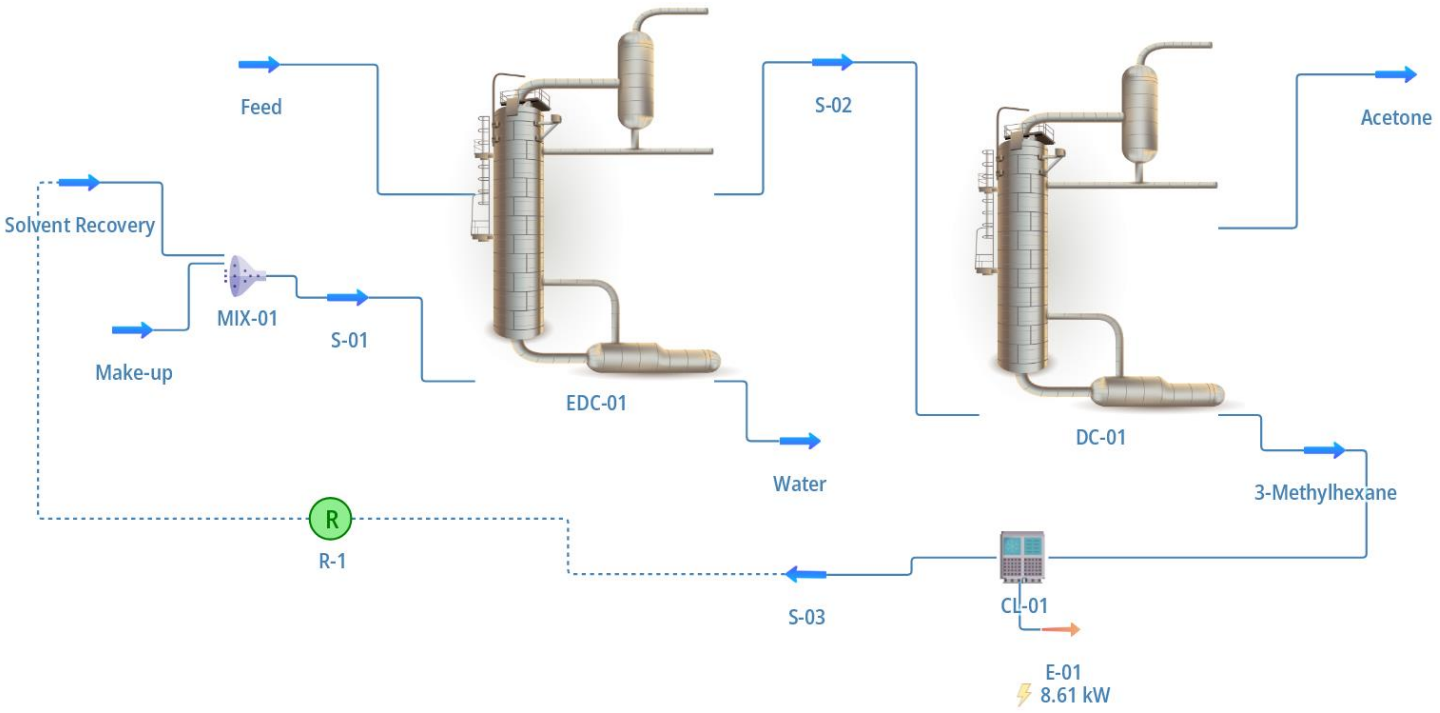
3-Methylhexane is an organic compound with the formula C_7H_{16}. 3-Methylhexane is an alkane and a volatile organic compound. It is a colorless liquid with a gasoline-like odor and is commonly used as a solvent in various industries such as pharmaceutical, chemical, and polymer. It is primarily produced 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	61.0489	25.0013	25	25	57.5626	96.0964	**C**
Pressure	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	**bar**
Mass Flow	24.8585	163.715	163.715	388.798	313.656	150	100	225.083	163.715	**kg/h**
Molar Flow	1.31965	2.80549	2.80549	5.61097	4.30231	1.49698	2.62831	2.80549	2.80549	**kmol/h**
Volumetric Flow	0.0249903	0.201037	0.201037	0.525813	0.410532	0.219095	0.113715	0.322089	0.215262	**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	814.352	814.352	739.421	764.023	684.636	879.388	698.823	760.538	**kg/m3**
Molar Weight (Liquid 1)	18.8371	58.3552	58.3552	69.2923	72.9041	100.202	38.0472	80.2295	58.3552	**kg/kmol**
Dynamic Viscosity (Liquid 1)	0.00122402	0.000627517	0.000627517	0.000293162	0.000530091	0.000347326	0.000602427	0.000243095	0.000237361	**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	2.17409E-12	7.18226E-15	7.18226E-15	0.731778	2.77548E-15	0	0.897742	0.747845	3.06321E-15	
Molar Fraction (Liquid 1) / Acetone	9.61038E-15	1.37309E-16	1.37309E-16	0.234212	6.94179E-17	0	0.5	0.468424	1.37309E-16	
Molar Fraction (Vapor) / Water	0.97027	0.285459	0.285459	0.0630598	0.160744	0	0.102258	0.000854076	0.442586	
Molar Fraction (Liquid 1) / Water	0.99	0.509167	0.509167	0.256051	0.332145	0	0.5	0.00293427	0.509167	
Molar Fraction (Vapor) / 3-methylhexane	0.0297297	0.714541	0.714541	0.205163	0.839256	1	0	0.251301	0.557414	
Molar Fraction (Liquid 1) / 3-methylhexane	0.01	0.490833	0.490833	0.509737	0.667855	1	0	0.528642	0.490833	