**ssBio204 Current Paper Feb 2021**

***Effort By Younis Dasti***

**Q.1 how can sterilized the fermenter exhaust air?2marks**

**In many traditional fermentations the exhaust gas from**

**the fermenter was vented without sterilization or**

**vented through relatively inefficient depth filters.**

**Q.2 write down the advantage of continnous sterilization 2marks**

**i. Superior maintenance of medium quality.**

**ii. Ease of scale-up - discussed later.**

**iii. Easier automatic control.**

**iv. The reduction of surge capacity for steam.**

**v. The reduction of sterilization cycle time.**

**vi. Under certain circumstances, the reduction**

**fermenter corrosion.**

**Q.3 write down the effects of increased sterilization time on product yield and nutrient quality of medium? 3marks**

**The deleterious effect of**

**increasing medium sterilization time on the yield of**

**product of subsequent fermentations. The initial rise in**

**yield is due to some components of the medium being**

**made more available to the process micro-organism by**

**the 'cooking effect' of a brief sterilization period.**

**Two types of reaction contribute to the loss of nutrient**

**quality during sterilization:**

***i. Interactions between nutrient components of the medium.***

***ii. Degradation of heat***

***labile components.***

**Q.4 write down the advantage of anarobic treatment of organic wast materials?3marks**

**1. Higher loading rates can be achieved than are**

**possible for aerobic treatment techniques.**

**2. Lower power requirements may be needed per unit**

**of BOD treated.**

**3. Useful end-products such as digested sludge and/or**

**combustible gases may be produced.**

**4. Organic matter is metabolized to a stable form.**

**5. There is an alteration of water-binding characteristics**

**to permit rapid sludge dewatering.**

**6. The reduced amount of microbial biomass leads to**

**easier handling of sludge.**

**7. Low levels of microbial growth will decrease the**

**possible need for supplementary.**

**Q.5 Breifly discuss the batch and continnious culture?5marks**

**Batch Culture:**

In batch processing, a batch of culture medium in a fermenter is inoculated with a microorganism (the ‘starter culture’).Fermentation proceeds for a certain duration (the ‘fermentation time’ or ‘batch time’), and the product is

harvested at the.

 It is a closed system which contains an initial limited amount of nutrient.

We put all the things at one time here and ‘s’ (concentration of substrate) will

remain same.

Minor change in volume.

**Continuous Culture**

Exponential growth in batch culture may be

prolonged by the addition of fresh medium to the

vessel. Provided that the medium has been

designed such that growth is substrate limited

(i.e. by some component of the medium), and not

toxin limited, exponential growth will proceed

until the additional substrate is exhausted. This

exercise may be repeated until the vessel is full.

However, if an overflow device were fitted to

the fermenter such that the added medium

displaced an equal volume of culture from the

vessel then continuous production of cells could

be achieved.

**Q.6 What is spiral heat exchanger and what is the advantage of using it?5**

**5marks**

**The most suitable indirect heat exchangers are of the**

**double-spiral type which consists of two sheets of highgrade**

**stainless steel which have been curved around a**

**central axis to form a double spiral.Spiral heat exchangers are also**

**used to cool the medium after passing through the holding**

**coil. Incoming unsterile medium is used as the cooling**

**agent in the first cooler so that the incoming medium is**

**partially heated before it reaches the sterilizer and, thus,**

**heat is conserved. The major advantages of the spiral heat**

**exchanger are:**

**i. The two streams of medium and cooling liquid, or**

**medium and steam, are separated by a continuous**

**stainless steel barrier with gasket seals being confined to**

**the joints with the end plates. This makes cross**

**contamination between the two streams unlikely.**

**ii. The spiral route traversed by the medium allows sufficient clearances to be**

**incorporatedfor the system to cope with suspended solids. The exchanger tends to be selfcleaning which reduces the risk of sedimentation, fouling and 'burningon**

**Q.7 Explain filter sterilization in detail?10marks**

**FILTER Sterilization**

**Suspended solids maybe separated from a fluid during filtration by the following mechanisms:**

***i. Inertial impaction.***

***ii. Diffusion.***

***iii. Electrostatic attraction.***

***iv. Interception.***

**Inertial Impaction**

**Suspended particles in a fluid stream have momentum. The fluid in**

**which the particles are suspended will flow through the filter by the**

**route of least resistance. However, the particles, because of their**

**momentum, tend to travel in straight lines and may therefore**

**become impacted upon the fibers where they may then remain.**

**Inertial impaction is more significant in the filtration of gases than**

**in the filtration of liquids.**

**Diffusion**

**Extremely small particles suspended in a fluid are subject to**

**Brownian motion which is random movement due to collisions with**

**fluid molecules. Thus, such small particles tend to deviate from the**

**fluid flow pattern and may be come impacted upon the filter fibers.**

**Diffusion is more significant in the filtration of gases than in the**

**filtration of liquids**

**Electrostatic attraction**

**Charged particles may be attracted by opposite charges on the**

**surface of the filtration medium.**

**Interception**

**The fibers comprising a filter are interwoven to define openings of**

**various sizes. Particles which are larger than the filter pores are**

**removed by direct interception. However, a significant number of**

**particles which are smaller than the filter pores are also retained by**

**interception. This may occur by several mechanisms – more than**

**one particle may arrive at a pore simultaneously, an irregularly**

**shaped particle may bridge a pore, once a particle has been trapped**

**by a mechanism other than interception the pore may be partially**

**occluded enabling the entrapment of smaller particles. Interception**

**is equally important a mechanism in the filtration of gases and**

**liquids.**

**Filters have been classified into two types – those in which the pores in the filter are smaller than the particles which are to be removed and those in which the pores are larger than the particles which are to be removed.**

