Frequently Asked Questions:

1. **Define food spoilage?**

   Ans: Food spoilage means the original nutritional value, texture, flavour of the food are damaged, the food become harmful to people and unsuitable to eat.

2. **Explain the common causes of food spoilage?**

   Ans: Spoilage of food involves any change which renders food unacceptable for human consumption and may result from a variety of causes, which includes

   i) Insect damage;

   ii) Physical injury due to freezing, drying, burning, pressure, drying, radiation etc;

   iii) Activity of indigenous enzymes in plant and animal tissues;

   iv) Chemical changes not induced by microbial or naturally occurring enzymes.

3. **Explain the three types of microorganisms which are known to cause food spoilage.**

   Ans: There are three types of microorganisms that cause food spoilage -- yeasts, moulds and bacteria.

   - **Yeasts** growth causes fermentation which is the result of yeast metabolism. There are two types of yeasts *true* yeast and *false* yeast. *True yeast* metabolizes sugar producing alcohol and carbon dioxide gas. This is known as fermentation. *False yeast* grows as a dry film on a food surface, such as on pickle brine. False yeast occurs in foods that have a high sugar or high acid environment.

   - **Moulds** grow in filaments forming a tough mass which is visible as `mould growth'. Moulds form spores which, when dry, float through the air to find suitable conditions where they can start the growth cycle again. Mould can cause illness, especially if the person is allergic to molds. Usually though, the main symptoms from eating mouldy food will be nausea or vomiting from the bad taste and smell of the mouldy food.

     Both yeasts and moulds can thrive in high acid foods like fruit, tomatoes, jams, jellies and pickles. Both are easily destroyed by heat. Processing high acid foods at a

temperature of 100°C (212°F) in a boiling water canner for the appropriate length of time destroys yeasts and moulds.

Bacteria are round, rod or spiral shaped microorganisms. Bacteria may grow under a wide variety of conditions. There are many types of bacteria that cause spoilage. They can be divided into: *spore-forming* and *nonspore-forming*. Bacteria generally prefer low acid foods like vegetables and meat. In order to destroy bacteria spores in a relatively short period of time, low acid foods must be processed for the appropriate length of time at 116°C (240°F) in a pressure canner..

4. **Briefly discuss spoilage of fish.**

Ans: Fresh fish spoilage can be very rapid after it is caught. The spoilage process will start within 12 h of their catch in the high ambient temperatures of the tropics. Spoilage is the process through which fish loses its flexibility due to stiffening of fish mussels after few hour of its death. Most fish species degrade as a result of digestive enzymes and lipases, microbial spoilage from surface bacteria and oxidation. During fish spoilage, there is a breakdown of various components and the formation of new compounds. These new compounds are responsible for the changes in odour, flavor and texture of the fish meat.

5. **Explain the mechanism of fish off odors.**

Ans: Fish spoilage is a complex process in which physical, chemical and microbiological mechanisms are implicated. Some reports on the storage quality of frozen/chilled tilapia were still not comprehensive on spoilage mechanism and quality assessment. Degradation of lipids in fatty fish produces rancid odors. In addition, marine fish and some freshwater fish contain trimethylamine oxide that is degraded by several spoilage bacteria to trimethylamine (TMA), the compound responsible for fishy off odors. Iron is a limiting nutrient in fish, and this favors growth of bacteria such as pseudomonads that produce siderophores that bind iron.

6. **Which are the microorganisms involved in fish spoilage?**

Ans: Spoilage bacteria differ somewhat for freshwater and marine fish and for temperate and tropical water fish. Storage and processing conditions also affect microbial growth. *Pseudomonas* and *Shewanella* are the predominant species on chilled fresh fish under aerobic conditions. Packing under carbon dioxide and addition of low concentrations of sodium chloride favor growth of lactic acid bacteria and *Photobacterium phosphoreum*. Heavily wet-salted fish support growth of yeasts while dried and salted fish are spoiled by molds. Addition of organic acids selects for lactic acid bacteria and yeasts. Pasteurization kills vegetative bacteria but spores of *Clostridium* and *Bacillus* survive and may grow, particularly in unsalted fish. Spore-forming bacteria are usually associated with spoilage of heat-treated foods because their spores can survive high processing temperatures. These Gram-positive bacteria may be strict anaerobes or facultative.

