

**Lab 3: Monod cell growth kinetics in batch reactor and chemostat**

A microorganism is known to follow Monod kinetics with the following parameters;

$$\mu_{\max} = 1 \text{ h}^{-1}; Y_{\text{xs}} = 0.5; \text{ and } K_s = 0.1 \text{ g/l}$$

**Batch culture**

- a. If the microorganism is grown in batch culture, obtain a plot for the change in cell concentration ( $X_0 = 0.1 \text{ g/l}$ ;  $S_0 = 5 \text{ g/l}$ ) with time by employing numerical expression using Monod's equation and cell growth equation as discussed in class.
- b. Use the analytical solution for the problem discussed in part a and obtain a plot of change in cell concentration with time. Compare the results of part a and b.

**Chemostat**

- c. If the same microorganism is grown in a chemostat with the following ( $X_0 = 0.1 \text{ g/l}$ ;  $S_0 = 5 \text{ g/l}$ ), obtain plots for the change in cell and substrate concentration with time till steady state at the following dilution rates (D)  
 $[0.2 \text{ h}^{-1}; 0.4 \text{ h}^{-1}; 0.6 \text{ h}^{-1}; 0.8 \text{ h}^{-1} \text{ and } 1 \text{ h}^{-1}]$ .
- d. Based on the steady state values calculated in part b, plot the following at the 5 dilution rates D.
  - i. Substrate concentration in chemostat, S
  - ii. Steady state cell concentration, X
  - iii. Output of cells from chemostat, DX