



SNS COLLEGE OF TECHNOLOGY

COIMBATORE-35



DEPARTMENT OF FOOD TECHNOLOGY

Unit 1: FOOD SAFETY

Topic 1: Food spoilage and food borne infection hazards-sources of food spoilage

Food spoilage & source

In food, several kinds of chemical changes occur once the food is harvested. Some changes may be considered desirable such as meat tenderizing whereas other such as putrefaction render food unfit for consumption. The major classes of food change include –

1. Enzymatic processes – the flesh of the animal undergoes proteolysis by its own enzymes following its death but plants after harvest undergo other type of change. E.g. in harvested corn the sugar rapidly converts to starch.

2. Chemical reactions with the environments – the most common abiotic chemical reactions involve oxidation by air. E.g. lipid autoxidation generates rancid odours.

3. Microbiological processes – microbes when contaminated the food generate a wider range of chemical products. Food spoilage refers to the microbial changes that render a product unfit or unpalatable for consumption. Most foodstuffs serve as good media for the growth of many different microorganisms. Once the microorganism grows, they will produce changes in appearance, flavour, odour and other qualities of food. The degradation process may be –

1. Putrefaction:

Protein foods + proteolytic microbes \longrightarrow amino acids + amines + ammonia + hydrogen sulphide

2. Fermentation:

Carbohydrate foods + carbohydrate fermenting microbes \longrightarrow acids + alcohol + gases

3. Rancidity:

Fatty foods + lipolytic microbes \longrightarrow fatty acids + glycerol

Different foodstuffs spoil in different ways depending on their nutrient content, microbial species and environmental factors such as temperature.

Dairy products – although milk by fermentation lead to the production of yogurt, cheese etc, however under certain conditions, bitter off flavours are produced because of the bacterial degradation of proteins. Protein degradation is commonly caused by the psychrophilic organisms (organisms that can grow at cold temperature) while cheese are less susceptible than milk to spoilage because of their solid structure and lower water activity.



Fig: milk and milk products

Meat and poultry— meat is easily contaminated with bacteria in the slaughterhouse from their hides, hooves and intestinal contents. Also, muscle tissue has high water content as well as rich nutrients including glycogen, peptides and amino acids which supports the microbial growth. Therefore, the breakdown of these peptides and amino acids produces the undesirable odorants which is an indication of spoilage. Meat also contains fats but the lipids are largely unavailable to microbial action because they consist of insoluble fats. Meat's lipids are commonly spoiled abiotically by autoxidation of unsaturated fatty acids independent of microbial activity.



Fig: meat and poultry

Seafoods – fish spoils more rapidly than meat and poultry. This is because fish do not thermoregulate and they inhabit relatively low temperature environments and also since they grow in low temperature environments, their surface microorganism tends to be more psychrotrophic and thus grow well under refrigeration. In addition, marine fish contain high level of osmoprotectant trimethylamine oxide in which bacteria reduce it to trimethylamine. Trimethylamine is a volatile amine responsible for the fishy smell of seafoods. Finally, the rapid microbial breakdown of proteins and amino acids leads to foul smelling amines and sulphur compounds such as hydrogen sulphide and dimethylsulphide.

Plant foods – fruits, vegetables and grains spoil differently than animal food because of their high carbohydrate content and their relatively low water content. And hence because of the low water content of the plant foods, they have considerably longer shelf life than the

animal based foods. Further, carbohydrates favour microbial fermentation to acids or alcohols that limit further decomposition and this microbial action can be managed to produce fermented foods.



Fig: fruits, vegetables and grains

Microbial flora of fresh foods

The inner tissues of healthy plants and animals are free of microorganisms. However the surfaces of raw vegetables and meats are contaminated by a number of microbes. Hence it is desirable to maintain a very low microbial level of contamination on raw foods.

Meats—among the most common bacteria occurring on fresh meats are the pseudomonas, staphylococci, micrococci, enterococci and the coliforms.

