

BIOREACTOR ENGINEERING

Chapter 6

Culture Kinetic Study of Modifying Continuous Fermentation

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Exercise 1

A cell recycle chemostat with a feed flowrate of $F = 95 \text{ mL/h}$ and culture volume of $V = 900 \text{ ml}$ is operated under steady state condition with $C = 1.5$ and the recycle ratio is 0.7. Glucose is the limiting substrate with feed a concentration of 9.5 g/L . The cells yield coefficient and kinetic constant are as below:

$$K_s = 1.0 \text{ g glucose/L}$$

$$\mu_{\max} = 0.2 \text{ h}^{-1}$$

$$Y_{x/s} = 0.5$$

- Determine substrate and cell concentrations in the recycle stream.
- Determine specific growth rate of the cells.



Exercise 2

Consider a multistage chemostat with the volume of the 1st reactor of 500 L (for cell production) and the 2nd reactor of 300 L (for product formation). The glucose concentration in the feed is 5 g/L and flow into the 1st reactor at 120 L/h. The cells have the following parameters:

$$\mu_{\max} = 0.45 \text{ h}^{-1}$$

$$K_s = 0.09 \text{ g/L}$$

$$Y_{x/s} = 0.5$$

By assuming steady state operation, determine the following:

- Glucose and cell concentrations in the effluent of the 1st reactor.
- Glucose and product concentrations in the effluent of the 2nd reactor if no growth occurred in the 2nd reactor, $q_p = 0.02 \text{ h}^{-1}$, and $Y_{p/s} = 0.6$.

