AU-6260

M.Sc. (Third Semester) Examination, 2014

BIOTECHNOLOGY

(LBTM 301: Bioprocess Engineering & Technology)

Maximum Marks: 60

Section- A

(Objective Type Questions)

- (i) (a) Enrichment method

  (ii) (a) μX-$K_d X$

  (iii) (b) Foam separation

  (iv) (d) 6.4-6.8

  (v) (c) Glutamate

  (vii) (a) Alcohol dehydrogenase

  (viii) (a) Solid state process

  (ix) (c) Photobioreactor

  (x) (b) Glycerol

Section-B

(Descriptive Type Questions)

Ans.2 A **bioreactor** may refer to any manufactured or engineered device or system that supports a biologically active environment. In one case, a **bioreactor** is a vessel in which a chemical process is carried out which involves organisms or biochemically active substances derived from such organisms.

It can be used for the cultivation of microbial plant or animal cells. A typical bioreactor consists

of following parts.

Agitator – This facilitates the mixing of the contents of the reactor which eventually keeps the "cells" in the perfect homogenous condition for better transport of nutrients and oxygen for adequate metabolism of cell to the desired product(s).

Baffle – The purpose of the baffle in the reactor is to break the vortex formation in the vessel, which is usually highly undesirable as it changes the centre of gravity of the system and consumes additional power.

Sparger – In aerobic cultivation process the purpose of the sparger is to supply oxygen to the growing cells. Bubbling of air through the sparger not only provide the adequate oxygen to the growing cells.

Jacket – The jacket provides the annular area for circulation of constant temperature water which keeps the temperature of the bioreactor at a constant value.

Basic control systems for the operation of the bioreactor are described below:

Temperature Measurement and control – The measurement of the temperature of the bioreactor is done by a thermocouple or Pt -100 sensor which essentially sends the signal to the Temperature controller.

pH measurement and control – The measurement of pH in the bioreactor is done by the autoclavable pH probe. The measured signal is compared with the set point in the controller unit which then activates the acid or alkali to bring the measured value close to the set point.

Ans.3. Key factors in bioreactor design and operation: The effective bioreactor is to control, contain and positively influence the biological reaction. The macrokinetic system includes microbial growth and metabolite production. Microbes can include bacteria, yeast, fungi, and animal, plant, fish and insect cells, as well as other biological materials.

The other area of major importance in bioreactor design involves the bio-reaction parameters, including: Controlled temperature, Optimum pH, Sufficient substrate (usually a carbon source), Water availability, Salts for nutrition, Vitamins, Oxygen (for aerobic processes), Gas evolution and Product and by product removal.

The function of the bioreactor is to provide a suitable environment in which an organism can efficiently produce a target product.

The target product might be Cell biomass, Metabolite, and Bioconversion Product. The performance of any Bioreactor depends on the following key factors: Agitation rate, Oxygen transfer, pH, and Temperature and Foam production.

Ans. 4.Isolation of industrially important microorganisms: The procedures for isolation of actinomyetes, algae, bacteria and fungi differ markedly, and they usually utilize specialized media (see, Demain and Solomon, 1986). The main isolation methods used routinely for isolation from soil samples are as follows: sponging (soil directly), dilution, gradient plate, aerosol dilution, flotation, and differential centrifugation. Often these methods are used in conjunction with an enrichment technique.

Preservation of industrial microorganisms: Microorganisms require special preservation methods in order to ensure optimal long-term viability and genetic stability.

In general each preservation method can be assigned to one of the following groups:

1. **Metabolically inactive preservation techniques**

Cryopreservation: Freezing and low temperature storage in or above liquid nitrogen

Freezing and low temperature storage below -70°C,

Drying

Preservation by shelf freeze-drying

Preservation by spin freeze-drying

Preservation by liquid drying (L-drying)

Preservation by vacuum drying

2**. Metabolically active methods**

Periodic transfer on agar or in liquid medium

Keeping agar cultures under mineral oil

Ans. 5. There are three methods for cell lysis used during downstream processing, described as below:

A. Physical method includes manual grinding, sonication, liquid homogenization, freeze thaw method.

B. Chemical methods most widely used detergents are tritonX-100, tween 20, tween80,SDS

C. Enzymatic method

Ans.6. L-Iysine, one of the well known essential amino acid is in great demand as medicament and as an additive to animal feed or human food-stuff. The importance of L-lysine as an essential amino acid in the nutrition of human beings has made it a desirable supplement of the diet in recent years. This is more prominent in underdeveloped and over-populated areas or the world, where the chief staples have been found deficient of this amino acid. For these reasons, efforts are now being focused on the potential of L-lysine derived bacteria anti its application. In the present studies, the production of L-lysine was achieved through fermentation of an auxotrophic mutant developed from a locally isolated bacterial strain of Corynebacterium glutamicum.

Ans.7.A **bioconversion** utilises the catalytic activity of living organisms and hence can involve several chemical / reaction steps. A living microorganism will be continuously producing enzymes and hence bioconversions often involve enzymes which are quite unstable. Fermentation, where the product of metabolic activity often bears no structural resemblance to the pool of compounds given to the microorganism, is significantly different from biotransformations and bioconversions. There are few applications of biotransformation in context with developing economical products.

a. operate at near neutral pH, ambient temperatures and atmospheric pressure

b. enantiomer specific products

c. can carry out reactions not possible or not economically feasible by traditional chemical synthesis

d. produce "nature-like", biodegradeable compounds

Ans.8. Biodiesel is a renewable and clean burning fuel that is made from waste vegetable oils,animal fats or recycled restaurant grease for use in diesel vehicles. Biodiesel produces less toxic pollutants and greenhouse gases than petroleum diesel. Importance of petrocrops are as below;

- Produced from renewable resources
- Can be used in existing diesel engines
- Less green house emissions
- Grown, produced and distributed locally
- Biodegradable and non-toxic

- Better fuel economy
- More health benefits