FACULTY OF ENGINEERING &TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Batch culture

A technique used to grow microorganisms or cells. A limited supply of nutrients for growth is provided; when these are used up, or some other factor becomes limiting, the culture declines. Cells, or products that the organisms have made, can then be harvested from the culture. Batch culture technique is also called as closed system of cultivation.

Salient feature of batch culture

In this technique at first nutrient solution is prepared and it is inoculated with inoculum (culture organism) and then nothing is added in the fermentation tank except aeration.

In batch culture, neither fresh medium is added nor used up media is removed from the cultivation vessel. Therefore volume of culture remains same.

Since fresh media is not added during the course of incubation, concentration of nutrition decreases continuously. Furthermore various toxic metabolites also accumulate in the culture vessel. Therefore batch culture technique gives characteristics growth curve with lag phase, log phase, stationary phase and decline phase.

Chance of contamination of culture is minimum in batch culture technique because it is closed system of cultivation.

Continuous culture system

Cultures that require a *continuous* supply of the cell suspension or the product in the medium are known as *continuous cultures*. This system is maintained in a steady state for prolonged periods by draining out the used liquid medium and adding fresh medium to stabilize the physiological state of growing cells. Continuous culture technique is also called as open system of cultivation.

Salient feature of continuous culture system

In this technique, bacteria grow continuously in their log phase. This type of growth is known as steady state growth.

The cell density in continuous culture remains constant and it is achieved by maintaining constant dilution and flow rate.

A microbial population can be maintained in the exponential growth phase and at a constant biomass concentration for extended periods in a continuous culture system

Types of continuous culture system

There are two commonly used continuous culture system

- Chemostat
- Turbidostat

Chemostat.
It is a culture system in which chemical environment is static.

In a chemostat the flow rate is set at a particular value with the help of a flow rate regulator and the rate of growth of the culture adjusts to this flow rate. That is, the sterile medium is fed into the vessel at the same rate as the media containing microorganisms is removed.

The culture medium for a chemostat possesses an essential nutrient (e.g., an amino acid) in limiting quantities. Because of the presence of a limiting nutrient, the growth rate is determined by the rate at which new medium is fed into the growth chamber, and the final cell density depends on the concentration of the limiting nutrient. The dilution rate and concentration of limiting nutrient are used to control the growth of bacterial cells.

Dilution rate is defined as the ratio of medium flow rate (ml/h) to vessel volume (ml)
i.e.

$D = F / V$

Where D = Dilution rate; F = Medium flow rate; V = Volume

Turbidostat

In this culture system, the cell density is maintained at constant value by altering the medium flow rate. The flow rate of media through the vessel is automatically regulated to maintain a predetermined turbidity or cell density. The turbidostat differs from the chemostat in several ways. The dilution rate in a turbidostat varies rather than remaining constant, and its culture medium lacks a limiting nutrient. The turbidostat operates best at high dilution rates; the chemostat is most stable and effective at lower dilution rates.

Advantages of continuous culture system

Continuous culture systems are very useful because they provide a constant supply of cells in exponential phase and growing at a known rate. They make possible the study of microbial growth at very low nutrient levels.

Synchronous culture system

A synchronous or synchronized culture is a microbiological culture or a cell culture that contains cells that are all in the same growth stage e.g., exponential phase, stationary phase. Synchronous culture of bacteria can be obtained by several techniques. Synchrony in bacteria is accomplished either by repetitive shifts of temperature or by furnishing fresh nutrients to cultures that have just entered the stationary phase or by nutrient deprivation.
The synchronous growth of a bacterial population. By careful selection of cells that have just divided, a bacterial population can be synchronized in the bacterial cell division cycle. Synchrony can be maintained for only a few generations.

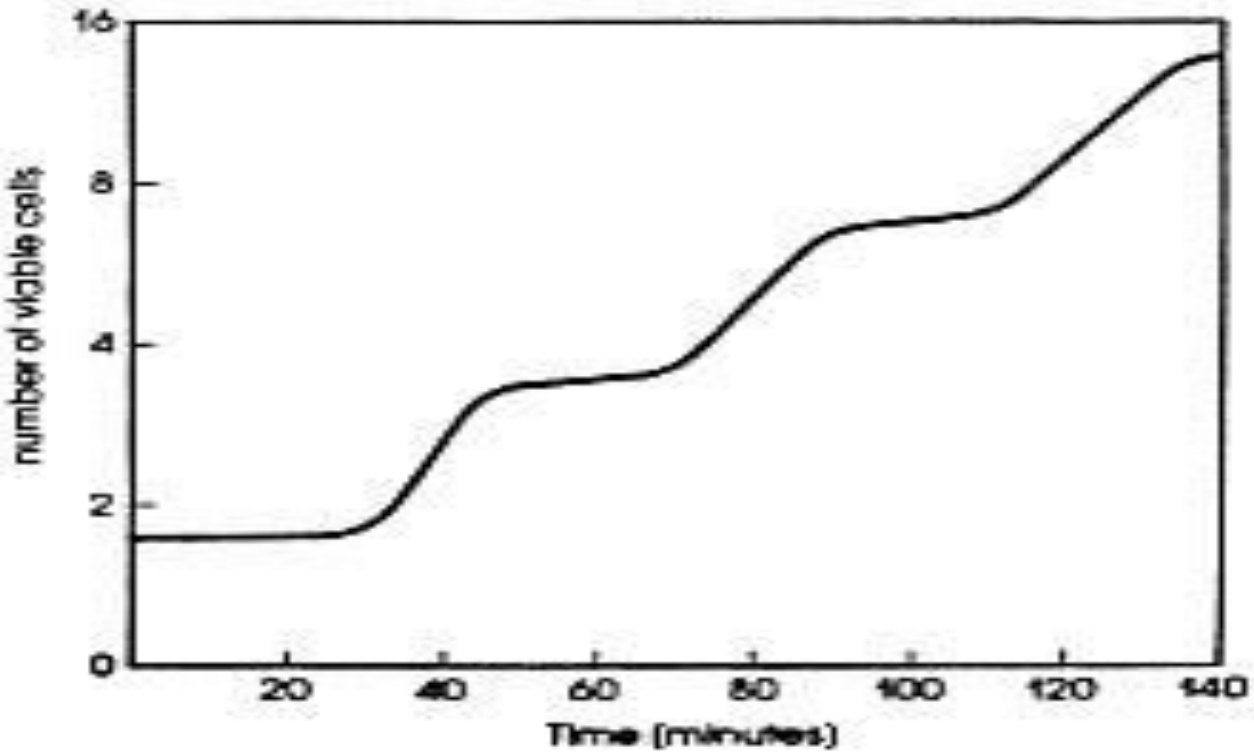

Figure. The synchronous growth of a bacterial population. By careful selection of cells that have just divided, a bacterial population can be synchronized in the bacterial cell division cycle. Synchrony can be maintained for only a few generations.