Frequently asked questions

Q1.Define fermentation and elaborate its role in the preservation of foods?

Ans. Fermentation is derived from the Latin word “fervere” that means life without air. Fermentation can be defined as the metabolic process of deriving energy from organic compounds by the use of different microrganisms without the involvement of an exogenous oxidizing agent turning out the complex raw materials into simpler products.

Fermentation plays different roles in food processing. Some of the major roles are as under

(1)Preservation of food through formation of inhibitory metabolites such as organic acid (lactic acid, acetic acid, formic acid, propionic acid), ethanol, bacteriocins, etc., often in combination with decrease of water activity (by drying or use of salt)

(2) Improving food safety through inhibition of pathogens or removal of toxic compounds

(3) Improving the nutritional value

(4) Food fermentation also serves an important purpose, that is to enrich the diet through development of a diversity of flavors, aromas, and textures in food substrates and also enriches the food substrates with protein, essential amino acids, and vitamins and subsequently eliminates antinutrients thereby reducing cooking time and the associated use of fuel.

Q2.Describe the role of bacteria in the production of buttermilk, acidophilus milk and yoghurt?

Ans. The bacteria usually involved in the production of buttermilk are lactic acid starters. The lactic acid bacteria are inoculated in skimmed milk with a lactic or buttermilk starter culture resulting in the formation of curd like product called cultured buttermilk. Among the flavor-producing bacteria used in buttermilk cultures are L. lactis producing diacetyl and Leuconostoc mesenteroides subsp. cremoris or Leuc. lactis. Yoghurt is produced by a mixed culture of S. thermophilus and Lactobacillus bulgaricus chiefly responsible for the initial acid production. Acetaldehyde, the chief volatile flavor component of yogurt is produced by L. delbrueckii subsp. bulgaricus when grown in association with

S. salivarius subsp. Thermophilus. Acidophilus milk is chiefly produced by the inoculation lactic acid producing strain of L. Acidophilus into sterile skim milk.

Q3.Explain the role of various bacteria and molds in the production of cheese?

Ans. Cheese is mostly produced by a joint action of both bacteria and molds. The bacterial starter used for lactic acid production consist of a mixed culture of L. delbrueckii and S. salivarius along with a culture of Propionibacterium shermanii or P. freundenreichii that are added to function during the ripening process, flavor development and eye formation. B. alimentarium and B. tyrofermentans comprise beneficial components of the surface microbiota of various cheese. The molds are commonly employed for the ripening of cheese for eg Penicillium camemberti is used for all white-mold cheeses where P. caseifulvum grows naturally on the surface of blue mold cheeses and has a valuable aroma. Blue-mold cheeses are always fermented with Penicillium roqueforti. Another mold Verticillium lecanii strain has been listed as potentially useful for cheese ripening. In the production of camembert cheese spores of Penicillium camemberti are used.

Q4.Define idli and explain the role of various microorganisms in its production?

Ans. Idli is a south Indian fermented bread-type product. The commonly employed microorganisms in its production are L. mesenteroides which is the most abundant species and chiefly involved in lactic acid production followed by E. faecalis. The leavening action of idli is produced by L. mesenteroides. Other probable fermenters include L. delbrueckii subsp. delbrueckii, L. fermentum, and Bacillus spp.

Q5.What is the difference between sauerkraut and pickles?

Ans. Sauerkraut is a fermentation product of fresh cabbage prepared by the action of Leuconostoc mesenteroides, Lactobacillus plantarum, and Leuconostoc fallax as the most dominant lactics whereas pickles are fermentation products of fresh cucumbers and are generally produced by the action of L. mesenteroides,

E. faecalis, P. cerevisiae, L. brevis, and L. plantarum as the dominant species.

Q6.Which are the common microorganisms involved in the production of sour breads?

Ans. The commonly employed microorganisms in the manufacture of sour breads are both yeasts and bacteria. In the case of sour dough bread the yeast has been identified as Candida holmii and the responsible bacteria are Lactobacillus sanfranciscensis, L. fermentum, L. fructivorans, L. Brevis strains, and L. pontis. Among other organisms found in some sourdough fermentations are Candida humilis, Dekkera bruxellensis, Saccharomyces cerevisiae, and Saccharomyces uvarum.

Q7.Describe in brief the various microbes involved in the production of wine, beer and cider?

Ans. Wine is the fermented product of grapes produced by the employment of a suitable wine strain of S. ellipsoideus that results in the formation of malic and tartaric acids which are the two predominant organic acids in grape wine. Beer is a malt beverage produced by brewing. The species generally used for this purpose is L. Delbrueckii and the fermentation is carried out by the inoculation of S. cerevisiae. Cider is a product that represents a mild fermentation of apple juice by naturally occurring yeasts including six species of Acetobacter . Zymomonas a Gram negative bacteria that ferment glucose to ethanol is also involved in the production of ciders.

