Chapter 4 - Bioprocess / fermentation technology

4.1 Introduction
- A. Fermentation technology
- B. Old
- C. Recent
  1. 1° metabolites
  2. 2° metabolites
     a. enzymes
  3. medical therapeutics
- D. Organisms.
  1. historical
  2. recently
     a. plant cell culture
     b. mammalian cell culture
- E. Success
- F. How do overview
  1. Optimization

4.2 Principles of microbial growth
- A. Vocabulary
  1. growth
  2. measurement of mass
  3. doubling time
  4. generation time
- B. Growth conditions
- C. Batch culture
  1. conditions
  2. growth phases
     a. lag
     b. transient acceleration
     c. exponential phase
     d. deceleration phase
     e. stationary phase
     f. death phase
  3. products
  4. substrate feed methods
     a. fed batch
     b. perfusion
- D. Continuous culture
  1. conditions
  2. products
- E. Organisms
  1. source
  2. selection and screening
  3. long term Storage
  4. genomic modification
     a. mutagenesis
     b. hybridization
     c. recombinant DNA technologies

4.3 The bioreactor - containment vehicles
1. goal
A. Types
1. non-aseptic
2. aseptic
a. operating considerations
b. methods of mixing
1) mechanical aeration & agitation
2) air distribution
B. Control measurements
1. on-line
2. off-line

4.4 Scale-up
A. laboratory
B. pilot plant
C. commercial scale

4.5 Media design for fermentation process
A. Water
B. Energy source
C. Nutrients
D. Media role in product formation
1. growth associated product
2. non-growth associated product
E. Sterilization

4.6 Solid-substrate fermentation
A. Historical
B. Organisms
1. single pure culture
2. mixed identifiable
3. mixed indigenous
C. Pretreatment

4.7 Technology of mammalian and plant cell culture
A. Mammalian cell culture
1. media content
2. cell structure
3. cell types
a. primary -
b. cell line
4. attachment
1) limiting factor
a) solutions
-roller tubes
-gas-permeable Teflon coils
-discs in tube
-microcarrier beads
5. products
6. Why use
7. tissue engineering
B. Plant cell culture

4.8 Metabolic engineering

4.9 Downstream processing
- A. Steps - Table 4.11
  1. separation
  2. concentration
  3. purification
  4. modification
  5. drying
- B. complex and costly