Extractive Distillation for Dehydration of tert-butanol

• ***Abstract:***

Extractive Distillation technique for the dehydration of tert-Butanol is investigated with Glycerol as an Entrainer. Two columns are used, Top product from the first column is desired product that is tert-Butanol (TBA) and other column is for Entrainer recovery. The Entrainer from the bottom of second column is recycled back with the feed stream with makeup.

• ***Introduction:***

Tert-Butanol (TBA) is widely used as a solvent, paint remover ingredient, gasoline octane booster and can react with methanol to produce methyl tertiary butyl ether (MTBE). It is derieved commercially from isobutane as a co-product of propylene oxide production. This process gives water containing TBA. This mixture can be concentrated by simple distillation into a TBA/H_2O minimum- boiling azeotrope. Because of its still high water content, it is not suitable for all uses of TBA. Therefore, separation of TBA/water azeotrope is an important task.

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 entrainer to alter the relative volatility of the component to be separated. With the presence of the suitable entrainer, the relative volatility of the original two components can be enhanced.

• ***Flowsheet Description:***

This process content a two-column design with an Entrainer. The reproduced flowsheet is shown in Figure 1. Among the various Entrainer available like DMSO, DMF here Glycerol is used as it is easily and cheaply available. In Figure-I column-I is Extractive column and column-II is for recovery of Entrainer Glycerol. The azeotropic mixture of tert-Butanol-Water along with Entrainer is fed to column-I, the top product of column-I is our desired product i.e. 98 wt. % tert-Butanol. The bottom product is fed to column-II for Entrainer recovery where Water is separated from mixture and separated water is then obtained from the top with 98 wt.
% purity. This Entrainer is again recycled to column-I after cooling and adding make-up stream of Entrainer to account for the loss of Entrainer in distillates of column-I and column-II

Fresh feed flow rate is kept at 100 kg/hr containing 0.5 wt. % tert-Butanol (2-methyl 2-butanol) and rest water at a temperature of 298 K. The pressure of both the columns are maintained at 0.3 and 0.02 atm. Distillate from column-I is our desired product i.e. tert-Butanol with 98 wt. % purity.

- ***Results***

STREAM TABLE											
Object	tert-BUTANOL	WATER	RECYCLE STREAM	MSTR-012	MSTR-010	MSTR-007	MIXER FEED	MAKEUP	FEED	ENTRAINER	
Temperature	55.1841	17.429	45.1	178.23	178.234	83.6656	15.5667	25	25	45.1	C
Pressure	0.303975	0.020265	0.32424	0.32424	0.020265	0.303975	0.32424	1.01325	1.01325	0.32424	bar
Molar Flow	98.4878	50.0815	42.4985	42.4985	42.4985	92.58	91.0678	48.5688	100	42.4985	kmol/h
Molar Fraction (Mixture) / 2-methyl-2-propanol	0.988373	0.0244816	4.02243E-07	4.02243E-07	4.02243E-07	0.0132436	0.533326	1	0.5	4.02243E-07	
Molar Fraction (Mixture) / Glycerol	5.25259E-06	1.0119E-08	0.9999	0.9999	0.9999	0.459	0.466627	0	0	0.9999	

Flowsheet

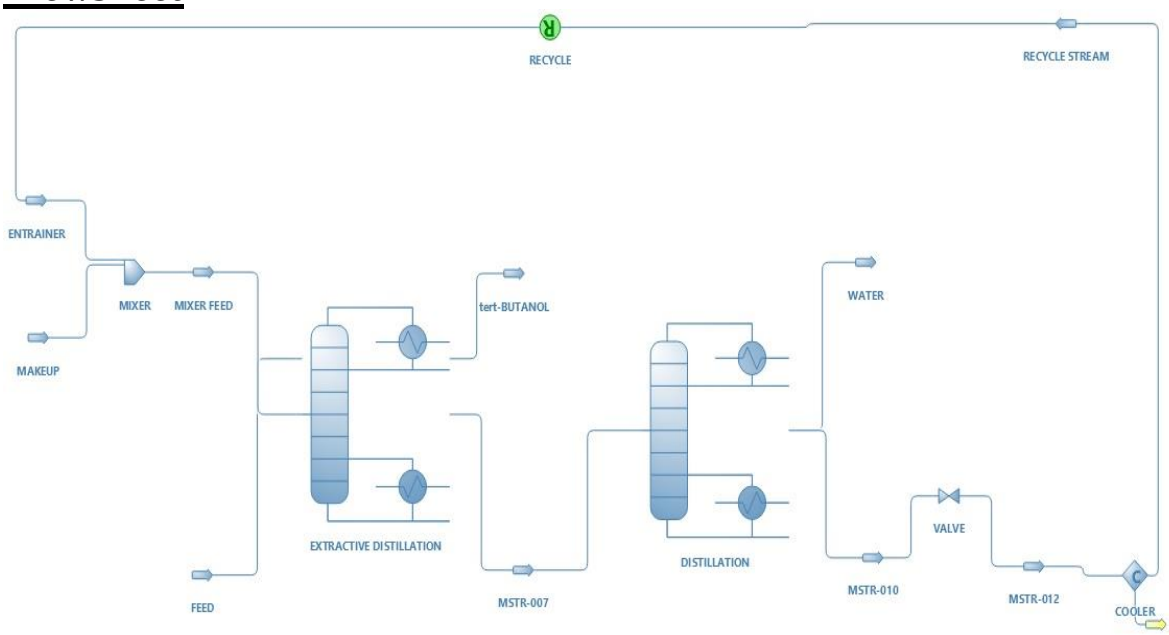

FIGURE-1

- ***Reference:***

Efficient separation method for tert-Butanol dehydration via extractive distillation
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