Q8. Which microorganism is called bakers yeast and why?

Ans. *Saccharomyces cerevasie* is called as the bakers yeast due to its utmost prevalence in the fermentation process of bread making. *S cerevasie* is chiefly responsible for the production of CO_2 that results in the leavening of the breads forming its sponge like structure.

Q9. Explain the role of yeasts in production of fermented food products?

Ans. Fungi can be added as fiber, vitamins and proteins to fermented foods, or be consumed as single cell protein (SCP). Aspergillus species for instance Aspergillus oryzae and A. sojae are used in the production of miso and soya sauce

fermentations. Aspergillus oryzae and A. niger are also used for production of sake and awamori liquors, respectively. Aspergillus acidus is used for fermenting Puerh tea. Rhizopus oligosporus is used in the fermentation process of Tempeh. Fusarium domesticum has been used for cheese fermentations (cheese smear). Fusarium solani a type of yeast was isolated from a Vacherin cheese, Fusarium venenatum is being used extensively for mycoprotein production now adays.

Q10. What is blue mold cheese and how is it produced?

Ans. Blue-mold cheese is a typical cheese prepared by the ripening action of blue mold Penicillium roqueforti. The production mechanism involves the inoculation of the curd with spores of Penicillium roqueforti during its preparation which effect ripening and impart the blue-veined appearance characteristic of this type of cheese.

Q11. Which microorganisms are commonly employed in the preparation of fermented meat ?

Ans. Fermented meat sausages are generally produced by curing followed by addition of seasonings and then fermentation by Lactobacillus with L.plantarum being the most commonly isolated species. L. brevis and L. buchneri increase during the six-day incubation period as a result of changes in pH and relative humidity. Other microorganisms involved in the fermentation process are Micrococcus represented by two species, M. luteus and M. lylae. Weissella ,Enterococcus faecalis and Halomonas elongata,

Q12. **What is kefir and name the microorganisms invoved in its preparation?**

Ans. kefir is a fermented milk product prepared by the use of kefir grains, which contain one or more bacterial species of the genera Acetobacter, Lactobacillus, Lactococcus, Leuconostoc and one or more yeast species of the genera Candida, Kluyveromyces, and Saccharomyces. These symbionts are held together by coagulated protein. The important Lactobacillus species in kefir are: L. kefiri, L. parakefiri, L. Kefiranofaciens subsp. Kefiranofaciens and L. kefirgranum. The last two are responsible for the production of kefiran (a water-soluble polysaccharide), an important component of kefir grains.

Q13.What are distilled spirits? How is it produced?

Ans. Distilled spirits are alcoholic products that result from the distillation of yeast fermentations of grain, grain products, molasses, or fruit or fruit products. In its production the fruit mash is generally soured by inoculating with a homolactic such as L. delbrueckii subsp. delbrueckii, which is capable of lowering the pH to around 3.8 in 6–10 hours and a suitable strain of S. cerevisiae for the production of ethanol. The fermentation process results in the sap becoming milky white in appearance due to the presence of large numbers of fermenting bacteria and yeasts. This product is unique in that the microorganisms are alive when the wine is consumed. The following genera of bacteria are the most predominant in finished products, Micrococcus, Leuconostoc, "Streptococcus," Lactobacillus, and Acetobacter. The predominant yeasts found were Saccharomyces and Candida spp., with the former being more common. The fermentation occurs over a 36- to 48-hour period. During the early phases of fermentation, Serratia and Enterobacter spp increase in numbers, followed by lactobacilli and leuconostocs.

Q14.Name a few microorganisms involved in the production of sauerkraut?

Sauerkraut is a fermentation product of fresh cabbage. The starter for sauerkraut production is usually the normal mixed biota of cabbage. Leuconostoc mesenteroides, Lactobacillus plantarum, and Leuconostoc fallax are the three most dominant lactics in sauerkraut production, with the two Leuconostoc species having the shorter generation time and the shorter life span. The final stages of sauerkraut production is mainly brought up by L. Plantarum and L. brevis. P. cerevisiae and E. faecalis also contribute to product development.

Q15.Name a few molds involved in the producton of fermented food products?

The mold species Penicillium solitum is found on naturally fermented lamb meat. On the other hand Penicillium algiovense and few strains of Penicillium chrysogenum are used especially for mold fermented salami. *Aspergillus* species, notably *Aspergillus oryzae*, and *A. sojae*, are used to fermentsoybean and wheat mixture to make soyabean paste and soy sauce. These molds break down the starch in rice, barley, sweet potatoes, etc., by a process called saccharification during the production of sake