Extractive distillation for the separation of Acetone and Chloroform using Ethylene Glycol

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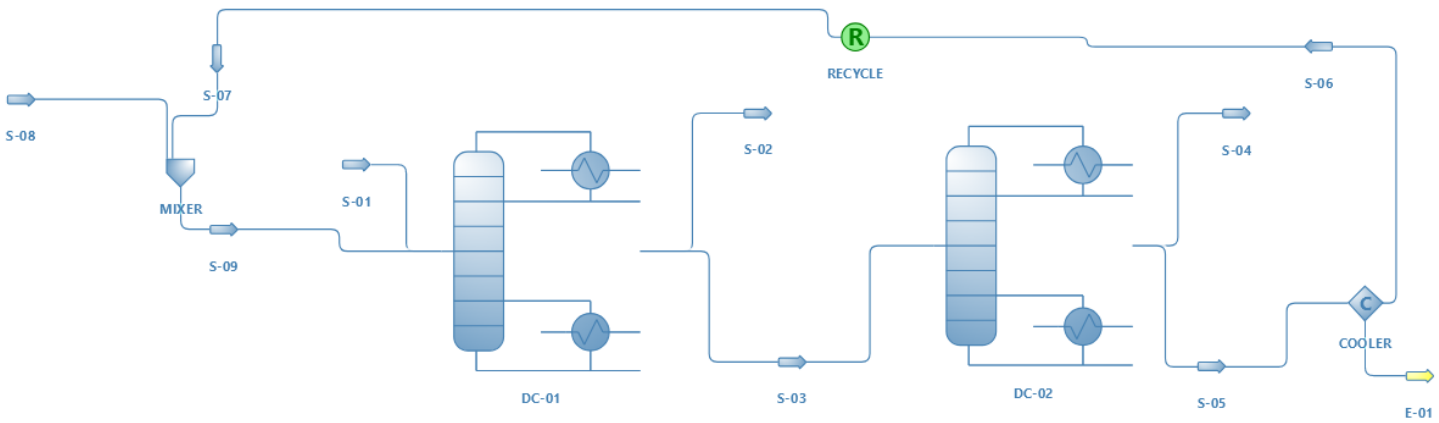
Background Work:

Extractive distillation is one of the leading distillation processes for the separation of minimum- or maximum-boiling azeotropes and low-relative-volatility mixtures. Such mixtures cannot be separated by simple distillation, because the volatility of the two components in the mixture is nearly the same, causing them to evaporate at nearly the same temperature at a similar rate, making normal distillation impractical.

Process Description:

In this present flowsheet extractive distillation of acetone (C_3H_6O) and chloroform ($CHCl_3$) is achieved and Ethylene Glycol ($C_2H_5O_2$) is used as solvent for this extractive distillation process. The property package used for this process is UNIFAC. At first, the feed mixture of acetone and chloroform is fed to the 9th stage of extractive distillation column containing a total number of 30 stages, with the solvent of Ethylene glycol which is fed to the 3rd stage of column. The presence of solvent changes the relative volatility between the two compounds, causing the pure chloroform to move towards the bottom and pure acetone to the top of the column. The bottom mixture is feed into the 4th stage of Regeneration column containing a total number of 10 stages, to produce almost maximum composition of pure chloroform at top of the column. Ethylene glycol is recycled back to the extractive distillation column before which it is mixed with the pure make up stream to account for the solvent losses.

Flowsheet:



FLOWSHEET OF EXTRACTIVE DISTILLATION OF ACETONE AND CHLOROFORM USING ETHYLENE GLYCOL AS SOLVENT

Results:

The Master property table for the given flowsheet is as follows,

Object	S-01	S-02	S-03	S-04	S-05	S-06	S-08	S-09
Description	**FEED**	**TOP PROD - 1**	**BOTTOM PROD-1**	**TOP PROD -2**	**BOTTOM PROD-2**	**COOLED PRODUCT**	**MAKEUP**	**SOLVENT**
Temperature (K)	320	329.398	397.012	334.098	472.25	320	320	320
Pressure (atm)	1.1	1	1.1	1	1.1	1.1	1.1	1.1
Molar Flow (kmol/hr)	100	50.101	271.5	50	221.5	221.5	0.101	221.601
Molar Fraction – Acetone	0.5	0.993697	0.000791307	0.0042968	2.11827E-10	2.11827E-10	0	2.30449E-10
Molar Fraction – Chloroform	0.5	0.00610288	0.183474	0.99402	0.000506172	0.000506172	0	0.000536591
Molar Fraction - Ethylene glycol	0	0.000200391	0.815735	0.00168337	0.999494	0.999494	1	0.999463

References:

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