Poultry – freshly dressed poultry have a bacterial flora on their surface that originates from the bacteria normally present on the live birds and that are contaminated during killing, defeathering etc. Under good sanitary conditions the bacterial count has been reported to be from 100-1000 bacteria per square centimetre of skin surface.

Fruits and vegetables— fruits and vegetables are normally susceptible to infection by bacteria, fungi and viruses. In fruits since their pH is acidic ranging from 2.3 for lemons to 5.0 for bananas, it restricts the bacterial growth but does not retard the fungal growth. In case of vegetables since their pH is slightly higher ranging from 5.0-7.0, they are more susceptible than fruits to attack by bacteria.

Food Infections:

Campylobacter jejuni—Foodborne Infection Found

Widely distributed in nature; can be isolated from meats, milk, vegetables, and fish. Transmission

Bacteria produce a toxin that causes illness. Vomiting-type outbreaks have usually been associated with rice products and other starchy foods such as potatoes, pasta, and cheese products. Sauces, puddings, soups, casseroles, pastries, and salads have also been implicated in outbreaks.

Symptoms

Food poisoning is characterized by nausea and vomiting 0.5 to six hours after the ingestion of a contaminated food product. In more severe cases, abdominal cramps and diarrhea might occur with symptoms lasting up to 24 hours.

Campylobacter jejuni – Foodborne Infection Found

Intestinal tracts of animals, birds, raw milk, untreated water, and sewage sludge. Transmission

Contaminated water, raw milk, and raw or undercooked meat, poultry, or shellfish. Symptoms

Fever, headache, and muscle pain followed by diarrhea (sometimes bloody), abdominal pain, and nausea that appear two to five days after eating; may last seven to 10 days.

Escherichia coli 0157:H7 – Foodborne Infection

Found

Intestinal tracts of some mammals, raw milk, unchlorinated water; one of several strains of *E. coli* that can cause human illness.

Transmission

Contaminated water, raw milk, raw or rare ground beef, unpasteurized apple juice or cider, uncooked fruits and vegetables, person-to-person.

Symptoms

Diarrhea or bloody diarrhea, abdominal cramps, nausea, and malaise; can begin two to five days after food is eaten, lasting about eight days. Some, especially the very young, have developed Hemolytic Uremic

Syndrome (HUS) that causes acute kidney failure. A similar illness, thrombotic thrombocytopenic purpura (TTP), may occur in older adults.

Hepatitis A virus – Foodborne Infection Found

Hepatitis A is widely distributed throughout the world, occurring in both epidemic and sporadic cases.

Hepatitis A is primarily transmitted person to person by the fecal-oral route, but common source transmission does occur. Transmission

Hepatitis A virus is excreted in feces of infected people and can produce clinical disease when a susceptible individual consumes contaminated water or foods. Cold cuts and sandwiches, fruits, fruit

juices, milk and milk products, vegetables, salads, shellfish, and iced drinks all can be considered vehicles for the transmission of Hepatitis A.

Symptoms

Hepatitis A is usually a mild illness characterized by sudden onset of fever, malaise, nausea, anorexia, and abdominal discomfort, followed by several days of jaundice.

Listeria monocytogenes – Foodborne Infection

Found

Some studies suggest that 1% to 10% of humans may be intestinal carriers of *Listeria Monocytogenes*. It has been found in at least 37 mammalian species, both domestic and feral, as well as at least 17 species of birds and possibly some species of fish and shellfish. It can be isolated from soil, silage, and other environmental sources

Transmission

Raw milks, pasteurized fluid milk, cheeses, ice cream, raw vegetables, fermented raw-meat sausages, raw and cooked poultry, raw meats, and raw and smoked fish.

Symptoms

Some studies suggest that 1% to 10% of humans may be intestinal carriers of *Listeria monocytogenes*. It has been found in at least 37 mammalian species, both domestic and feral, as well as at least 17 species of birds, and possibly some species of fish and shellfish. It can be isolated from soil, silage, and other environmental sources.