IIT KHARAGPUR

NPTEL ONLINE CERTIFICATION COURSES

Dairy and Food Process and Products Technology

PROF. TRIDIB KUMAR GOSWAMI
AGRICULTURAL AND FOOD ENGINEERING DEPARTMENT
IIT KHARAGPUR

Lec 01

Week 1	:	**Basic principles and methods of food processing and preservation. EmergingTechnologies in food processing. Food additives and preservatives.**
Week 2	:	Food laws and standards. Effect of processing on acceptability and nutritive value offood.
Week 3	:	Physico-chemical properties and structure of milk and milk constituents.
Week 4	:	Chemical and microbial spoilage of milk and milk products; Fluid milk Processing, packaging and distribution.
Week 5	:	Common dairy processes – cream separation (standardization), pasteurization, sterilization and Homogenization.
Week 6	:	Process technology for manufacture of evaporated milk, condensedmilk, dried milk, malted milk, infant and baby foods, ice-cream, cheese, butter,fermented milk and indigenous dairy products.

Week 7	**:**	**Methods and procedures forsampling and testing of milk and milk products. Laws and standards for milk andmilk products.**
Week 8	:	Technological processes for industrially manufactured foods of commercial importance, from plant and animal origin.
Week 9	:	Cereals, vegetables,fruits, meats, poultry and egg products; Bakery, pasta and confectionary products, ready to eat foods, fermented foods, alcoholic and non- alcoholicBeverages, tea, coffee and cocoa, fabricated foods.
Week 10	:	Packaging materials; Characteristics, properties and their design. Packaging requirement for Different processed and unprocessed foods.
Week 11	:	Working Principles of various typeof fillers : form-fill-seal machine.
Week 12	:	Gas packaging and modified atmosphere Package design. Shelf life prediction of foods in packages. Quality control inFood packaging. Product safety and packaging regulations.

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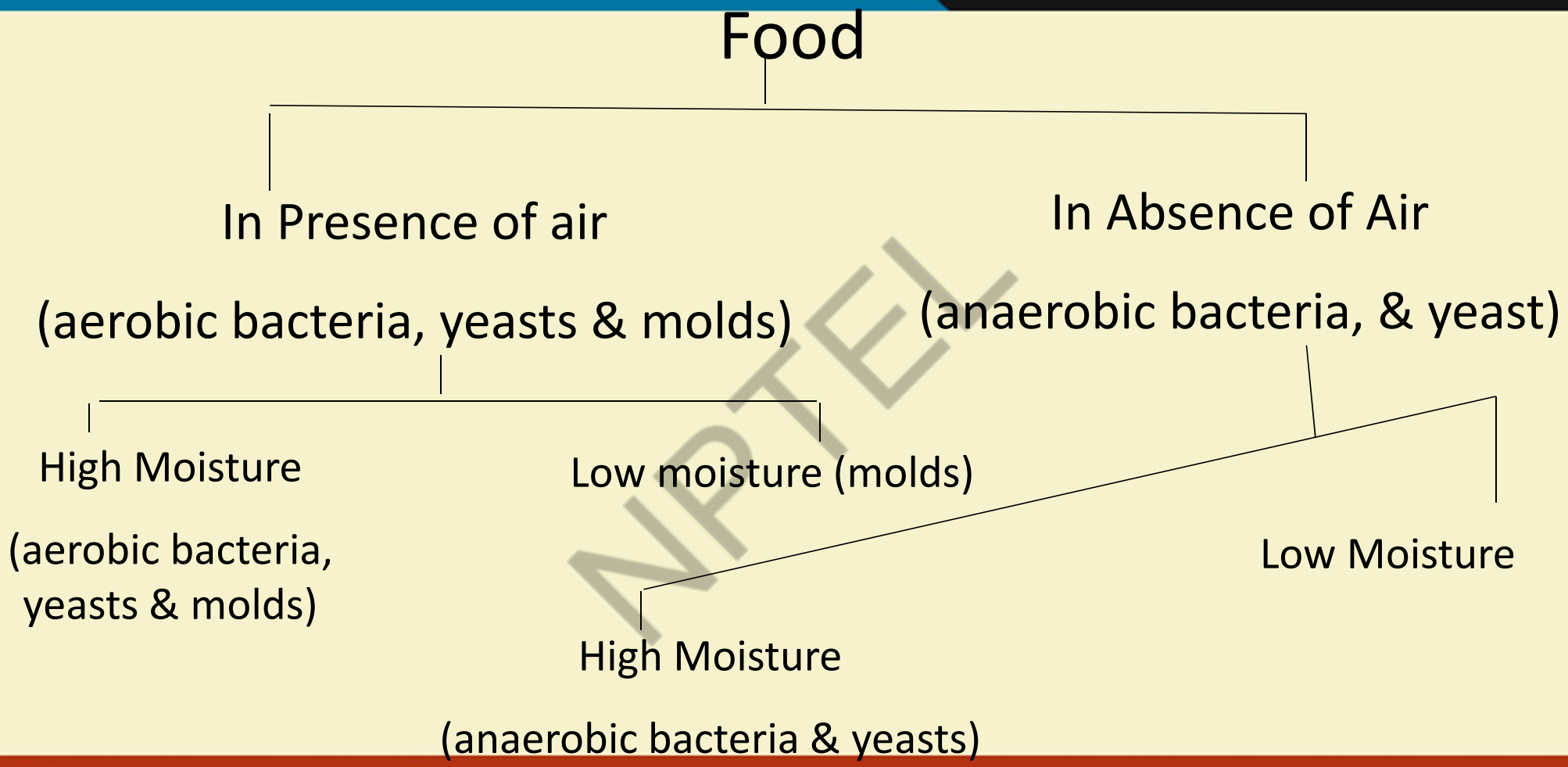
Food
In Presence of air
(aerobic bacteria, yeasts & molds)
In Absence of Air
(anaerobic bacteria, & yeast)
High Moisture
(aerobic bacteria, yeasts & molds)
Low moisture (molds)
Low Moisture
High Moisture
(anaerobic bacteria & yeasts)

