TE | Sem V | CBSGS | BT | BAT

19/12/16

Extra

# Bioreactor Analysis & Technology

Q.P. Code : 569302

24

(3 HOURS) (MAX. MARKS : 80)

**Note:**
1. Question No. 1 is compulsory.
2. Attempt any three questions out of remaining five questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicate full marks.

Q.1 Answer the following ( **Any four**)

a. Discuss the advantages and disadvantages of Batch reactor 5

b. Explain the temperature dependency of rate constant. 5

c. What are the reasons of non-ideality of flow reactor? Define RTD. 5

d. Derive Monod's equation. 5

e. Differentiate between intrinsic and overall biochemical reaction rate. 5

Q.2 a. A homogeneous liquid phase reaction, with the stoichiometry and kinetics $A \rightarrow S$, $-r_A = kC_A^2$ takes place in amixed flow reactor and results in 50% conversion. 12

i) Find conversion if this reactor is replaced by another MFR having volume 6 times that of the original reactor- all else remain unchanged.

ii) Find the conversion if the original reactor is replaced by a PFR of the same size- all else remain unchanged.

b. Explain the integral method of analysis of data. 8

Q.3 a. Describe the kinetics of substrate uptake in cell culture with product formation. 10

b. A Gas phase decomposition of A is carried out in a MFR. The stoichiometry of the decomposition is $A \rightarrow R + S$. The initial concentration of A $C_{A0}$ is 0.003 mol/l. The following data are obtained by conducting various runs using $C_{A0}$ = 0.003 mol/l. 10

| | | | | | |
|---|---|---|---|---|---|
| τ (sec) | 0.4 | 5 | 14 | 45 | 195 |
| XA | 0.2 | 0.6 | 0.76 | 0.90 | 0.97 |

Find a rate equation for this decomposition.



TURN OVER

Q.4 a. A Dilute aqueous solution of acetic anhydride is to be hydrolysed at 25°C with rate $-r_A = 0.158C_A$ & $V_0 = 500$ cm³/min of solution with anhydride concentration of $C_{A0} = 1.5 \times 10^{-4}$ gmol/cm³. There are total 3 reactors. Two of size 2.5 lit each and one of 5 lit. For getting higher conversion which alternative will be better. 15

i) One 5 lit reactor used as steady flow tank reactor

ii) Two 2.5 lit used in series

iii) Two 2.5 lit were operated in parallel with equal feed rate of 250 cm³/min in each

iv) Compare the conversions obtained in (i) and (ii) with that of tubular reactor of 5 lit capacity.

b. Explain the significance of heterogeneous reactions in bioprocessing. 5

Q.5 a. The effluent concentration is measured as a function of time for a pulse input into a closed vessel. The results are tabulated below: 10

| Time (min) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
|---|---|---|---|---|---|---|---|---|
| $C_{pulse}$ (gm/l) | 0 | 3 | 5 | 5 | 4 | 2 | 1 | 0 |

This vessel is to be used as a reactor for the decomposition of liquid reactant. The stoichiometry of decomposition is A → S . The decomposition is first order with k= 0.307 min⁻¹. Estimate the fraction of reactant unconverted in the real reactor and compare this with the fraction unconverted in a PFR.

b. Explain space time and space velocity. 3

c. Explain diagnosing ills of operating flow reactors. 7

Q.6 Write a note on (Any four)

a. Hallow fiber bioreactor 5

b. Michaelic-Menten kinetics 5

c. Stepwise series reaction 5

d. Non-growth associated products 5

e. Concentration profile for zero order kinetics in heterogeneous reactions 5