

Lecture No. 4

**Batch culture**

Advantages:

- Less contamination because it is a closed system.
- Genetically stable.
- Growth environment almost controlled
- Many Products at the same time

Disadvantages:

- Many changes to the growth media because of accumulation of by-products or less O<sub>2</sub>... etc
- Alteration of synthetic processes
- Microorganisms take a lot of time for adaptation (Lag phase)
- Production process less than whole process compared to collecting and purification processes.

**Continues culture**

Advantages:

- High productivity.
- Easy computerized process and calculations
- Simple selection of the effective components
- Used for different products

Disadvantages:

- As it is an “Open system”, easy to contaminate
- One of its big problem is what called “isolates fading out” as a result of mutations during the process

**Fermentation products****ENZYMES**

Very important chemical compounds composed of protein extracted from animals, plants and microorganisms. Enzymes are specialized proteins that catalyze chemical reactions.

□ Enzymes either combine molecules to produce new products or break a molecule into smaller parts. Enzymes lower “activation energy” (amount of energy required for reaction to occur). Without enzymes, reactions would not occur fast enough to sustain life.

**Uses:**

Enzyme	Uses
<b>Therapeutic industry, Analytical Uses</b>	
Penicillin acylase	Aid in the production of semi synthetic penicillin
glucose isomerase	Aid in the production of fructose syrup.
Streptokinase	administered to patients immediately after heart attacks.
Prolactazyme	Treats lactose intolerance.
Collagenase	treats skin ulcer.
Asparaginase	used to treat leukemia.
Glucose oxidase	Enzymes can be used to detect and measure amounts of glucose in blood (is an indicator for diagnosis of diabetes.)
Streptokinase	some cardiac mal functions
Hyaluronidase	Ease absorption of injected liquids
□ <b>Industrial Enzymes</b> □	

Cellulase:.	Conversion of cellulose waste to fermentable feedstock for ethanol or single cell protein production. Degradation of cell walls of grains, allowing better extraction of cell contents and release of nutrients
Lactase	Additive for dairy products for individuals lacking lactase. Breakdown of lactose in whey products for manufacturing polyactide.
Acetolactate decarboxylase	Reduction of maturation time in wine making by converting acetolactate to acetoin
Glucose oxidase	Conversion of glucose to gluconic acid to prevent Maillard reaction in products caused by high heat used in dehydration.
Lipase	Enhancing flavor development and shortening the time for cheese ripening. Production of specialty fats with improved qualities. Production of enzyme-modified cheese/butter from cheese curd or butterfat.
Papain	Used as meat tenderizer.
Chymosin	Curdling of milk by breaking down kappa-caseins in cheese making
Microbial proteases	Processing of raw plant and animal protein. Production of fish meals, meat extracts, texturized proteins, and meat extenders.
Pectinase	Treatment of fruit pulp to facilitate juice extraction and for clarification and filtration of fruit juice
Glucoamylase	Conversion of dextrins to glucose in the production of corn syrup. Conversion of residual dextrins to fermentable sugar in brewing for the production of "light" beer.
Beta-glucanase	Breakdown of glucans in malt and other materials to aid in filtration after mashing in brewing.

Alpha-amylase	Converts starch to dextrins in producing corn syrup. Solubilizes carbohydrates found in barley and other cereals used in brewing.
<b>Baking Industry</b>	
Alpha-amylases	Breakdown of starch, maltose production
Amyloglycosidases	Saccharification
Maltogen amylase	Delays process by which bread becomes stale
Pentosanase	Breakdown of pentosan, leading to reduced gluten production
Glucose oxidase	Stability of dough
Amyloglucosidase	Conversion of starch to sugar
Cellulases, beta-glucanases, alpha amylases, proteases, maltogenic amylases	For liquefaction, clarification and to supplement malt enzymes
<b>Cheese Production</b>	
Lipase/ esterase	Triglyceride (fat) Hydrolysis, Flavor enhancement in cheese products
Aminopeptidase	Releases free amino acids from N-terminus of proteins and peptides Releases free amino acids from N-terminus of proteins and peptides
Lactoperoxidase Cheese whey:	Oxidation of thiocyanate ion to bactericidal Hypothiocyanate Cold sterilization of milk
Chymosin (rennet)	Kappa casein hydrolysis Cheese making
Pepsin	Casein hydrolysis in cheese Help for rennet action
<b>Meat Industry</b>	
Papain	protein hydrolysis Meat tenderization
Bromelain Pineapple juice and stem	Muscle and connective tissue protein hydrolysis Meat tenderization
Ficin Fig fruit latex	Muscle and connective tissue protein hydrolysis As bromelain & papain but not widely used due to cost



INVERTASE (sucrase)	Enzyme digests sucrose into glucose and fructose Used to create candies with a soft center chocolate
<b>Other Industries</b>	
Pectinase	More Filtration and acquirement of Juices
Pectinase	Textile
Xylanase, Hemicellulase, lipase	Paper
Protease, Amylase, Lipase, Cellulase	Detergents Clothes and dishes Cleaning
Lactones	Food flavoring additives