References:

1. The Technology of Food Preservation – N.W. Desrosier and J.N. Desrosier.
2. Elements of Food Technology – N.W. Desrosier.
3. Food Processing and Preservation – B. Shivashankar.
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Lecture 02

Basic principles and methods of food processing and preservation

- ***Food, What it is*?**

  One of the three basic requirements of mankind. It is also regarded as a source of power.

- ***What it does*?**

  It is the source of nutrients and provides the energy required for all activities, e.g., Growth, Repair of the damaged tissues, Reproduction and sustenance.

- ***Its availability*:**

  It is related directly to the production and to the strength of population. It is not equitable everywhere. Undernourished people and people with Exotic food.

- ***Nutrients*:**

  Six types, e.g., Carbohydrates, Fats, Proteins, Minerals, Vitamins and Water.

Nutrient contents in some different foods:

Food (100 g)	Water (g)	Carbohydrate (g)	Fat (g)	Protein (g)	Vitamin & Mineral (g)
Milk	87-88	4.5-4.9	3.3-3.8	3.5	0.1
Bread	40	50	2	1	1

Food

Plant Origin

- Cereals (Rice, Wheat, Corn)
- Legumes (Soyabean)
- Nuts (High Fat- Cashew Nut
  High Protein – Almonds
  High Carb. – Chest Nuts)
- Roots & Tubers (Carrots, Beets, Radishes, Potatoes)
- Vegetables (Cabbage, Onion, Caulifaower)
- Friuts (Banana, Orange, Apple)

Animal Origin

- Meat (Beef, pork, lamb)
- Fish (Fatty, Lean, crustaceans)
- Poultry (Chicken, duck, turkey)

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Lecture 3

Energy available from Nutrients & Some Foods

From nutrients in (kcal/g):

- Carbohydrate: 4
- Fat: 9
- Protein: 4

Energy available from 100 g of some foods:

- Milk: 65; Bread: 230; Butter: 740; Egg:150

Objectives of Food Scientists & Technologists:

- To make available nutritious food at cheap rate
- To improve nutritive value and to minimize losses during processing
- To ensure storage stability at even normal temperature
- To prevent food poisoning or contamination
- To cater special dietary requirements
- To develop new varieties of instant or convenience foods

Perishable foods:

- These deteriorates quickly after harvest (e.g., fruits and vegetables) or soon after slaughter / catch (fresh meat, poultry, and fish).

