FACULTY OF ENGINEERING & TECHNOLOGY

Overview of Fermentation Technology

Fermentation

•It is a process by which the living cell is able to obtain energy through the breakdown of glucose and other simple sugar molecules without requiring oxygen.

•Fermentation results in the production of energy in the form of two ATP molecules, and produces less energy than the aerobic process of cellular respiration .

Louis Pasteur in the 19th century used the term fermentation in a narrow sense to describe the changes brought about by yeasts and other microorganisms growing in the absence of air (anaerobically); he also recognized that ethyl alcohol and carbon dioxide are not the only products of fermentation.

Fermentation is the metabolic process in which carbohydrates and related compounds are oxidized with release of energy in the absence of external electron acceptors under anaerobic conditions.

•Chronological development of the Fermentation Industry

•The chronological development of the Fermentation industry may be represented as Five overlapping stages. They are:
Stage -1 : Pre-1900
Stage -2 : 1900-1940
Stage -3 : 1940- present
Stage -4 : 1964- present
Stage -5 : 1979- present
• Stage Main products Vessels Process control Strain Selection Stage-

1: Pre 1900 Alcohol Vinegar Wooden up to 1500 barrels capacity Barrels, Shallow trays, trickle filters Use of- Thermometer, Hydrometer and Heat exchangers Pure Yeast cultures. Inoculated with good Vinegar.

Stage-2: 1900-1940 Baker's yeast, Glycerol, Citric acid, Lactic acid and Acetone Air Spragers for Baker's Yeast, Steel vessels for Acetone, Mechanical Stirring used in small vessels PH Electrodes, Temperature control Pure Cultures.

Stage-3: 1940- Present Penicillin, Streptomycin Gibberelin, Amino acids Mechanically aerated vessels, operated aseptically-True Fermenters pH and O2 Electrodes, Use of

RANGE OF FERMENTATION TECHNOLOGY

❑Microbial cell (Biomass)	Yeast
❑Microbial enzymes	Glucose isomerase
❑Microbial metabolites	Penicillin
❑Food products	Cheese, yoghurt, vinegar
❑Vitamins	B12, riboflavin

FERMENTATION TECHNIQUES

surface (solid state)

- microorganisms cultivated on the surface of a liquid or solid substrate.
- complicated and rarely used in industry.
- Mushroom, bread, cocoa, tempeh

submersion techniques.

- microorganisms grow in a liquid medium.
- (biomass, protein, antibiotics, enzymes and sewage treatment) are carried out by submersion processes.

Products of Fermentation

Fermentation products include:

- Food products: from milk (yogurt, kefir, fresh and ripened cheeses), fruits (wine, vinegar), vegetables (pickles, sauerkraut, soy sauce), meat (fermented sausages, salami)
- Industrial chemicals: (solvents: acetone, butanol, ethanol, enzymes, amino acids)
- Specialty chemicals (vitamins, pharmaceuticals)

Some important fermentation products

Product	Organism	Use
Ethanol	*Saccharomyces cerevisiae*	Industrial solvents, beverages
Glycerol	*Saccharomyces cerevisiae*	Production of explosives
Lactic acid	*Lactobacillus bulgaricus*	Food and pharmaceutical
Acetone and butanol	*Clostridium acetobutylicum*	Solvents
α-amylase	*Bacillus subtilis*	Starch hydrolysis