

## CH3030 Tutorial 9

1. A 2000 kg batch of pyridine-water solution containing 50% pyridine is to be extracted with an equal weight of chlorobenzene. The raffinate from the first extraction is to be re-extracted with a weight of solvent equal to the raffinate weight. This process is to be repeated. How many theoretical stages and what total solvent amount will be required to reduce the concentration of pyridine to 2% in the final raffinate. The tie line data in weight percentages are given below

Pyridine	Chlorobenzene	Water	Pyridine	Chlorobenzene	Water
0	99.95	0.05	0	0.08	99.92
11.05	88.28	0.67	5.02	0.16	94.82
18.95	79.9	1.15	11.05	0.24	88.71
24.1	74.28	1.62	18.9	0.38	80.72
28.6	69.15	2.25	25.5	0.58	73.92
31.55	65.58	2.87	36.1	1.85	62.05
35.05	61	3.95	44.95	4.18	50.87
40.6	53	6.4	53.2	8.9	37.9
49	37.8	13.2	49	37.8	13.2

2. A ternary mixture is composed of 50 wt% of an alcohol, 45 wt% an ether, and 5 wt% water. The ether and alcohol are to be separated using water solvent in an equipment where the solvent enters the top and the feed enters the bottom, so as to produce an ether containing less than 5 wt% alcohol and an extracted alcohol of at least 20 wt%. Using the McCabe Thiele approach, find the stages required. What is the limit of the alcohol content in the extract?

Tie line data is as below

Alcohol	Ether	Water	Alcohol	Ether	Water
2.4	96.7	0.9	8.1	1.8	90.1
3.2	95.7	1.1	8.6	1.8	89.6
5	93.6	1.4	10.2	1.5	88.3
9.3	88.6	2.1	11.7	1.6	86.7
24.9	69.4	5.7	17.5	1.9	80.6
38	50.2	11.8	21.7	2.3	76
45.2	33.6	21.2	26.8	3.4	69.8

Additional points on the phase boundary are as below

Alcohol	Ether	Water
45.37	29.7	24.93
44.55	22.45	33
39.57	13.42	47.01
36.23	9.66	54.11
24.74	2.74	72.52
21.33	2.06	76.61
0	0.6	99.4
0	99.5	0.5