





MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

A Constituent Institution of Manipal University I SEMESTER M.TECH (INDUSTRIAL BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: ADVANCED BIOSEPARATION PROCESSES [BIO 5124]

REVISED CREDIT SYSTEM (23/11/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.

	A biochemist discovers and purifies a new enzyme, generating the purification table below							
	Procedure	Total Protein	Activity					
		(mg)	(units)					
	Crude Extract	25000	4000000					
1A.	Precipitation (Salt)	5000	3000000	5				
	Precipitation (pH)	4000	1000000					
	Ion exchange Cellulose Chromotography 200 800000							
	Affinity Chromotography 50 750000							
	Size exclusion Chromotography 45 675000							
	Calculate the yield and specific activity at each fraction and pick out the most							
	efficient and the least efficient purification steps							
1B.	Explain the common stages of downstream processing. Highlight the typical bioseparation techniques employed in each stage							
2A.	You are filtering a beer which contains two species: bacterial cells 7×10^{-4} cm in diameter and spores 0.3×10^{-4} cm in diameter. You have measured the specific cake resistance of each species: $\mu \alpha \rho_i$ (bacteria) = 1.3×10^9 kg/sec m ³ . $\mu \alpha \rho_i$ (spores) = 2.3×10^9 kg/sec m ³ Other experiments show that for a mixed culture, $\mu \alpha \rho_0 = \left(\sum \phi_i \sqrt{\alpha_i \rho_{0_i} \mu}\right)^2$ Where, ϕ_i is the fraction of solute <i>i</i> in all the solutes. Your present beer contains half the concentration of bacteria as spores. How long will it take to filter 850 liters of combined beer in a filter of negligible							
2B.	medium resistance, a pressure drop of 10^5 N/m ² and 4.0 m ² area? A broth of 80 L contains the desired protein at 12.8 g/L as well as a contaminant protein at 1.8 g/L. Calculate the ammonium sulphate concentration required to recover 98% of the desired protein if the precipitation constants β and <i>k</i> of the desired protein are 9.33 and 1.1 respectively and that of the contaminant							

	protein are 8.8 and 0.95 respectively. What will be the purity of the desired									
2.4	protein at 98% recovery? A laboratory bottle centrifuge is used to collect yeast cells after fermentation The centrifuge consists of a number of cylinders rotated perpendicularly to th axis of rotation. During centrifugation, the distance between the surface of liquid and the axis of rotation is 3 cm, and the distance from the bottom of th cylinder to that axis is 10 cm. The yeast cells can be assumed to be spherical with a diameter of 8.0 μ m and a density of 1.05 g/cm ³ . The fluid has physical properties close to those of water. The centrifuge is to be operated at 500 rpm How long does it take to have a complete separation?									5
3A.										
	We have measured the adsorption of gentamicin from water at pH 9.5 onto a									
20	nonionic carbon. We find the following results: C(a = courto(a water)) = 0.1 = 0.3 = 0.6 = 0.9 = 1.2							_ ۲	5	
Э D.	a	a solute/a c	arbon)	1.3	1.7	2.3	2.4	2.6	-	•
	Which adsorption isotherm fits these data? Determine equilibrium constants.							ants.		
4A.	A solution containing 6.2×10^{-4} g/cm ³ of a polypeptide of molecular weight 2360 Da is to be concentrated by ultrafiltration. The ultrafiltration membrane is nearly ideal, passing solvent but completely retaining polypeptide; low molecular weight species have no significant effect. Concentration polarization also has a minor effect. The value of RT is 24 L atm /mol, the initial solution volume is 64 L, the final concentration should be 0.01 g/cm ³ , the spiral wound module has a total area of 2.6 m ² , and the permeability of the membrane is 0.15 L/m ² atm hr with $\Delta P =$ 235 psi, how long will the filtration take place?								5	
	A bead mill was used to grind <i>Penicillium</i> filaments and the energy required for different size reductions for the same mass of material was determined (see Table below): Average Initial Average Final Energy redives (microne) Required (1)									
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