

R07

Code: R7312302

B.Tech III Year I Semester (R07) Supplementary Examinations, May 2013

**BIOCHEMICAL REACTION ENGINEERING - I**

(Biotechnology)

Time: 3 hours

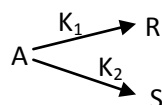
Max. Marks: 80

Answer any FIVE questions  
All questions carry equal marks

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- 1 (a) Differentiate between order and molecularity of a reaction.  
(b) The rate constants of a certain reaction are  $1.6 \times 10^{-3} \text{ s}^{-1}$  and  $1.625 \times 10^{-2} \text{ s}^{-1}$  at  $10^\circ\text{C}$  and  $30^\circ\text{C}$  respectively. Calculate the activation energy.
- 2 (a) Explain continuous sterilization with a neat sketch.  
(b) Differentiate between batch, fed-batch and continuous mode of operation.
- 3 Explain the models for inhibition kinetics.
- 4 Assume that experimental measurement for certain organisms have shown that cells can convert two-thirds (wt/wt) of the substrate carbon (alkane or glucose) to biomass.  
(a) Calculate the stoichiometric coefficients for the biological reactions:  
Hexadecane:  $\text{C}_{16}\text{H}_{34} + a\text{O}_2 + b\text{NH}_3 \rightarrow \text{C} (\text{C}_{4.4} \text{H}_{7.3} \text{N}_{0.86} \text{O}_{1.2}) + d\text{H}_2\text{O} + e\text{CO}_2$   
Glucose:  $\text{C}_6\text{H}_{12}\text{O}_6 + a\text{O}_2 + b\text{NH}_3 \rightarrow \text{C} (\text{C}_{4.4} \text{H}_{7.3} \text{N}_{0.86} \text{O}_{1.2}) + d\text{H}_2\text{O} + e\text{CO}_2$ .  
(b) Calculate the yield coefficients  $Y_{\text{XS}}$  (g dw cell / g substrate),  $Y_{\text{X/O}_2}$  (g dw cell / g  $\text{O}_2$ ) for both reactions.

- 5 Reactant A in a liquid produces R and S by following reactions.



Both these reactions are first order.

A feed with  $C_{\text{AO}} = 1$ ,  $C_{\text{RO}} = C_{\text{SO}} = 0$  enters into two mixed flow reactors in series ( $\tau_1 = 2 \text{ min}$ ;  $\tau_2 = 5 \text{ min}$ ). The composition in first reactor is  $C_{\text{A1}} = 0.40$ ,  $C_{\text{R1}} = 0.40$  and  $C_{\text{S1}} = 0.2$ . Find composition leaving second reactor.

- 6 (a) Explain about activation energies of enzymatically catalyzed and un-catalyzed reactions.  
(b) Explain about lock and key model of substrate complex formation.
- 7 (a) Give the advantages and disadvantages of different immobilization techniques.  
(b) Give the effect of  $P^{\text{H}}$  and temperature on immobilized reaction kinetics.
- 8 Differentiate between film and pore diffusion effects on kinetics of immobilized enzyme reactions.

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