

Separation of Pyridine and Water using Pressure Swing Distillation

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Background & Description:

Pyridine is a vital intermediate chemical that finds use as a precursor to agrochemicals, dyes, and pharmaceuticals as well as specialty reagents like Cornforth reagent and Collins reagent. Therefore, its recovery from waste water is of paramount interest. However, pyridine forms a binary azeotrope with water (43% water and 57% pyridine), making conventional distillation ineffective for separation of such a binary mixture.

In the following flowsheet, a double column pressure swing distillation process has been employed, where change in column pressure is used to shift azeotropic compositions. The feed (S-01), with 43% water and 57% pyridine, and recycle enter the first column (DC-01), operating at 1.01325 bar, at stages 10 and 2, respectively. The first bottom product (S-04) obtained is 98% pyridine while the distillate enters the second column (DC-02), operating at 5 bar, as feed at stage 10. The second bottom product (S-06) obtained is 97% water while the distillate is recycled back to the first column (DC-01).

Note: All percentage compositions mentioned above are on mole basis.

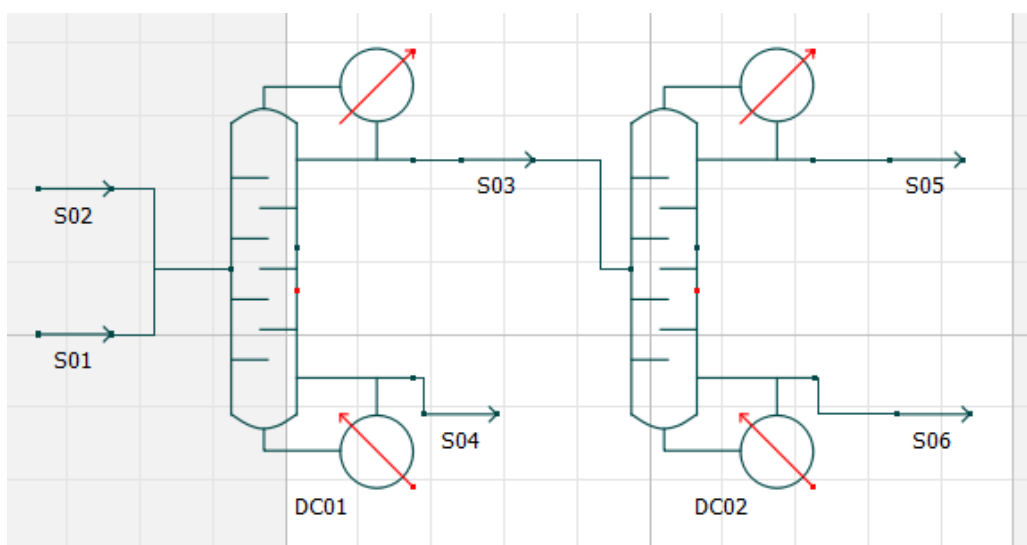


Figure 1: Water and Pyridine DCPSD Separation Flowsheet

Results:

Object	Feed (S-01)	Bottom 1 (S-04)	Bottom 2 (S-06)	
Temperature	25	179.328	100.294	C
Pressure	5	5	1.01325	bar
Mass Flow	150	108.2448	7.85336	kg/h
Molar Flow	2.83911	1.38991	0.03957	kmol/h
Molar Fraction (Mixture) / Water	0.43	0.02	0.97	
Molar Fraction (Mixture) / Pyridine	0.57	0.98	0.03	

Table 1: Streamwise Results for Water and Pyridine DCPSD Separation Flowsheet

Reference:

1. [Completed DWSIM Flowsheet: Separation of Pyridine and Water using Pressure Swing Distillation](#)
2. Dryden's Outlines of Chemical Technology
3. Shreve's Chemical Process Industries