

Unit Operation

Liquid-liquid extraction

Sheet No. (1)

Q1) Pure water is to be used to extract acetic acid from 400 kg of feed solution containing 25 wt% acetic acid in isopropyl ether

(a) If 400 kg of water is used calculate the percentage of extraction in the water solution in one stage by co-current process.

(b) If multiple four-stage systems are used and 100 kg of fresh water is used in each stage calculate the overall percentage of the acid extraction in the outlet water. Given the equilibrium relationship $Y = 1.5 X$, where Y and X are the weight Ratio in the extract and raffinate respectively.

Q2) 1000 kg/h of an aqueous feed containing 28.6% by mass of solute B is to be treated co-currently with solvent S in order to reduce the solute concentration to 9.1% by mass using a three-stage mixer settler extractor. If the solvent contains 4.75% by mass solute what total solvent flowrate should be used and what is the flowrate of the final extract? The equilibrium relationship is $Y=0.8 X$ where Y and X are the weight Ratio in the extract and raffinate respectively.

Q3) Benzoic acid in a solution with toluene is to be extracted using pure water as a solvent in a counter-current multistage extraction unit. The benzoic acid concentration in the toluene feed is 20% and the weight ratio of water to toluene is 1.45. If 95% of the benzoic acid is to be removed in the water phase calculate the number of stages required if the equilibrium relationship is

a) $Y = 1.5 X$ where Y and X are the weight Ratio in the extract and raffinate respectively.

b) $y = 1.5 x$ where y and x are weight fractions of the extract and raffinate respectively