Ref. No. : Ex/PG/FTBE/T/127A/2018

M.TECH. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING

FIRST YEAR SECOND SEMESTER – 2018

ADVANCED ENZYME ENGINEERING

Time: Three Hours | Full Marks: 100

Use Separate Answer scripts for each part

Different parts of the same question should be answered together
Part-I
Full Marks-50

1. Answer any two questions from (a) , (b) and (c):

a) What is meant by enzyme inhibitor? Classify enzyme inhibitors according to kinetic consideration. Explain with rate expression Non-competitive inhibition of enzyme. 1.5+2.5+6

b) Explain the enzymatic inhibition in following cases:

i) reaction with essential cation.

ii) antienzymes

iii) cofactor analogs 3.5+2.5+4

c) Describe competitive inhibition of enzyme. Discuss about antibiotic inactivating enzymes 5+5

2. Answer any one question from (a) and (b):

a) Discuss about diffusion effects in surface bound enzymes on non-porous support material. 10

b) What is meant by immobilization of enzyme? State the advantages and disadvantages if whole cell immobilization of enzyme. What is effectiveness factor? 2+5+3

3. Answer any two questions from (a) , (b) and (c):

a) What important factors are to be considered for isolation of enzyme? 5

b) Discuss about chemical processes for recovery of enzyme. 5

c) Describe salt fractionation and use of solvent for precipitation of protein. 3+2

4. Answer any one question from (a) and (b):

a) Experimental data on the hydrolysis of starch with α-amylase are given in the following table. Mention the types of inhibition involved in this hydrolysis. 10

Inhibitor(mg/ml)	substrate concentration(mg/ml)	Relative hydrolysis velocity
None (0.0)	12.56 9.oo 6.33 4.28 2.34	101 92.4 82.7 70.9 51.7
Maltose (12.7)	10.0 5.26 3.33 2.04 1.89	77.0 62.5 51.4 38.9 37.0
α-dextrin (3.34)	33.30 20.00 10.00 2.82 1.60	116 109 85.5 47.6 32.2

b) D. Thornton and Co-workers studied the hydrolysis of sucrose at pH 4.5 and 25^0 C, using crude invertase obtained from Baker's Yeast in free and immobilised form. The following initial velocity data were obtained with 408 units of crude enzyme (1 unit = quantity of enzyme hydrolyzing 1μ mol of sucrose/ min when incubated with o.29 M sucrose in a buffer at pH 4.5 and 25^0 C).

Free enzyme V_0 (m mol hydrolysed/lit.min)	Immobilized enzyme V_0 (m mol hydrolysed/lit.min)	S_0 (mol/lit)
0.083	0.056	0.010
0.143	0.098	0.020
0.188	0.127	0.030
0.222	0.149	0.040
0.250	0.168	0.050
0.330	0.227	0.100
0.408	0.290	0.290

Determine K_m and V_m for this reaction using both free and immobilized enzyme. 10

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M.TECH. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING 1st YEAR, 2ND SEMESTER EXAMINATION-2018

ADVANCED ENZYME ENGINEERING

Part-II

(50 Marks for Part-I)

(Use a separate answer script for each group)

Time: 3 hrs Full Marks: 100

GROUP A

Answer any one **10×1 = 10**

1. (a) Write five important applications of enzymes in food industry.
   (b) Describe the moderm enzyme immobilization techniques. 5+5=10
2. (a) What are the different resistances acted in immobilized enzyme bead?

   (b) Define Demkohler number. What is its significance and relation with mass transfer coefficient? 5+5 = 10

GROUP-B

Answer any one **20×1 = 20**

3. (a) The bioconversion of glucose to ethanol is carried out in a packed bed immobilized cell bioreactor containing yeast cells entrapped in Ca-alginate beads. The rate limiting substrate in glucose and its concentration in the feed bulk liquid phase is S_{oi} = 5g/l. the nutrient flow rate is F = 2l/min. The particle size of Ca-alginate beads is D_P=0.5cm. The rate constants for this conversion are r_m=100mg S/cm^3.h and Ks = 10mg.S/cm^3, $D_s = 10^{-6}$ cm^2/s. The surface area of the alginate beads per unit volume of the reactor is a = 25 cm^2/cm^3 and cross sectional area of the bed is 100 cm^2. Assuming the first order reaction kinetics determine the required bed height for 80% conversion of glucose to ethanol in exit stream.
   (b) Give the basic principle and structure of a biosensor 15+5=20
4. (a) Derive the differential mass balance for the rate limiting substrate within the thin film.
   (b) Define effectiveness factor with graph. Derive the value of modified Thiels modulus. 12+8=20

GROUP-C

Answer any one $20 \times 1 = 20$

5. (a) Give prominent example of raw materials of steroids.
   (b) Illustrate the solvent solute nature for biotransformation of steroids.

   © What are the different limitation of application of enzyme in organic Synthesis? $5+10+5 = 20$

6. (a) Give examples of analytical applications of immobilized enzymes.
   (b) Briefly describe microencapsulation techniques. $10+10 = 20$