Ref. No. : Ex/PG/PHAR/T/111D/2018

M. PHARMACY FIRST YEAR FIRST SEMESTER - 2018

Subject : INDUSTRIAL PHARMACY-I **Time : 3 hr** **Full Marks : 100**

Answer any five questions taking at least two from each group.

GROUP A

1(a) A continuous vacuum crystallizer is fed with a 31% $MgSO_4$(M.W. 120.5)solution. The equilibrium temperature of magma in the crystallizer is 86°F. A product magma containing 5tons of $MgSO_4.7H_2O$ (crystal) is obtained. The mass ratio of crystal to mother liquor is 0.224 (Mc/M_L). Concentration of mother liquor is 28.5%. Determine the Feed Rate (M_F) and the Rate of Evaporation (M_V)? Determine enthalpy of slurry (h_T)?
Enthalpy of vapor= 1098 BTU/lb ; Enthalpy of mother liquor (h_L)= - 43 BTU/lb ;Enthalpy of Crystal(hc)= - 149 BTU/lb. Solve Graphically. **Use mm graph paper.**
(b) Write on the principle, construction, operation of Krystal crystallizer.What are its advantages and disadvantages?

Marks 10+10

Q2.(a) A mixture of liquids is agitated in an unbaffled tank with the specifications **(SI unit)** given below, calculate power requirement (watt) for mixing.

Unit	rpm	Impeller dia	Density	viscosity		**NRe**	100	250	1000	3000	10^4		a=1.7
SI	580	0.36	400	1		**Np**	1.3	1	0.75	0.65	0.6		b=18

(b) (i) Give names of different dimensionless numbers involved in agitation of liquid system and show that these are dimensionless. (ii)Derive flow number,(iii) What do you mean by axial component , tangential component and radial component of velocity, and explain the effects of these components in case of mixing of liquid in a tank by an impeller?

Marks 10 +(2+4+4)

Q3. (a) Draw a sketch of 'continuous heat exchanger type sterilizer' and describe its operation. What are the advantages of 'continuous steam injector system sterilizer'?
(b) Air flows at a rate 10 m^3/min for 100 hr , to a fermenter of volume 20 m^3. Optimum linear air velocity = 9 m min^{-1}, k=153.5 per meter. Air contains 200 microorganisms /m^3.
What are the thickness and diameter of air filter?
What would be the length of filter if linear air velocity decreases to 1.8 m min^{-1} and value of k is 20 per meter?
(c)A pilot plant sterilization is carried out in 1000 liter vessel with a medium containing 10^6 organisms per c.c. requiring probability of contamination of 1 in 1000.What is its Del factor? If same probability of risk factor is maintained in 10,000 liter vessel, what is its Del factor?
(d) Define D,Z and F values and write their expressions. Derive Z correlating Arrhenius equation.

Marks 5+3+2+10

MASTERS OF PHARMACY 1ST SEM EXAM – 2018

INDUSTRIAL PHARMACY-I TIME: THREE HOURS FULL MARKS: 100

GROUP: B

ANSWER ANY TWO

4. A total of 100 gm-mol feed containing 40 mole percent n-hexane and 60 percent n-octar fed per hour to be separated at one atm to give a distillate that contains 92% hexane and bottoms 7% hexane. A total condenser is to be used and the reflux will be returned to column as a saturated liquid at its bubble point. A reflux ratio of 1.5 is maintained. The f is introduced into the column as a saturated liquid at its bubble point. Use the Ponchon-Sav Method and determine the following:

i. Minimum number of theoretical stages.
ii. The minimum reflux ratio.
iii. The heat loads of the condenser and reboiler for the condition of minimum reflux.
iv. The quantities of the distillate and bottom streams using the actual reflux ratio.
v. Actual number of theoretical stages.
vi. The heat load of the condenser for the actual reflux ratio.
vii. The internal reflux ratio between the first and second stages from the top of tower

VLE Data, Mole Fraction Hexane, 1 atm:

x_A (mole fractions)	0	0.1	0.3	0.5	0.55	0.7	1
y_A (mole fractions)	0	0.36	0.7	0.85	0.9	0.95	1

Enthalpy-Concentration data:

Mole fraction Hexane,		0	0.1	0.3	0.5	0.7	0.9	1
Enthalpy, Cal/gm-mol	Sat. Liquid.	7000	6300	5000	4100	3400	3100	3000
	Sat. Vap.	15700	15400	14700	13900	12900	11600	1000

5. [20 marl

a. A liquid mixture of benzene toluene is being distilled in a fractional distilled column 101.3 KPa. The feed of 100 kmol/h is liquid and it contains 45 moles% benzene (A) a 55 moles% (B) and enters at 327.6 K. A distillate containing 95 moles% benzene and moles % toluene and a bottom containing 10 moles % benzene and 90 moles % toluene to be obtained. The amount of liquid is fed back to the column at the top is 4 times t distillate product. The average heat capacity of the feed is 160 KJ/kg-mole. K and t average latent heat 32099 KJ/kg moles.

