

Virtual University of Pakistan

Bio204

Principles of Biochemical Engineering

Midterm past papers solved

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Bio 204

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Total questions 26

20 mcq's + 6 questions

1) Describe relationship between q_p and u .

Ans: Product concentration in a fed batch system over the time of the fermentation will be dependant on the relationship between q_p and u . If q_p is growth related then it will change as u thus, the product concentration remains constant. If q_p is constant and independent of u then product concentration will start of the cycle when D is greater q_p/x but will rise with time as D decreases and q_p/x become greater than D .

2) Why use of glass is preferable in fermenter?

Ans: On a small scale (1 to 30 L) it is possible to use glass and/or stainless steel. Glass is useful because it gives smooth surfaces, is non-toxic, corrosion proof and it is usually easy to examine the interior of the vessel.

3) Write two functions of agitation.

Ans: Agitation plays an important mixing and shearing role in fermentation processes. It not only improves mass and oxygen transfer between the different phases, but also maintains homogeneous chemical and physical conditions in the medium by continuous mixing.

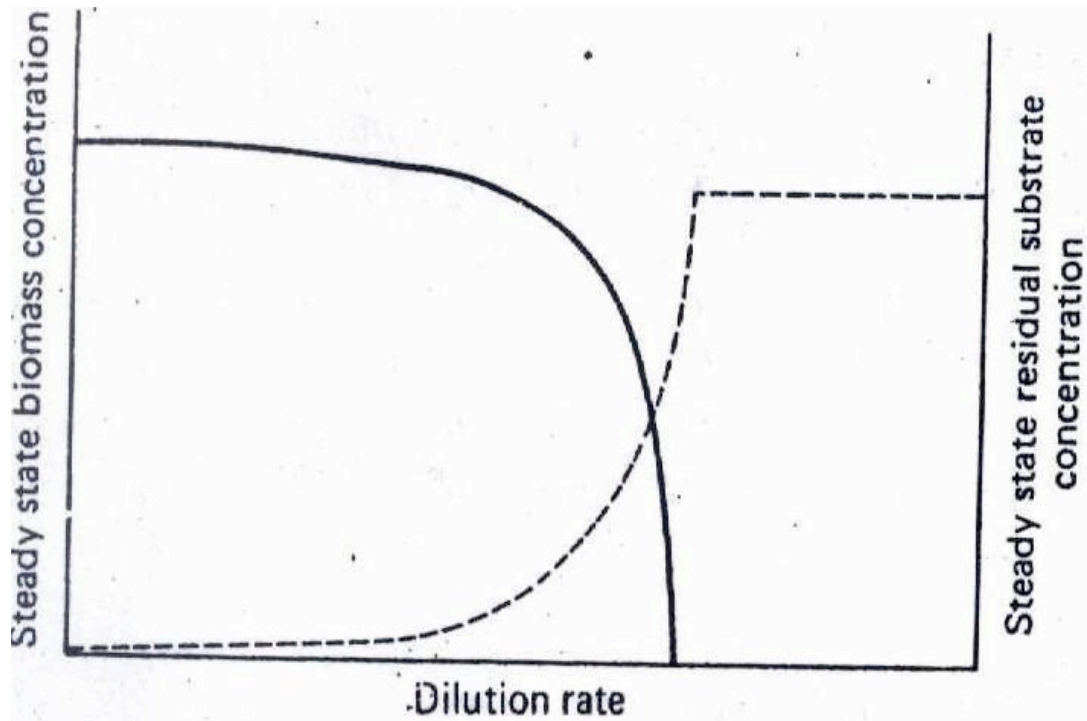
4) Define quasi steady state.

Ans: The total biomass in the culture increase with time, cell concentration remains virtually constant that is $(dx/dt) \approx 0$ and therefore $\mu = D$ it is called quasi steady state.

5) What is the major difference between quasi steady state and steady state of chemostat of fed-batch culture also write effects of values of Y , U_{max} and K_s .

Ans: The major difference between the quasi steady state and steady state of chemostat of a fed batch culture is that μ is constant in the chemostat but decreases in the fed batch culture.

The effect of dilution rate on the steady state biomass and residual substrate concentrations in a chemostat of a microorganisms with a low K_s value for the limiting substrate compared with the initial concentration.



With increasing dilution, the residual substrate concentration increases only slightly until D approaches μ_{max} when s increases significantly. The dilution rate at which x equal zero is termed the critical dilution rate (D_{crit}) and is given by the equation:

$$D_{crit} = \mu_{max} S_R / (K_S + S_R)$$

The kinetic characteristics of the organism are described by the numerical values of the constants y , μ_{max} and K_S .

The value of Y affects the steady state biomass concentration, The value of μ_{max} affects the maximum dilution rate that may be employed and the value of K_S affects the residual substrate concentration and also the maximum dilution rate that may be used.

The continuous culture behavior of a hypothetical bacterium with high K_S for the limiting substrate compared with the initial limiting substrate concentration. With increasing dilution rate, the residual substrate concentration increases significantly to support the increased growth rate. Thus, there is a gradual increase in s and a decrease in x as D approaches D_{crit} . Thus, D_{crit} is affected by the constants, μ_{max} and K_S , and the variable, SR ; the larger SR the closer is μ_{max} . However, μ_{max} cannot be achieved in a simple steady state chemostat because substrate limited conditions must always prevail.

6) Differentiate between axial and radial flow.

Ans: With radial flow mixing, the liquid flow from the impeller is initially directed towards the wall of the reactor; i.e. along the radius of the tank.

q With axial flow mixing, the liquid flow from the impeller is directed downwards towards the base of the reactor, i.e. in the direction of the axis of the tank.

q Radial flow impellers are primarily used for gas-liquid contacting (such as in the mixing of sparged bioreactors) and blending processes.

q Axial flow impellers provide more gentle but efficient mixing and are used for reactions involving shear sensitive cells and particles.

Radial flow mixing is not as efficient as axial flow mixing.

For radial flow impellers, a much higher input of energy is required to generate a given level of flow.

Radial flow impellers do and are designed to, generate high shear conditions. This is achieved by the formation of vortices in the wake of the impeller.
