53 (FPT 712) FRTC

2017

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 from* **seven**.

1. (i) Explain Stoichiometry with microbial growth equation.

   (ii) Define "Respiratory Quotient" and "Theoretical oxygen demand".

   (iii) "How cells work" — briefly describe mentioning major metabolic pathways and genetic level regulation.

   6+4+10=20

2. (i) Briefly write about upstream process for microbial fermentation.

   Contd.

(ii) What are the environmental parameters for microbial culture ?

(iii) Why sterilization of nutrient medium is required ?

(iv) How "Del factor" (sterilization job) for nutrient medium sterilization is estimated ?

(v) Why final microbial load cannot be considered zero in "Del factor" estimation ? $\qquad$ 10+2+3+4+1=20

3. *(i)* Draw microbial cell growth curve and discuss briefly.

(ii) Write cell growth equation and show calculation of specific cell growth rate (by graphical method) and doubling time.

(iii) Write substrate consumption and product formation equation and define all terms. $\qquad$ 8+6+6=20

4. *(i)* How limiting substrate influence cell growth during log phase ? Explain with Monod model.

(ii) What is batch and continuous fermentation (CSTR)?

(iii) What does dilution rate $\left(n^{-1}\right)$ signify in CSTR?

(iv) What is Fed batch culture? Why is it required?   6+6+2+6=20

5. *(i)* Why agitation is required in suspension microbial culture?

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

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

  (iv) How Plug flow reactor is effective in immobilized enzymatic conversion?

   (v) Write S1 unit of mass transfer coefficient, diffusion coefficient, volumetric oxygen transfer coefficient.   4+4+3+6+3=20

6. *(i)* Define the following:

Effectiveness factor

Damkohler Number

Thiele modulus.

(ii) What fraction of V_{Max} is observed at substrate concentration $[s] = 4km$?

(iii) Suppose a microbial species obey Monod model :

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

where $\mu_{Max} = 0.7 hr^{-1}$

$$K_s = 5 g/L.$$

Cell yield $(Y_{x/s}) = 0.65$

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+2+6=20

7. *(i)* Briefly discuss downstream processing of culture broth to get purified finished product.

(ii) Briefly discuss fermentative production of chemicals important in food industry, fermented food and beverage.

10+10=20

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