TUTORIAL TWO

1. Why is it important to understand microbial growth kinetics? (5)
2. Why is a bioreactor better than a large flask for the production of an industrial antibiotic? (4)
3. Suppose you are culturing an organism that produces enough lactic acid to kill itself in a few days.
   1. How can the use of a bioreactor help you maintain the culture for weeks or months? The following graph shows conditions in the bioreactor. (2)
   2. If your desired product is a secondary metabolite, when can you begin collecting it? (1)
   3. If your desired product is the cells themselves and you want to maintain a continuous culture, when can you begin harvesting? (2)
4. Discuss bioreactor design for SSF processes. Also mention TWO advantages and TWO disadvantages of this process**. (6)**
5. List four advantages that airlift bioreactors have over mechanically agitated bioreactors. (4)
6. Write short notes on mixing as a unit of operation in as well as the equipment utilized to ensure that the process is optimal in mechanically agitated bioreactors (8)
7. A bacterium known to have a μmax of 1.4h-1 is grown in a chemostat with a working volume of 750ml. Fresh medium is fed to the culture at a rate of 0.375l/h. In the chemostat the steady-state concentration of the limiting substrate () is 0.08 g/l, the concentration of the limiting substrate in this medium (S0) is 6 g/l and the yield coefficient (Y) for biomass at steady-state is 0.42 g dry biomass/g substrate. Using the Monod equation and the related equations for steady state calculate:
   1. The specific growth rate in steady-state.
   2. The value of the saturation constant of the culture.
   3. The dilution rate of the culture.
   4. The biomass concentration .

Present the results in suitable units. (12)

1. Differentiate between primary and secondary metabolites. (4)
2. A chemoheterotropic microorganism will be cultivated, as a batch culture, in a bioreactor with working volume of 4 L.
   1. How much glucose, as only carbon source, should the medium contain (g/L) if we want to obtain a final dry biomass of 8.0 grams. (4)
   2. How much N, added to the medium as NH4CI, will be required in order to produce 8.0 grams of dry biomass? (2)
3. You have set up a fermentation plant to produce lysine but have now isolated a novel *Corynebacterium glutamicum* strain from the environment. Your process developmental experiments show that the strain has promise in industrial application. For the scale up (pilot) stage you set up a continuous culture with a working volume of 74 L. The sterile feed stream consisting of molasses is set at a limiting concentration of 740 mg/L at a flow rate of 12L/h. Knowing that the maximum specific growth rate of your strain is 0.2/h, the yield coefficient biomass is 0.56 and the saturation constant of the culture is 15.5 mg/L: Determine the steady state substrate and biomass concentrations. (6)

**ALL QUESTIONS TO BE SOLVED AND DISCUSSED DURING TUTORIALS  
QUESTIONS 1, 2 & 10 TO BE SUBMITTED FOR ASSESSMENT**