7. **Which are the factors that influence the meat spoilage by microflora.**

Ans: There are a number of factors that influence the composition of the meat spoilage microflora:

- Pre-slaughter husbandry practices (e.g., free range vs. intensive rearing)
- Age of the animal at the time of slaughter
- Sanitary handling during slaughter, evisceration, and processing
- Temperature controls during slaughter, processing, and distribution
- Preservation controls
- Type of packaging
- Consumer handling and storage.

8. **Which are the frequent bacteria associated with meat spoilage.**

Ans: The most frequent bacteria to occur on fresh meat are bacteria of the genera *Acinetobacter, Pseudomonas, Brochothrix, Flavobacterium, Psychrobacter, Moraxella, Staphylococcus* and *Micrococcus*, lactic acid bacteria and various genera of the *Enterobacteriaceae* family. The survival and growth of these microbes is influenced, to a great extent, by the composition of the atmosphere surrounding the meat. Among these most frequently caused by the following groups of bacteria:

i) *Pseudomonas* spp.

ii) Enterobacteriaceae

iii) Brochothrix thermosphacta

iv) Lactic acid bacteria.

9. What is "Blown Pack Spoilage" (BPS)?

Ans: Spoilage of vacuum-packed beef may also be caused by psychrotrophic clostridia. This type of spoilage is known as "blown pack spoilage" (BPS), which emphasises the characteristic feature accompanying this kind of spoilage – a strongly inflated package Cases of spoilage of this kind have been registered in the USA, Canada, Brazil, New Zealand, South Africa, the United Kingdom and Ireland. The species *Clostridium* is considered the most frequent agent of this type of spoilage.

10. Give an account on meat spoilage by pseudomonades.

Ans : It is common knowledge that meat can be spoiled quickly under aerobic conditions (in the presence of an atmosphere comprised of air). This is caused by the rapid growth of pseudomonades. Psychrotrophic species such as *Pseudomonas fragi*, *P. lundensis, P. putida* and *P. fluorescens* can be isolated from unpacked meat showing signs of spoilage. *P. fluorescens* occurs more frequently on fresh meat, though during longer periods of storage *P. fragi* becomes dominant. Higher concentrations of CO_2 (10%) inhibit the growth of both *P. fluorescens* and *P. fragi* on red meat. *P. fragi* plays a significant role in meat spoilage; meat is even considered the ecological niche for this species. *P. fragi* represents the dominant species among the pseudomonades regardless of the packaging of the meat. All other species occur primarily on unpacked meat, i.e. under aerobic conditions.

A population of pseudomonades of $10^7 – 10^8$ CFU/g causes slime to form on meat and a bad smell to appear. Both these deviations appear, however, when pseudomonades exhaust the glucose and lactic acid in the meat and begin to metabolise nitrogenous compounds, particularly amino acids. When the diffusion gradient of glucose from lower layers of the meat towards the surface no longer serves to cover the needs of a large

number of bacteria, the degradation of amino acids and proteins begins, accompanied by the release of ammonia, amines and sulphides. The characteristic aroma of spoiling meat appears.

The proteolytic activity of pseudomonades assists their penetration into the meat. In such case, the capabilities of proteolytic bacteria enable them to gain a competitive advantage over other bacterial groups or species, as they are able to gain access to new sources of nutrients that are not available in this way to microbes with weaker or no proteolytic properties..

11. Briefly discuss spoilage of poultry?

Ans: The consumption of poultry and poultry products has increased markedly during the past decade. Poultry is the second most widely eaten type of meat globally and, along with eggs, provides nutritionally beneficial food containing high-quality protein accompanied by a low proportion of fat. All poultry meat should be properly handled and sufficiently cooked in order to reduce the risk of food poisoning. Growing demand in poultry consumption has led to the evolution of intensive broiler flock production and mechanized slaughter practices, which influence the microbiology of the raw products.

