Pressure-swing distillation of isobutyl alcohol and isobutyl acetate

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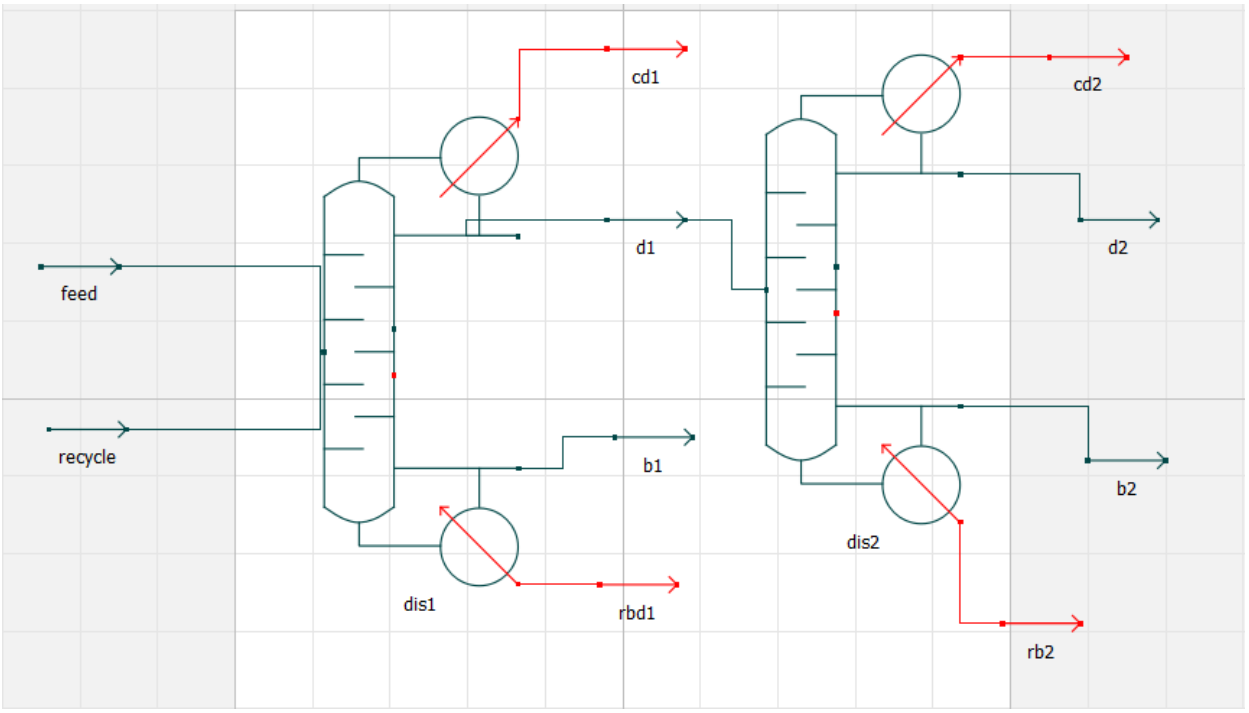
Background & Description:

There are several separation methods that can be employed to separate the azeotropes, which includes extractive distillation, pressure swing distillation, etc. Due to limited conversion ratio the mixture of Iso Butyl Acetate and Iso Butyl Alcohol cannot be achieved by simple distillation process because of the formation of minimum boiling azeotrope between them, so isobutyl acetate and isobutyl alcohol are separated by pressure swing distillation (PSD).

In the flowsheet, the fresh feed stream is mixed with the recycle stream to become final feed to the distillation column (dist1) despite of the different composition of the feed stream and recycle stream. The recycle is at 338.577 K temperature and 101325 Pa of pressure while that of feed with 380.69 K of temperature and 101325 Pa of pressure is fed to the distillation column (dist1) where from bottom Isobutyl Acetate is obtained with 99.5% purity while from top there is a mixer of Isobutyl Acetate and Iso Butyl Alcohol. So, the mixer is fed again to distillation column (dist2) where the temperature of mixer is 381.665 K and 101325 Pa of pressure. In the distillation column (dist2) low pressure should be maintained (19000 Pa). From the distillation column (dist2) Isobutyl Alcohol is obtained from bottom with purity of 98.5%.

Flowsheet:



Results:

1) DWSIM output

Master Property Table						
Object	ISOBUTYL ALCOHOL	ISOBUTYL ACETATE	FEED	DISTILLATE - 2	DISTILLATE - 1	
Temperature	64.6056	116.378	107.54	65.2579	108.515	C
Pressure	0.19	1.01325	1.01325	0.19	1.01325	bar
Mass Flow	624.749	875.279	1500.02	1121.56	1746.31	kg/h
Molar Flow	8.35761	7.54888	15.907	12.0041	20.3618	kmol/h
Volumetric Flow	0.820613	1.10179	1.95964	3.17187	2.40189	m3/h
Molar Fraction (Mixture) / Isobutyl acetate	0.015	0.995	0.48	0.459349	0.276963	
Molar Fraction (Mixture) / 2-methyl-1-propanol	0.985	0.005	0.52	0.540651	0.723037	

2) OpenModelica Output

COMPONENT	B2	B1	D2	D1
ISOBUTYL ACETATE	0.015	0.995	0.459349	0.02769
ISOBUTYL ALCOHOL	0.985	0.005	0.540651	0.72037