FACULTY OF ENGINEERING & TECHNOLOGY

Characteristics of microorganisms related to modern industrial biotechnology

- The microbes use must be contamination free. In case, if it is bacteria, it should be phage free.

- Grow in simple media: minimal nutritional requirements. Also, preferably not require growth factors (i.e., pre-formed vitamins, nucleotides, and acids).

- The organism should be genetically and physiologically stable. Hence, they must resist random mutations.

- The organism should also accept a certain degree of genetic manipulation to enable the creation of strains with more acceptable properties.

- The microbes should grow vigorously and rapidly.

- The growth period must be shorter, not more than 24 – 36 hours.

- They should lead to a single desired product in a short time possible.
- The product should not contain unwanted materials and toxins.
- The microbes should produce their products extracellularly to reduce the cost price.
- Should produce the products of interest in high yield.
- If possible, the microbes used should be nonpathogenic.
- The organism should not be too highly demanding of oxygen.
- The microbes should be conserved for an extended period and become viable after thawing process.
- The microbes need to be reasonably resistant to predators such as Bdellovibrio spp or bacteriophages.
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Fermentation media for industrial fermentation

- Media preparation can be considered as the backbone of the entire 'bioprocess operation'. It must be carried out with utmost care and precaution.

- the improper and inadequate media design may ultimately give rise to both impaired efficiency of growth as well as concomitant significantly poor product formation.

- Optimization of fermentation process is a continuous and constant activity that plays a key role in industrial fermentation production.

- Designing a fermentation medium is of critical importance because medium composition can significantly affect product concentration, yield and volumetric productivity.

- In addition, it must be taken into account that raw materials in fermentation can range from 15 to 60 % of total costs and that medium composition can also affect the ease and cost of downstream product separation.

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- There are many challenges associated with medium design. Designing the medium is a laborious, expensive and often time-consuming process involving many experiments.

- Micro-organisms used for fermentation process grow on or in growth medium which satisfies the nutritional needs of microbes.

- Complete analysis is needed to be done to establish the most favorable medium for the growth of the microbe used for fermentation.

- Formulating medium at lab scale can be done by adding main ingredients like water, carbon source, nitrogen source, minerals and other supplements in pure form and in required quantities is very easy which supports the growth of the microbe whereas, the same may not support the satisfactory growth of the same organism at industrial level. Following criteria need to be satisfied for the material to be treated as medium at industrial level.

✓It should give maximum yield of product. •
✓It should give minimum yield of undesired product. •
✓It should be consistently available throughout the year. •
✓It should be cheap.

▪Generally carbohydrates are used as carbon sources for fermentations at lab level. But, at industrial level cane molasses, corn steep liquor, sugar beet juice which are inexpensive sources are utilised.

▪. On contrary, some sensitive fermentation makes use of glucose, sucrose and other carbohydrates in their pure form which ensures the purity and quality of the final product. Sometimes starch will be added to the medium for the specific production of amylases.

▪At lab level, peptone or tryptone or beef extract which is a partially digested hydrolysate, which is utilised in synthesis of proteins, components of nucleic acids and other essential cellular components. But at industrial level it is supplemented with soy meal or ammonia or nitrate salts to supplement the nitrogen source.

- Other elements include growth factors, vitamins, anti-foaming agents, precursors, inducers chelating agents, trace elements such as Fe, Cu, Mn, Mo and Co, are added to the fermentation medium.

- Where growth factors, vitamins, precursors, inducers and trace elements directly supports the growth of microbe and anti-foaming agents are added to prevent the foam formation, in case of presence of higher concentrations of metal ions which is not preferable chelating agents are added.