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Total number of printed pages – 3

B. Tech
PCCH 4306

Sixth Semester Examination – 2013

MASS TRANSFER – II

BRANCH : CHEMICAL

QUESTION CODE : A 198

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions :

2×10

- What is the effect of the selectivity of the solvent used in liquid-liquid extraction on the separation of solute ?
- For a ternary system containing two pairs of partially soluble liquids, the number of plait point(s) is _____.
- What should be the value of distribution coefficient, so that less solvent will be required for the extraction ?
- Briefly write the importance of preparation of the solid on leaching operation.
- How adsorption is applied to gaseous separations ?
- What is adsorption hysteresis ?
- A wet solid is to be dried from 90 to 20 % moisture, wet basis. The moisture to be evaporated, per 1000 kg of dried product is _____ kg.
- Graphically show different types of moisture.
- Discuss the effect of hold up on the performance of a dryer.
- What do you understand by a cationexchanger ? Explain briefly.

P.T.O.

2. Isopropyl ether is used to extract acetic acid from dilute aqueous solution by passing the two immiscible phases counter-currently through a packed column 3 m in height and 7.5 cm in diameter. It is found that if 2000 kg/hr.m² of pure ether are used to extract 1000 kg/hr.m² of 5 % acid by weight then the ether phase leaves the column with a concentration of 1.2 % acid by weight. Calculate the number of overall transfer units based on raffinate phase.

The equilibrium relationship is given by: Weight % acid in ether phase = 0.32 times the weight % acid in water phase. 10

3. Copper ore containing copper as CuSO₄, is to be extracted in a counter-current extractor using pure water as the fresh solvent. The feed charge to be treated per hour comprises of 8 tonnes of gangue, 1.5 tonnes of copper sulphate, and 0.5 tonnes of water. The strong solution produced is to consist of 80 % H₂O and 20 % CuSO₄ by weight. The recovery of CuSO₄ is to be 95 % of that of the ore. After each stage one tonne of inert gangue retains 2.2 tonnes of water plus the copper sulphate dissolved in that water. Equilibrium is attained in each stage. How many stages are required ? 10

4. The equilibrium water adsorbed by a silica-gel in contact with moist air varies with the humidity of air, as :

$$Y = 3.5 \times 10^{-2} X$$

where, X = kg water adsorbed / kg of dry gel and

Y = humidity of air, kg moisture / kg dry air.

0.5 kg silica-gel containing 6 % (dry basis) adsorbed water is placed in a collapsible vessel in which there are 9 m³ of moist air, the partial pressure of water being 15 mmHg. The total pressure and temperature are kept at 1 atm and 298 K respectively. Calculate the amount of water picked up from the moist air in the vessel by the silica-gel. 10

5. A wet solid is to be dried from 40 to 13 % moisture under constant drying conditions in 4.5 hours. If the equilibrium moisture content is 3.9 % and critical moisture content is 16 %, how long it will take to dry the solids to 5 % moisture under the same conditions ? 10
6. (a) Discuss in detail with a neat sketch, the construction and operation of sieve-tray extraction tower. 5
- (b) Explain the construction and working of a Rotocel with a neat diagram. 5

7. (a) Differentiate between van der Waals adsorption and activated adsorption. 4
- (b) Write the processes on which the rate of ion exchange depends. 4
- (c) Write the applications of ion exchange. 2
8. Write short notes on any two : 5×2
- (a) Effect of temperature on ternary equilibria
- (b) Adsorption isotherms
- (c) Rate of drying curve
- (d) Drum dryer.