Semi perishable foods:

- These contains natural inhibitors to spoilage (e.g., egg and root vegetables) or have received some type of mild preservation treatment which creates greater tolerances to the environmental conditions and abuses during handling and distribution (e.g., pasteurization, smoking or pickling).

Shelf stable foods:

- These are non perishable at room temperature (e.g., cereals, grains, and nuts); or received preservation treatment (e.g., canning) or processed to reduce moisture content (e.g. drying).

Dry storage:

- Storage at 20 ^{o}C and 50 % R.H.

Cool storage:

- Storage below 12 ^{o}C.

Refrigerated storage:

- Storage betn 0 to 8 ^{o}C.

Freezer storage:

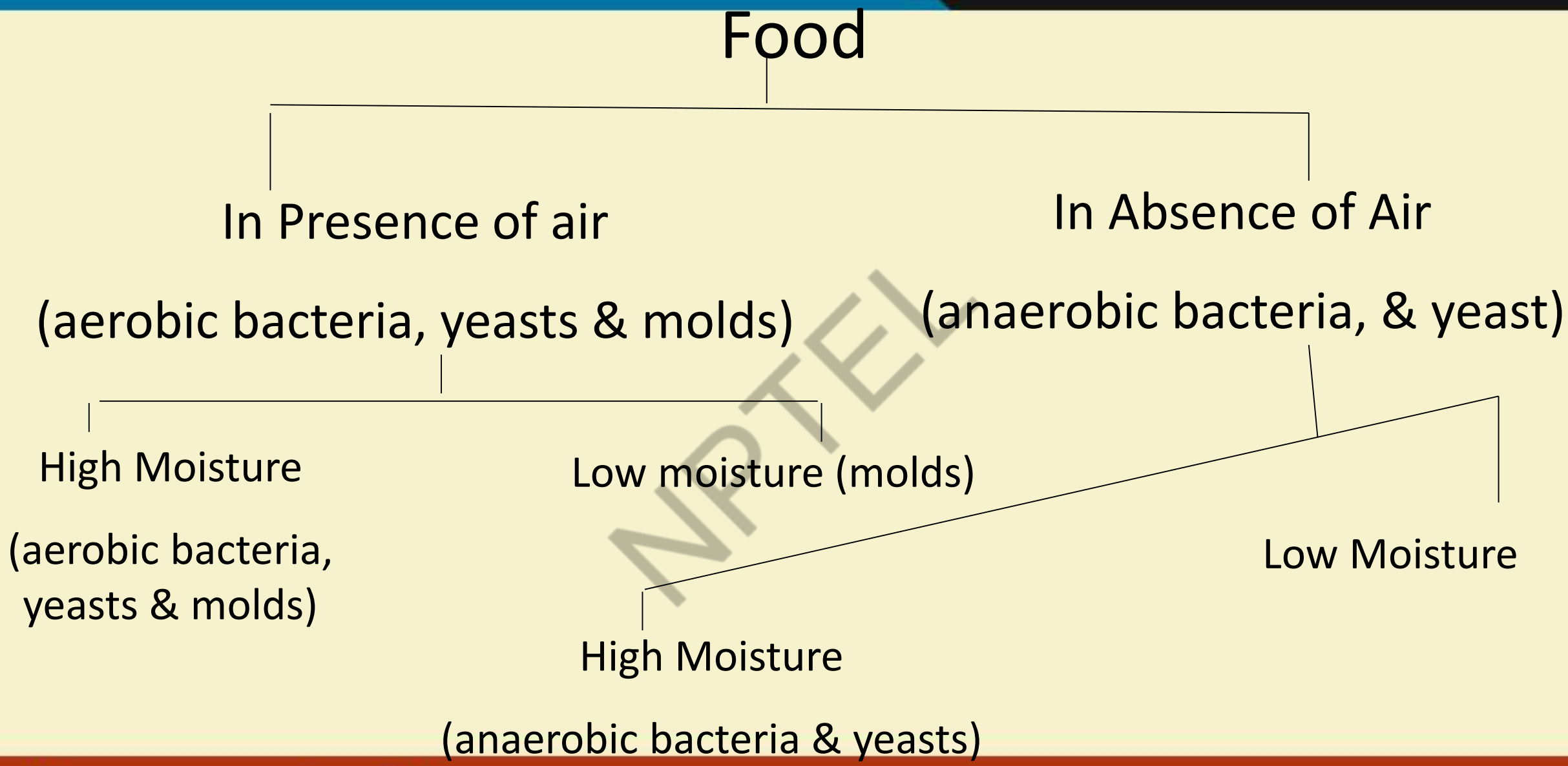
- Storage betn 0 to –23 ^{o}C.

