EXTRACTIVE DISTILLATION OF ACETALDEHYDE-TOLUENE SOLUTION

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PROBLEM STATEMENT:

Extractive Distillation of Acetaldehyde and Toluene by using water as a solvent.

➢ OBJECT USED:

1. Distillation column
2. Material Stream
3. Recycle block
4. Cooler
5. Mixer

➢ DESCRIPTION:

I. Abstract:

Extractive Distillation technique for the separation of acetaldehyde and toluene by using the solvent of water. Two columns are used, Bottom product from the first column is Toluene and other column is for Feed recovery where Acetaldehyde is separated from Top. The mixture from the Bottom of second column is recycled back with the feed stream with makeup.

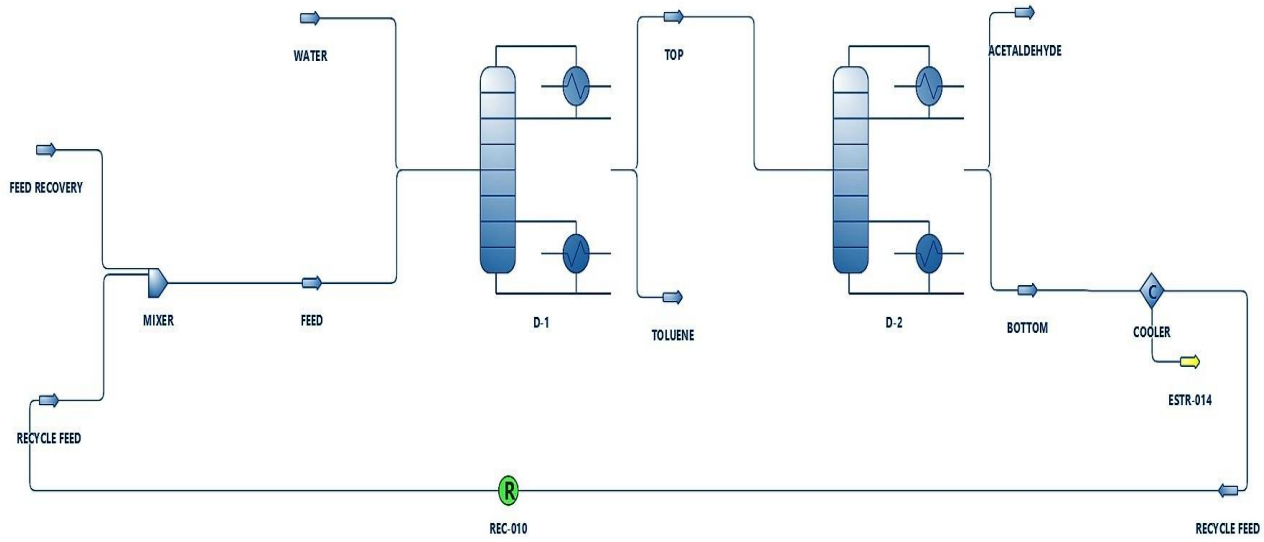
II. Introduction:

Extractive distillation is a commonly used method for the separation of azeotropic mixture. In this method, a third component is added into the system as solvent to alter the relative volatility of the component to be

separated. With the presence of the suitable solvent, the relative volatility of the original two components can be enhanced.

III. Flowsheet Description:

This process content a two-column design with a solvent. The reproduced flowsheet is shown below. Among the various solvent available like DMSO, DMF here Water is used as it is easily and cheaply available. In below figure column-I is Extractive column and column-II is for recovery of Acetaldehyde. The mixture of Acetaldehyde-Toluene along with solvent is fed to column-I, the bottom product of column-I is our desired product i.e. 99 wt. % Toluene. The top product is fed to column-II for further separation where Acetaldehyde is separated from mixture and separated Acetaldehyde is then obtained from the top with 95 wt. % purity. This bottom product mixture is again recycled to column-I after cooling and adding make-up stream to account for the loss in distillates of column-I and column-II. Fresh feed flow rate is kept at 61.5613 kmol/hr containing 0.7 wt. % Acetaldehyde and rest Toluene at a temperature of 298.15 K. The pressure of both the columns are maintained at 101325 Pa.



Flowsheet of Extractive Distillation of Acetaldehyde-Toluene Solution

The property table for the flowsheet is given below:

Object	Feed	Recycle Feed	Feed Recovery	Top	Bottom	Toluene	Acetaldehyde
Temp	298.15	298.15	298.15	372.82	374.39	383.39	295.594
Pressure	101325	101325	101325	101325	101325	101325	101325
Molar Flow	8867.64	8893.08	61.5613	8955.64	8893.08	20.958	62.5653
Molar Fraction (Mixture)/ Acetaldehyde	0.00486	8.01E-07	0.7	0.006638	8.01E-07	9.47E-19	0.95
Molar Fraction (Mixture)/ Toluene	0.16224	0.161256	0.3	0.1601	0.16126	0.99	0.00289498

Table-1 Streamwise Result for Extractive Distillation of Acetaldehyde-Toluene Solution

➢ REFERENCES:

Unit Operations of Chemical Engineering by Warren L. McCabe, Julian C. Smith, Peter Harriott, 7 Edition, McGraw Hill Education.