

PLANTWIDE CONTROL OF AN ISOPROPYL ALCOHOL DEHYDRATION PROCESS

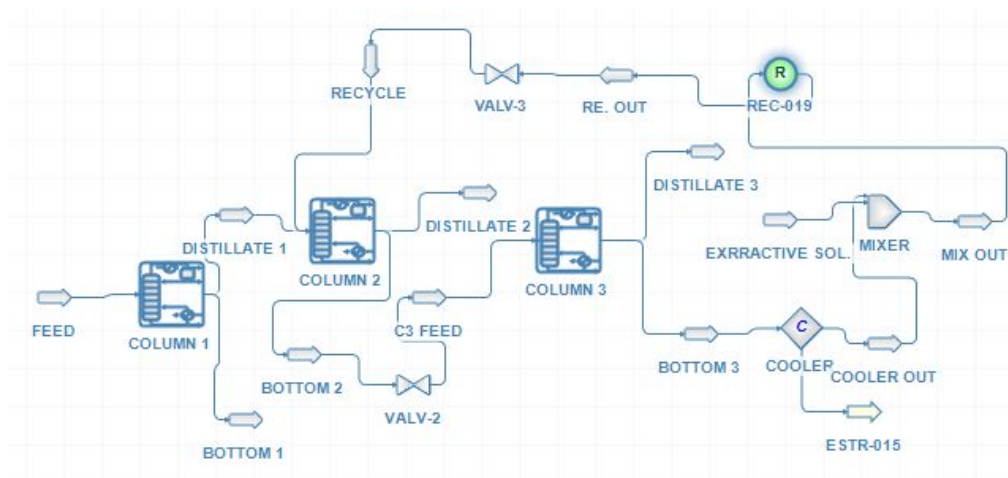
INTRODUCTION:

Isopropyl alcohol dissolves a wide range of non polar compounds. It is used widely as a solvent and as a cleaning fluid, especially for dissolving oils. It is primarily produced by combining of water and propene in a hydration process. Both processes require separation of isopropyl alcohol from water and other by-products by distillation.

PROCESS:

The binary mixture of 80 wt% isopropyl alcohol (IPA) and 20% water is fed to the column 1. The bottom product is around 98 wt% of water and the distillate is around 85 wt% of IPA, which is fed to the column 2 with extractive solvent of ethylene glycol. The distillates of column 2 contain around 97 wt% of IPA and bottom is fed on stage 12 of column 3. The bottoms stream of column 3 contains ethylene glycol, which is cooled and recycled back to column 2.

The flow sheet is as shown:



RESULTS:

	DISTILLATE 1	DISTILLATE 2	DISTILLATE 3	
Temperature	343.234	345.099	351.145	K
Pressure	1	0.8	0.4	atm
Mass Flow	0.483471	0.424745	0.0587289	kg/s
Mass Fraction (Mixture) / Isopropanol	0.860549	0.97953	1.21E-11	
Mass Fraction (Mixture) / Water	0.139451	0.0204704	1	
Mass Fraction (Mixture) / Ethylene glycol	0	3.38E-11	5.47E-15	

	BOTTOM 1	BOTTOM 2	BOTTOM 3	
Temperature	369.779	412.072	434.704	K
Pressure	1	0.8	0.4	atm
Mass Flow	0.0373623	1.44419	1.38546	kg/s
Mass Fraction (Mixture) / Isopropanol	0.016497	4.94E-13	1.77E-16	
Mass Fraction (Mixture) / Water	0.983503	0.0420416	0.00143425	
Mass Fraction (Mixture) / Ethylene glycol	0	0.957958	0.998566	

	EXRRACTIVE SOL.	FEED	RECYCLE	
Temperature	298.15	350	349.98	K
Pressure	1	1	0.4	atm
Mass Flow	1.00E-05	0.520833	1.38546	kg/s
Mass Fraction (Mixture) / Isopropanol	0	0.8	8.62E-17	
Mass Fraction (Mixture) / Water	0	0.2	0.00143634	
Mass Fraction (Mixture) / Ethylene glycol	1	0	0.998564	

REFERENCE:

Plantwide control of an isopropyl alcohol dehydration process, William L. Luyben.