Each step in the processing of raw poultry influences the level of spoilage microflora on the product. In general, whole poultry carcasses have lower microbial populations than cut-up poultry. Poultry carcasses receive several washing steps during the slaughter process.

12. Which are the frequent bacteria associated with poultry spoilage?

Ans: More than 50 strains of spoilage bacteria representing 25 genera have been reported as part of the initial microflora in raw chicken. At refrigerated temperatures, pseudomonads represent the largest genus represented. Cell numbers of nonpigmented pseudomonads increase substantially during spoilage, and storage conditions greatly influence the cell numbers of pigmented pseudomonads. Modified atmospheric storage dramatically changes the predominant spoilage microflora compared to aerobic storage,

as it prevents the growth of obligately aerobic microorganisms. Psychrotrophic spoilage microorganisms isolated from chicken carcasses are Pseudomonads, *Acinetobacter* spp., *Flavobacterium* spp., *Corynebacterium,* Yeasts, enterics, and others.

13. Which are the fungal members known to cause poultry spoilage?

Ans : Fungi typically play a minor role in poultry spoilage. However, when antibiotics are used to control bacterial growth, fungi can become major causes of spoilage. The principal spoilage yeasts found on raw poultry are *Candida* spp., *Rhodotorula* spp., and *Torulopsis* spp.

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14. Explain the rate of microbial spoilage of broiler carcasses during storage conditions.

Ans: The rate of microbial spoilage of broiler carcasses is twice as fast at 10°C than at 5°C, and three times more rapid at 15°C. The shelf life of cut-up poultry is 2–3 days at 10°C, 6–8 days at 4.4°C, and 15–18 days at 0°C, respectively.

15. Write an account on spoilage of egg by microorganisms.

Ans: Chicken eggs are the eggs most commonly consumed by humans. Between 2000 - 2010, global egg output expanded by more than two per cent a year from 51 million tonnes to 63.8 million tonnes. This subunit will discuss the types of microbial spoilage that may occur in a variety of different egg products – shell eggs, liquid eggs, and processed eggs (cooked, frozen, dried, and baked). The microbes primarily responsible for the spoilage of shell eggs and liquid eggs are typically Gram-negative microorganisms.

A shell egg at the time of oviposition should be essentially free from microbial contamination. However, this condition is quickly changed once the exterior of the egg comes in contact with the nesting material where the egg is deposited. Dust, soil, and feces are the primary sources of contaminating microorganisms. The relatively few Gram-negative microorganisms are primarily responsible for egg spoilage. The types of spoilage or rots are sometimes characterized by the color of the spoiled eggs. For

example, black rots are associated with the presence of species of *Proteus* and *Aerobacter*. *Serratia* species are associated with red rot and certain species of *Psuedomonas* with green and pink rots.

Liquid whole eggs are typically sold as blends of egg whites and yolks. The microbes responsible for the spoilage of unpasteurized liquid eggs were identified in a detailed evaluation of the spoilage microflora of unpasteurized liquid whole eggs. Gram-negative bacteria were dominant at all temperatures evaluated. Genera of the *Enterobacteriaceae* were predominant in the temperature range of 20–30◦C, whereas the *Pseudomonadaceae* predominated at 5◦C. Very few Gram-positive bacteria were isolated. Liquid whole egg samples were incubated at 5, 10, 20, 25, and 30◦C until signs of spoilage became apparent. From these samples, the following bacteria were isolated and identified: *Acinetobacter sps, Aeromonas hydrophila, Bacillus cereus, Citrobacter sps, Enterobacter aerogenes, Escherichia coli, Klebsiella pneumoniae, Proteus vulgaris, Serratia sps, Pseudomonas putida, Salmonella typhimurium, Streptococcus faecalis and S. lactis.*