**Q .8 freezing drying?2marks**

**Freeze drying is an important operation in the production of many biologicals and pharmaceuticals. Material is first frozen and then dried by sublimation in a high vacuum. The great benefit of this technique is that it**

**does not harm heat sensitive materials.**

**Q.10 design of continuous sterilization?10 marks**

**The design of continuous sterilization cycles may be approached in exactly the same way as for batch sterilization systems. The continuous system includes a time period during which the medium is heated to the**

**sterilization temperature, a holding time at the desired temperature and a cooling period to restore the medium to the fermentation temperature. The temperature of the medium is elevated in a continuous heat exchanger and is then maintained in an insulated serpentine holding coil for the holding period. The length of the holding period is dictated by the length of the coil and the flow rate of the medium. The hot medium is then cooled to the fermentation temperature using two sequential heat exchangers - the first utilizing the in-coming medium as the cooling source (thus conserving heat by heating-up the incoming**

**medium) and the second using cooling water. The major advantage of the continuous process is that a much higher temperature may be utilized, thus reducing the holding time and reducing the degree of nutrient degradation. The required Del factor may be achieved by the**

**combination of temperature and holding time which gives acceptably small degree of nutrient decay.**

**There are two types of continuous sterilizer which may be used for the treatment of fermentation media: the indirect heat exchanger and the direct heat exchanger (steam injector).**

**Q.11 filteration in animal cell?**

**An ideal filtration system for the**

**sterilization of animal cell culture media must fulfill the**

**following criteria:**

***i. The filtered medium must be free of fungal, bacterial and***

***mycoplasma contamination.***

***ii. There should be minimal adsorption of protein to the filter***

***surface.***

***iii. The filtered medium should be free of viruses.***

***iv. The filtered medium should be free of bacterial***

***endotoxins.***

**Q.12 Why potassium hydroxide and sulphuric acid is used in fermentation?**

 **Potassium hydroxide is preferred to NaOH, as potassium**

**ions tend to be less toxic to cells than sodium ions.**

**However KOH is more expensive than NaOH. Sodium**

**carbonate is also commonly used in small scale**

**bioreactor systems.**

 **Likewise, sulphuric acid concentrations should not be**

**between 10% and 80% as between this range, sulphuric**

**acid is most corrosive.**

**Q.13 Requirements of designing fermentation?**

**There is no universal bioreactor. The general**

**requirements of the bioreactor are as follows:**

**1. The vessel should be capable of being operated aseptically**

**for a number of days and should be reliable in long-term**

**operation and meet the requirements of containment**

**regulations.**

**2. Adequate aeration and agitation should be provided to**

**meet the metabolic requirements of the micro-organism.**

**However, the mixing should not cause damage to the**

**organism.**

**3. Power consumption should be as low as possible.**

**4. A system of temperature control should be provided.**

**5. A system of pH control should be provided.**

**6. Sampling facilities should be provided.**

**Q.14 separate medium of batch sterilization advantages aur disadvantages?10marks**

**The major advantages of a separate medium sterilization vessel may be summarized as:**

**i. One cooker may be used to serve several fermenters and the medium may be sterilized as the fermenters are being cleaned and prepared for the next fermentation, thus saving time between fermentations.**

**ii. The medium may be sterilized in a cooker in a more concentrated form than would be used in the fermentation and then diluted in the fermenter with sterile water prior to inoculation. This would allow the construction of smaller**

**cookers.**

**iii. In some fermentations, the medium is at its most viscous during sterilization and the power requirement for agitation is not alleviated by**

**aeration as it would be during the fermentation proper. Thus, if the requirement for agitation during *in situ sterilization* were removed, the fermenter could be equipped with a less powerful motor. Obviously, the sterilization kettle would have to be equipped with a powerful motor, but this would provide sterile medium for several fermenters.**

**iv. The fermenter would be spared the corrosion which may occur with medium at high temperature.**

**The major disadvantages of a separate medium sterilization vessel may be summarized as:**

**i. The cost of constructing a batch medium sterilizer is much the same as that for the fermenter.**

**ii. If a cooker serves a large number of fermenters complex pipework would be necessary to transport the sterile medium, with the inherent dangers of contamination.**

**iii. Mechanical failure in a cooker supplying medium to several fermenters would render all the fermenters temporarily redundant. The provision of contingency equipment may be prohibitively costly.**