Shelf life:

- Time duration bet^{n} processing and consumption.

Light protected:

- Kept in dark or protected from visible light or wrapped with aluminum foil that prevents light reactions.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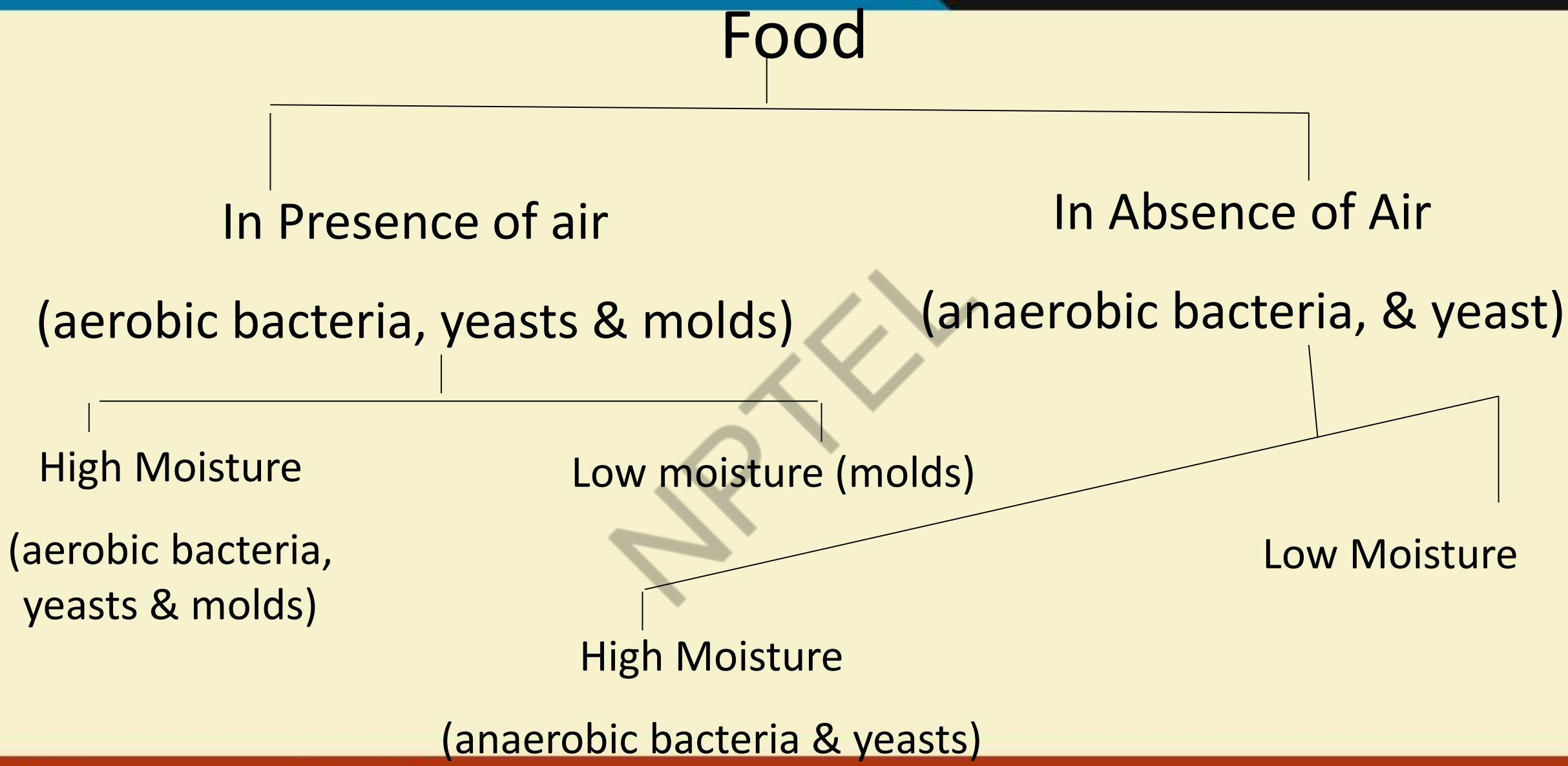
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Lecture 5

