

### Tutorial 3

**Problem 1:** Nicotine (C) in water (A) solution containing 1% nicotine is to be extracted with kerosene (B) in cross current mode of contact at 20°C. Water and kerosene are essentially insoluble.

- (a) Determine the percentage extraction of nicotine if 100 kg of feed solution is extracted once with 150 kg solvent
- (b) Repeat for 3 theoretical extractions using 50 kg solvent.
- (c) Determine the number of stages required to attain the same % extraction obtained in part (b)

**Problem 2:** If 100 kg of a solution of acetic acid (C) and water (A) containing 30% acid is to be extracted three times in cross current mode with isopropyl ether (B) at 20°C, using 40 kg of solvent in each stage, determine the quantities and composition of the various streams. How much solvent would be required if the same final raffinate concentration were to be obtained with one stage?

Wt % acetic acid, 100x	Water layer		Isopropyl ether layer		
	Water	Isopropyl ether	Acetic acid, 100y*	Water	Isopropyl ether
0.69	98.1	1.2	0.18	0.5	99.3
1.41	97.1	1.5	0.37	0.7	98.9
2.89	95.5	1.6	0.79	0.8	98.4
6.42	91.7	1.9	1.93	1.0	97.1
13.30	84.4	2.3	4.82	1.9	93.3
25.50	71.1	3.4	11.40	3.9	84.7
36.70	58.9	4.4	21.60	6.9	71.5
44.30	45.1	10.6	31.10	10.8	58.1
46.40	37.1	16.5	36.20	15.1	48.7

**Problem 3:** An aqueous mixture weighing 100 kg with 30% acetic acid is contacted with 60 kg of pure isopropyl ether. The exit mixture from the mixer is equilibrated in a settler and the equilibrium phases separated. What are the compositions of the two equilibrium phases? (Use the Problem 2 ternary data).

**Problem 4 and 5:** Exercise problems 8.1 and 8.2 of Chapter 8 from Principles of mass transfer and separation process by B. K. Dutta