BIOREACTOR ENGINEERING
Chapter 5
Culture Kinetic Study of Modifying Batch Fermentation

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A 15-L stirred tank reactor is used to produce polysaccharide gum via fermentation. The cell growth kinetic values are μ_{max} = 0.01 h^{-1}, K_s = 0.1 g/L and $Y_{X/S}$ = 0.45. At the beginning of fermentation, the reactor consists of a culture medium containing 3% (w/v) of substrate and 1.0 g/L cell is operated in batch mode. When the substrate is virtually consumed (S < 0.5 mg/L), medium flow at a substrate concentration of 3% (w/v) is then started at a constant rate of 0.2 L/h. By assuming the fed-batch operation reaches quasi-steady state rapidly, calculate the following.

a) The final cell concentration during the batch operation.

b) The final cell amount in the reactor if the fed-batch operation is run for 1,000 h.

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Exercise 2

A fed-batch fermentation is operated with intermittent addition of glucose. When the system reached quasi steady state at time t = 2 h, the following parameters values are measured:

V = 1000 ml
S_o = 100 g glucose/L
K_s = 0.1 g glucose/L
X^t_i = 30 g

F = 200 mL/h
μ_{max} = 0.3 h^{-1}
$Y_{X/S}$ = 0.5

Determine:

a) V_i (initial volume of fermenter).

b) The limiting substrate concentration in the vessel.

c) The concentration and total amount of cell in the vessel at quasi steady state.

d) The product concentration in the vessel at t = 2 h if q_p = 0.2 hr^{-1} and P_i = 0.

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