Calculate

i. The kg moles per hour distillate, kg mole per hour bottoms.
ii. No of theoretical stages at the operating reflux.
iii. The minimum no. of theoretical stages required at total reflux.
iv. If the actual no. of stage is 10, what is the overall efficiency increased at operatir condition compared to the condition of total reflux?

The equilibrium data:

Temp (K)	353.3	358.2	363.2	366.7	373.2	378.2	383.8
x_A (mole fractions)	1	0.78	0.58	0.45	0.258	0.13	0

y_A (mole fractions)	1	0.9	0.777	0.657	0.456	0.261	0

b. Design a liquid-liquid gravity separator which can handle a two-phase liquid stream of 0.5 m^3/min. The feed contains 45% by volume of light phase and 55% by volume of a heavy phase. Densities of light (ρ_l) and heavy phase (ρ_h) are 900 and 1150 kg/m^3 respectively. Required settling time of light phase is 5 min while the settling time for heavy phase is 4 min.

6. [10+10=20 marks]

a. If crushing rolls, 1m in diameter, are set so that the crushing surfaces are 12.5 mm apart and the angle of nip is 31°, what is the maximum size of particle which should be fed to the rolls? If the actual capacity of the machine is 12 per cent of the theoretical, calculate the throughput in kg/s when running at 2.0 Hz if the working face of the rolls is 0.4 m long and the bulk density of the feed is 2500 kg/m^3.

b. A quartz mixture having the screen analysis shown in the table below, is screened through a standard 10-mesh screen. The cumulative screen analysis of overflow and underflow are also provided in the table below. Calculate the mass ratios of the overflow and underflow to feed and the overall effectiveness of the screen.

Mesh	D_{p_i} mm	Cumulative fraction smaller than D_p		
		Feed	Overflow	Underflow
4	4.699	0	0	
6	3.327	0.025	0.071	
8	2.362	0.15	0.43	0
10	1.651	0.47	0.85	0.195
14	1.168	0.73	0.97	0.58
20	0.833	0.885	0.99	0.83
28	0.589	0.94	1.00	0.91
35	0.417	0.96		0.94
65	0.208	0.98		0.975
Pan		1.00		1.00

c. What are the advantages of controlled polymeric delivery system?
d. How many types of Biodegradable polymers are available.
e. Write the algorithm for solvent casting method.
f. Draw the schematic diagram for electro-hydrodynamic atomization process.
g. Write a short note on hydrodynamics with proper diagram od SAS setup and Modified SASEM setup.

7. [3+6+1+1+4+2+3=20 marks]

a. It is found that the energy required to reduce particles from a mean diameter of 1 cm to 0.3 cm is 11 kJ/kg. Estimate the energy requirement to reduce the same particle from a diameter of 0.1 cm to 0.01 cm assuming: a) kick's law b) Rittinger's law and c) Bond's law

b. The screen analysis shown in the table below applies to a sample of crushed quartz. The density of the particles is 2650 kg/m^3 (0.00265 g/mm^3), and the shape factor are a=2 and $\Phi_s = 0.571$. For the material between 4- mesh and 200- mesh in particle size, calculate a) A_w in square millimetre per gram and Nw in particles per gram b) $\overline{D_V}$ c) $\overline{D_s}$ d) $\overline{D_W}$ and e) N_i for the 150/200-mesh increment f) what fraction of the total number of particles is in the 150/200 – mesh increment?

Mesh	Screen opening D_{p_i} mm	Mass fraction retained, x_i	Average particle diameter in increment, $\overline{D_{p_i}}$ mm	Cumulative fraction smaller than D_{p_i} mm
4	4.699	0.000	-	1.0000
6	3.327	0.0251	4.013	0.9749
8	2.362	0.1250	2.845	0.8499
10	1.651	0.3207	2.007	0.5292
14	1.168	0.2570	1.409	0.2722
20	0.833	0.1590	1.001	0.1132
28	0.589	0.0538	0.711	0.0594
35	0.417	0.0210	0.503	0.0384
48	0.295	0.0102	0.356	0.0282
65	0.208	0.0077	0.252	0.0205
100	0.147	0.0058	0.178	0.0147
150	0.104	0.0041	0.126	0.0106
200	0.074	0.0031	0.089	0.0075
Pan		0.0075	0.037	0.0000

c. What are the advantages of Ball mill
OR
What is the difference between Bulk and tapped density

d. 100 moles of benzene (A) and toluene (B) mix containing 50% (mole) of benzene is subjected to a differential distillation at atmospheric pressure till the composition of benzene in the residue is 32%. Calculate the total moles of the mixture distilled. Average relative volatility may be assumed as 2.16.
OR
Write short note on any four: Crystallinity Index, Sessile drop method, water retention capacity, Power Law Model, Herschel-Bulkley Model, Tiu-Boger Model, Conductivity for testing the purity of powder, pH-measurement for testing the purity of powder

e. A ball mill, 1.2 m in diameter, is run at 0.80 Hz and it is found that the mill is not working properly. Should any modification in the conditions of operation be suggested?

[3+6+1+8+2=20 marks]

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