53 (FPT 712) FRTC

2018

FERMENTATION TECHNOLOGY

Paper : FPT 712

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions out of **seven.***

1. Discuss the following : 20

   Fermentation

   Upstream process

   Downstream process

   Maintenance coefficient

   Cold sterilization

   "Productivity" in CSTR.

2. Briefly discuss about operational strategy of Fcd batch culture mentioning the advantages. Why Fcd batch culture is required ?

A microbial strain obey Monod model :

$$dx/dt = \frac{\mu_{max}[s][x]}{K_s + [s]},$$

where $\mu_{max} = 0{\cdot}7h^{-1}$, $K_s = 5g/l$, cell yield $Y_{x/s} = 0{\cdot}65$.

The microorganism is cultured in a CSTR. The feeding rate and substrate concentration of inlet are $500l/hr$ and $85g/l$ respectively. The substrate concentration of outlet stream is $5g/l$. Calculate size of fermenter and cell concentration of outlet stream at steady state. 12+8=20

3. *(a)* Derive residence time (τ) in immobilized enzyme plug flow reactor.

(b) Why agitation is required in suspension microbial culture ?

(c) How O_2 is transferred from air to microbial cell in suspension culture ?

(d) How mixing pattern can be improved in fermenter ?

(e) Write SI unit of mass transfer coefficient, diffusion coefficient, volumetric oxygen transfer coefficient. 8+3×4=20

4. *(a)* Amylase enzyme was assayed at initial substrate concentration of 10^{-5} *moles*. $K_m = 2\times10^{-3}$ *moles*. After one minute, 2% substrate was converted to product. What % of substrate will be converted at the end of $3min$? If the initial substrate concentration would be 10^{-6} *moles*, what % of substrate will be converted to product after $3min$? Calculate V_{max} with the same enzyme concentration been used.

(b) Immobilized lactose is used to hydrolyse lactose in dairy waste to glucose and galactose. The enzyme is immobilized in resin particles and packed into a $0{\cdot}5m^3$ column. Effectiveness factor $\simeq 1$, $K_m = 1{\cdot}32kg/m^3$, $V_{max} = 45kg/m^3h$ lactose concentration in feed stream to packed bed reactor is $9{\cdot}5kg/m^3$. 98% substrate conversion is desired. The column is operated under plug flow condition for 310 days per year. Calculate :

At what flow rate should the reactor be operated ?

How many tonnes of glucose are produced per year ?

10+10=20

5. Define the following : 4×5=20

Michaelis-Menten Equation

Effectiveness factor

Damkohler Number

Thiele Modulus

6. Discuss briefly about the following downstream processing : 4×5=20

Filtration

Absorption

Adsorption

Extraction

Chromato graphic separation.

7. Briefly discuss about fermentative production of the following and their application/use : ***(any three)*** 20

(a) Production of organic acid (citric acid)

(b) Production of polysaccharides (Dextran, Xanthan)

(c) Production of amino acids (glutamic acid and lysine)

(d) Production of vitamin C (food additive) (Ascorbic acid)

(e) Fermentative production of alcoholic beverage (Beer)

(f) Production of enzymes important in food industry.
