Module 22

Hello students, I am Professor Sangeeta Sankhalkar from Parvatibai Chowgule College of Arts and Science Margao Goa I'm going to talk today on role of microorganisms in fermentation.

The outlines of my lecture, are Concept of microbial fermentation, Types of fermentation, Factors affecting fermentation, and examples of microbes in fermentation.

Learning outcomes: At the end of this module, students will able to describe fermentation process, Distinguish fermentation types, connect factors to fermentation process and list commonly used microbes types of fermentation.

Let us first see the general definition of fermentation and go to the types.

Generally, fermentation is defined as a metabolic process that produces a chemical change in organic substrates such as glucose through enzyme action. Now the various types could be lactic acid fermentation, where sugars are converted to lactic acid under the influence of bacteria or yeast species.

Ethanol or alcoholic fermentation: is a type of a fermentation where in sugars or carbohydrates are converted to carbon dioxide and alcohol.

Acetic acid fermentation, wherein the sugars are converted first to alcohol and then it is being oxidized by bacteria to acetic acid or also called as vinegar. This vinegar is a Sour substance,

Butyric acid fermentation: Where in sugars are converted to butyric acid under the influence of bacteria belonging to *Clostridium strain*. This is an obligatory anaerobic process.

Acetic acid fermentation: Is a fermentation either Aerobic process, and ethanol or alcohol fermentation is an anaerobic process.

Let us see what happens in alcoholic fermentation.

Alcoholic fermentation as I said, is a metabolic process which involves microorganisms creating desirable changes in the food and beverages. When we say desirable changes, we mean increasing or changing the flavour, preserving food stuff and providing health benefits.

Fermented foods are good and nutritious. They increase the immunity.They are pro biotic and they help in digestion of the foods, thereby having health benefits.

The general equation of fermentation is glucose is converted to carbon dioxide, giving ethanol with acetaldehyde as well and this is carried out in presence of decarboxylase and dehydrogenase enzymes.

This particular slide talks about the substrate and the intermediate compound that is formed in fermentation. That is, the pyruvic acid and various microorganisms that play a major role in giving us the desired product.

So what happens during the fermentation process?: Here Microbes, or yeast species act on either direct sugar or starch, giving primary fermentation product such as acid or a secondary fermentation product, alcohol. This again is influenced by the enzymes.

Secondary fermentation is a long term fermentation process which requires more time and given more time. Alcohol will be facilitated less at the time given in primary fermentation, where in acids will be produced.

So factors affecting fermentation.

Microbial source plays a major role in fermentation.

The slide, which I focused, talks about the different products that can be produced depending on the microbial source. So it is a very important factor substrate, whether we give direct sugar or sources of carbohydrates such as polysaccharide is important. If sugars are given directly, the fermentation will be faster, whereas if polysaccharides are given then, there should be an additional of more enzymes that will break the polysaccharides to simple sugars thereby giving the desired product like alcohol and carbon dioxide and Oxygen. Most of the microorganisms are anaerobic. So if oxygen concentration is maintained higher, then the fermentation is affected. That's why oxygen plays a very important role.

Temperature, microbes have a optimum temperature for the growth. They grow very well within a temperature range of 25 to 30 degrees celcius. If the temperatures are increased, then there is a tendency that the microbes will get killed, and so fermentation will not take place.

Similarly, if temperatures are lowered again, fermentation is affected. pH again is important because microbial activity prefers acidic pH. pH range which is lower 3 to 3.5 faster was the microbe growth and thus fermentation will be better and that's how direct influence.

So this is the slide which talks about various microbial species that are involved in fermentation

yeast species which are mainly used in manufacture of bread, beer, wine, distilled liquors,

bacterial species which are used in manufacture of vinegar, fermented milk products, etc.

Molds in preparation of cheese and oriental foods combination of both these yeast and bacteria can be used in other industrial products. Yeast species, which plays major role is *Saccharomyces crevice*

which is also called Bakers yeast. This is a common species which is used worldwide industrially. Bacterial species like *Lactobacillus acidophilus, Lactobacillus lactis ceromas* are important as far as curd is concerned. *Streptococcus thermophilus* involved in yogurt, same way *Lactobacillus bulgaricus* strain

can also be used for yogurt preparation. Probiotic foods, like yogurt is prepared by using *Lactobacillus casei* and *Propioni bacterium* strains are involved in Swiss cheese preparation.

Mold, specious penicillin, Cladosporium are some of these species.

Similarly, *Rhiziphus stolonifer*, these speeches are used in preparation of bakery products.

In summary fermentation is a metabolic process occurring anaerobically in presence of microorganisms.

The by products are alcohol and acids. Microbial species like yeast, bacteria, mold or combination of both play an important role in fermentation process.

These are some of the reference books you can follow for further reading.

Thank you very much.