Extractive Distillation for Heptane-Toluene Separation

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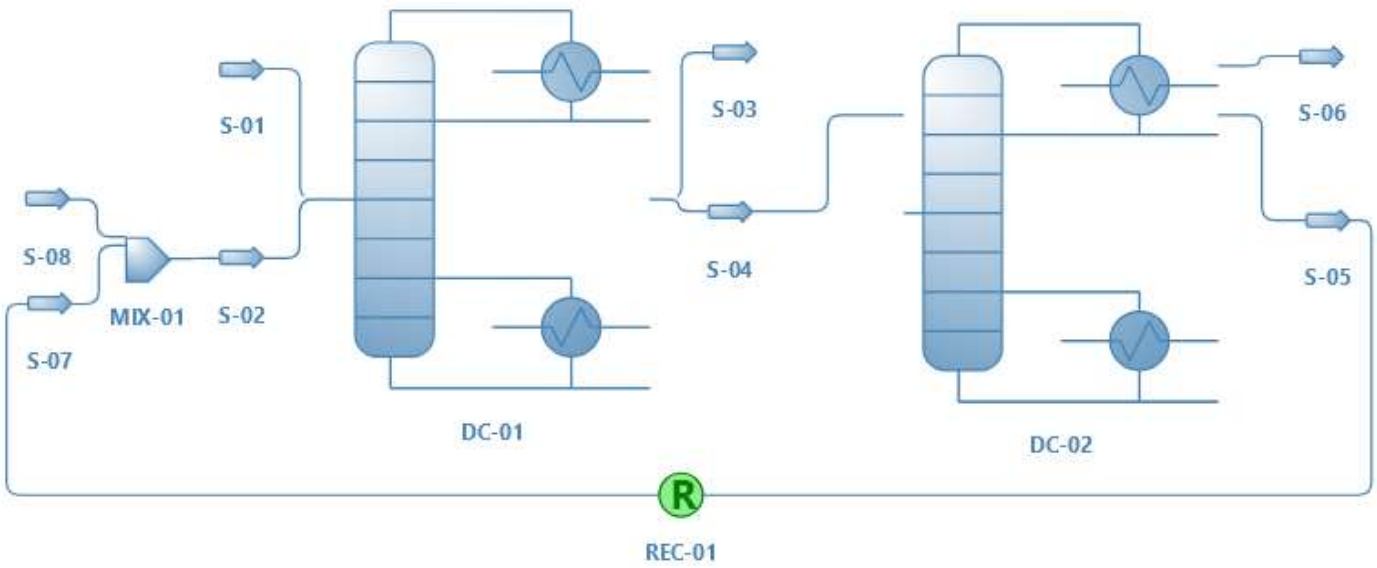
Background & Description:

When the two components in a binary mixture have very close normal boiling points, their relative volatility is likely to be small if they do not form an azeotrope. For such cases, it may be more efficient to use extractive distillation with a solvent than normal distillation. In extractive distillation, a less volatile solvent is used to increase the relative volatilities of the original mixtures, allowing for easier separation. In this flowsheet, phenol is used as the solvent for the separation of n-heptane and toluene.

Here, UNIFAC was selected as thermodynamic property package. 2 extractive distillation columns have been used with phenol as a solvent. After first distillation, n-heptane is a major component in top product with mole fraction of 0.987793 and as a bottom product, we get phenol (0.545804) and toluene (0.450301). To recover phenol, we add another column in which we take bottom product of previous column as a feed. After distillation in second column, phenol is recovered as a bottom product and used as a recycle stream along with a makeup stream of phenol.

Flowsheet:



Results:

Object	Feed (S-01)	Solvent (S-02)	Top1 (S-03)	Bottom1 (S-04)	Bottom2 (S-05)	Top2 (S-06)	Recycle (S-07)	Make-up (S-08)
Pressure(bar)	1	1	1	1	1	1	1	1.01325
Temperature(C)	100.732	180.359	98.147	123.875	180.830	109.884	180.83	25
Mole fraction of n-heptane	0.5	9.16E-15	0.987793	0.003895	9.19E-09	0.00856	9.19E-15	0
Mole fraction of toluene	0.5	8.24E-08	0.009159	0.450301	8.27E-08	0.99049	8.28E-08	0
Mole fraction of phenol	0	1	0.003047	0.545804	1	0.00094	1	1

Conclusion: n-heptane and toluene are separated by extractive distillation with phenol as a solvent.