Total number of printed pages – 7

B. Tech

CPCH 7307

Sixth Semester Examination – 2008

MASS TRANSFER – II

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

   (a) What do you mean by constant drying conditions ?

   (b) Suggest suitable dryers for drying the following materials :

      (i) Milk powder

      (ii) Wet lumpy solids

      (iii) Free flowing materials.

   (c) State whether fluidized bed dryers can be used for heat sensitive materials or not.

   (d) State two unit operations involving simultaneous heat and mass transfer.

   (e) Define selectivity.

   (f) Can two tie lines intersect within the two-phase region of a liquid-liquid equilibrium diagram ? Explain qualitatively.

   (g) What are the advantages and problems of carrying out extraction of a solid at an elevated temperature ?

   (h) Select suitable adsorbents for the following purposes :

      (i) Drying of air for pneumatic instruments.

(ii) Removal of phenolic contaminants from wastewater.

(i) Name different methods of generating supersaturation.

(j) Explain Caking of crystals.

2. It is desired to dry a certain type of fiber board in sheets 0.131 m by 0.162 m by 0.071 m from 58% to 5% moisture (wet basis) content. Initially from laboratory test data with this fiber board, the rate of drying at constant rate period was found to be 8.9 kg/m^2hr. The critical moisture content was 24.9% and the equilibrium moisture content was 1%. The fiber board is to be dried from one side only and has a bone-dry density of 210 kg/m^3. Determine the time required for drying. The falling rate may be assumed linear. 10

3. (a) Briefly explain about the selection criteria for solvent to be used for liquid-liquid extraction. 5

(b) What is a triangular diagram and how a ternary system is represented on it ? 5

4. 2000 kg of waxed paper per day are to be dewaxed in a continuous counter current extraction system which contains a number of ideal stages by using kerosene as solvent. The waxed paper contains, by weight 25% paraffin wax and 75% paper pulp. The extracted pulp is put through a dryer to evaporated the kerosene. The pulp, which retains the unextracted wax after evaporation, must contain over 0.2 kg of wax per 100 kg of wax-free pulp. The kerosene used for extraction contains 0.05 kg of wax per 100 kg of wax-free kerosene. Experiments show that

the pulp retains 2.0 kg of kerosene per kg of kerosene and wax-free pulp as it is transferred from cell to cell. The extract from the battery is to contain 5 kg of wax per 100 kg of wax-free kerosene. How many stages are required ? 10

5. A hot solution containing 5000 kg of Na_2CO_3 and water with a concentration of 25% by weight. Na_2CO_3 is cooled to 20 °C and crystals of $Na_2CO_3 .10\ H_2O$ are precipitated. At 20 °C, the solubility is 21.5 kg anhydrous Na_2CO_3 per 100 kg of total water. Calculate the yield of hydrated Na_2CO_3 crystals obtained if 5% of the original water in the system evaporates on cooling. Also calculate the quantity of mother liquor. 10

6. (a) Discuss the different criteria for selection of adsorbents. 5

(b) Explain about different methods of bed regeneration used in adsorption. 5

7. A 2500 kg batch of pyridine-water solution, 50% pyridine, is to be extracted once with 2200 kg of chlorobenzene. Determine the concentration of pyridine in the final raffinate and extract.

Equilibrium tie-line data for the system water-chlorobenzene-pyridine at 25 °C are given below :

Pyridine	Chloro-benzene	Water	Pyridine	Chloro-benzene	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

8. Write short notes on any *four* : 2.5 × 4

(a) Solutropic system

(b) Spray dryer

(c) Selectivity

(d) Super critical extraction

(e) Tray dryer

(f) Heat of adsorption.

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