Preservation Techniques:

- Application of Heat, Removal of cold, dehydration, Physical methods other than thermal, Biological controls, Fermentation, chemical preservation, Irradiation, Emerging technologies.
- **APPL. OF HEAT**: Cooking, frying, boiling, or simply heating prior to consumption. Commercial processes are blanching, pasteurization, sterilization, dehydration.
- BLANCHING: Temperature: 75-95 ^{0}C, Time:1-10 min.

- Use of blanching: prior to drying , canning, freezing, delay in reaching enzyme inactivating temperatures.
- Restricts undesirable changes in odour, flavour, colour, texture and nutritive value during storage by freezing. Removes intracellular gases. Minimizes potential for oxidative changes, reduces microbial load. Leaches toxic constituents such as nitrates (methaemoglobinemia in infants (supply of oxygen to tissues)), removes pesticides.

- To increase the stability of chlorophyll, Na_2CO_3 and CaO can be added during 3 min. blanching at 90 ^oC.
- To prevent discolouration , Sodium pyrophosphate can be added during blanching of potatoes and cauliflower.

Method: Achieved using hot water, steam, microwave and electroconduction.

Disadvantage : loss of nutrient -30 to 40% vitamins and minerals, 20% protein. commonly measured nutrient – ascorbic acid.

Efficiency: Measured through peroxidase activity.

Pasteurization : Application of heat below 100 °C .

Method: Hot water, steam, dry heat or electric currents and cooled promptly.

Low temperature long time (LTLT): 63 °C for 30 min.

High temperature long time (HTST): 72 °C for 15 sec. Cooled to 10 °C immediately.

In at least one instance blanching prior to canning is used to activate an enzyme. With some green beans, the epidermis is loosened upon heating and their results in a quality defect known as ‘sloughing.’ A moderate heat treatment (less than 61 ^{o}C) followed by a holding period prior to thermal processing can prevent sloughing through heat inactivation of an enzyme, pectin methylesterase, which demethylates the pectin molecule allowing crosslinking with calcium ions. This crosslinking bonds the outer layer of tissue to the underlying structure, thus preventing sloughing.

Activity of two enzymes, peroxidase and catalase can be used to evaluate the effectiveness of a blanching treatment. If both are inactivated then it can be assumed that other significant enzymes also are inactivated. The heating time necessary to destroy catalase or peroxidase depends on the type and the size of the fruit or vegetable, the method of heating, and the temperature of the heating medium. Although blanching of vegetables is most often done in hot water or steam, blanching of fruits is often done in calcium brines to firm the fruit through the formation of calcium pectates.

Thank You!!