Reg.No.

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MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH BIOTECHNOLOGY, END SEMESTER ONLINE EXAMINATION, 2ndFebruary, 2021 (2-5 pm)

Subject: Separation Processes [BIO3154]

Max Marks: 50

Instructions to Candidates:	
Answer ALL the questions& missing data may be suitable assumed	
Explain the operating principle, steps involved, advantages and disadvantages of Lyophilization.	[4]
A solution of washed, raw sugar, 48% sucrose by weight, is coloured by the presence of small quantities of impurities. Decolourization can be done by treatment with adsorption using activated carbon. The data for equilibrium adsorption was obtained by adding small quantities of carbon to separate batches of the original solution and observing the equilibrium colour reached. The data with quantity of carbon expressed on the basis of the sugar content of the solution are as follows	[6]
The following is the binary VLE data at 1 atm.	
x00.10.20.30.40.50.60.70.80.91.0 y 00.250.3650.510.630.750.8150.890.930.971.0A distillation column operates with 100 kmol/hr of feed of composition, 50% molefraction as composition. Top product is 0.95 (liquid at its bubble point) and Bottomproduct is 0.05 in compositions.i.Due to some error in the operation, the overhead condenser begins tocondense vapour from top tray partially to a liquid, without altering the reflux ratio of1.4 and the product (as vapour) composition. Calculate the compositions of liquid	[7]
	Instructions to Candidates: Answer ALL the questions& missing data may be suitable assumed Explain the operating principle, steps involved, advantages and disadvantages of Lyophilization. A solution of washed, raw sugar, 48% sucrose by weight, is coloured by the presence of small quantities of impurities. Decolourization can be done by treatment with adsorption using activated carbon. The data for equilibrium adsorption was obtained by adding small quantities of carbon to separate batches of the original solution and observing the equilibrium colour reached. The data with quantity of carbon expressed on the basis of the sugar content of the solution are as follows Kg carbon/kg dry sugar 0 0.005 0.001 0.015 0.02 0.03 Colour removed, % 0 47 70 83 90 95 Colour removed, % 0 0.47 70 83 90 Colour removed, % 0 0.47 70 83 90 95 Colour is measured in a scale, such that it is a qualitative representation of impurity, being directly proportional to impurity concentration in the units of weight of impurity/kg-solution. One kg raw impure sucrose solution with colour of 10 is mixed with one kg of another impure sucrose solution with a colour of 30. Convert the equilibrium data to an appropriate units for X (solid side) and Y (solution side), for the resultant solution. Provide your reasons for the

	ii. After correcting the problem in section (i) the column was brought back to normal operation, composition of vapour and liquid entering a tray in stripping section was (0.29,0.2). Determine the number of stages and q. (4)	
2(B)	A fixed bed of solid adsorbent is used for desorption of a component A of a gas. After the bed becomes saturated with adsorbate A, it is subjected to regeneration to desorb adsorbate A. It was decided by the plant engineer to desorb by using a DISPLACEMENT method by purging by using inert gas containing adsorbate B. B is strongly adsorbed in comparison with A by the solid. Finally the solid has to be brought back to unadsorbed state, without any adsorbate. Briefly write about the various steps involved and how concentration of A and B varies in the purge outlet during the operation as a function of time (3)	[3]
3(A)	An absorber (top section is tray column and bottom section is packed bed) is to recover 90% of the ammonia in the air ammonia stream fed to it using fresh water as the absorbing liquid. The ammonia content of the air is 20% mole. Temperature/pressure is 30° C/1 atm. 50% of the total water flow rate is introduced at the top of the column (above tray section) and remaining 50% is introduced in the middle of the column (just above packed bed section) to avoid flooding. Total liquid flow rate is 30% more than minimum based the entire column. Number of trays in the top section is 2. Assume 1 kmol/min of feed gas. Equilibrium data is given below. All trays are 100% efficient Draw the equilibrium diagram in the form of Y-X [2] Determine the number of equivalent trays in the lower section (packed bed) [4] $\boxed{x \ 0 \ 0.004 \ 0.008 \ 0.02 \ 0.032 \ 0.046 \ 0.06 \ 0.082 \ 0.119 \ 0.132}$	[6]
3(B)	A hygroscopic material is subjected to drying-wetting (humidification) experiment by changing RH of air and observing equilibrium moisture content of the particles to generate equilibrium diagram . It is observed that during drying, air in pores did not interfere with drying while during wetting, entrapped air created increased pressure with rising moisture content. Draw the equilibrium diagram for both the operations on the same plot. (RH on y axis, equilibrium solid moisture content \overline{X} on x-axis). Give your explanation. [2] Dried fish in the form of a block was dried and it was found that initially the material lost equal moisture in equal time, followed by rate of drying being proportional free moisture. The fish was pulverized to fine particles and subjected to drying again.	[4]



	chromatography to determine the level of phosphate and nitrogen, while assessing its	
	purity. Determine the most suitable detector/s which would provide the best results	
	and also add a comment on the method of detection. [1.5]	
	A student is carrying out crystallization process using 10000 kg of salt solution which	
	contains 20 wt % of sodium sulfate. On cooling to 20 ^o C, the salt crystallizes as the	
	decahydrate. The student is interested in studying the crystallization under two	
5(B)	scenarios: 1) When no water is evaporated and 2) When 4% of the total weight of	[5]
	solution is lost by evaporation of water during cooling. Determine the yield of the	
	decahydrate salt crystals in these scenarios, given the solubility is 22 kg anhydrous	
	sodium sulfate/100 kg of total water. The molecular weights are 105 for sodium	
	sulfate, 180.2 for 10 H ₂ 0, and 285 for sodium sulfate decahydrate [Na ₂ SO ₄ · 10H ₂ O]	
	In a lab setup, the crystallization of KCl is being studied in a saturated solution at	[2]
5(C)	80°C. The data of this study will be used for the development of a solubility curve.	
	Suggest a suitable approach for the experiment.	