6. Week: METHODS OF FOOD PRESERVATION

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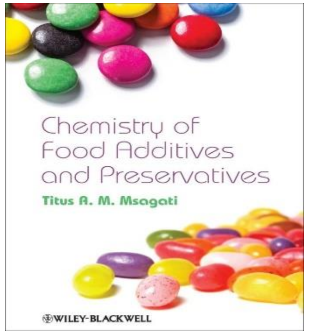

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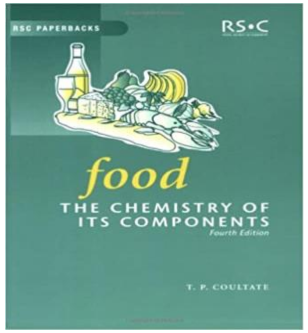

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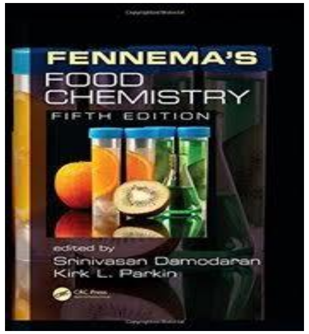

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METHODS OF FOOD PRESERVATION

* The idea of food preservation arises from the desire to preserve food quality, its physicochemical properties and the functionality of its nutrient components, without affecting the quality of the product.

* There are many traditional or modern methods and techniques that use natural or artificial preservatives to protect food.

TRADITIONAL FOOD PRESERVATION METHODS

There are numerous techniques which have been employed for food preservation for both short and long periods of time.

* Wood smoke
* Salting
* Canning
* Drying
* Chilling and freezing
* Pickling
* Addition of sugars

1. Wood smoke

Wood smoke has been used traditionally for preservation of food items such as meat. The smoke contains a number of antimicrobial compounds such as phenols, syringol and guaiacol and their derivatives as well as carbonyls, catechol as well as naphthalene derivatives. Wood smoke is also used in the food industry as a flavouring agent.

2. Salting

In the same way as wood smoke, salt has been used as a preserver for longer than can be remembered. Most of microbes live within a watery environment; since the inside of a microbial cell is composed of cytoplasm (with relatively less water content than outside), this will encourage water movement from outside to the inside of the cell. If the outside environment becomes salty, this will change the water balance between the outside and the inside of the microbial cell such that the amount of water in the environment where the microbes are is less than inside the microbial cell; water will therefore move out of the cell (cytoplasm), causing dehydration of the cell, and the microbial cells will then stop growing and die. In this way, salt serves as a food preservative. Examples of salts that are used as preservatives include NaCl, $NaNO_3$ and$NaNO_2$.

3. Canning

Canning involves putting foodstuffs in cans, sealing them and then applying heat to temperatures which can kill most pathogens. The sealing will keep the food safe from any further microbial attack.

4. Drying

Drying dehydrates food in the sense that it eliminates water/moisture from foods, excluding the important condition which encourages microbial growth which causes food spoilage.

5. Chilling and freezing

Temperature is one of the important factors which affect the ability of microbes to grow and multiply. Freezing or chilling slows down both the metabolic and enzymatic activities for the microbes, thus discouraging their growth and multiplication.

6. Pickling

The acidity/alkalinity environment may have a large affect on microbial growth. Lowering of the pH environment where food is kept may discourage the multiplication of microbial cells, since this also suppresses the metabolic and enzymatic activity of the microbial pathogens.

7. Addition of sugars

Sugar tends to draw water from the microbes (plasmolysis). This process leaves the microbial cells dehydrated, thus killing them. In this way, the food will remain safe from microbial spoilage.

MODERN FOOD PRESERVATION TECHNIQUES

New preservation technologies for food products include:

* **non-thermal inactivation technologies**
  - *high hydrostatic pressure* (HHP)
  - *pulsed electric fields* (PEF)
* **modern food packaging technologies**
  - *modified atmosphere packaging* (MAP)
  - *active packaging*
* **biological food preservation technology**
* **using bacteriocinogenic cultures for food preservation**
* **food irridation**

1. Non-thermal inactivation

Non-thermal inactivation techniques have been promoted as being associated with food attributes such as food nutritive integrity and an acceptable shelf life.

- ***High hydrostatic pressure (HHP)***

This technique involves exposing food products to pressures of above 100 MPa which has an inactivation effect on microbes, thus extending microbial shelf life as well as improving the microbial safety of food products.

- ***Pulsed electric fields (PEF)***

Pulsed electric field is a non-thermal inactivation technology which is based on a pulsing power applied to the food product sandwiched between a set of electrodes, causing severe disruption of microbial cells.

2. Modern food packaging technologies :

Modified atmosphere packaging (MAP)

MAP refers to the packaging/enclosure of food products in gas-barrier materials, in which the gaseous environment has been modified. Despite the fact that this technology has contributed to the extension of the shelf life of many food products, the most effective limit for the gas atmosphere for a particular food product in a particular packaging system or design are not yet well established.

3. Biological food preservation technology

This technology makes use of lactic acid bacteria (LAB) and their antibacterial products such as lactic acid, bacteriocins and others to extend the storage life as well as improve the safety of food products. This technology introduces LAB as antagonistic cultures to inhibit microbes and also to prolong the shelf life of food products as the sensory properties of that particular foodstuff are only slightly modified .

4. Bacteriocinogenic cultures for food preservation

Bactericin are compounds which can be used to kill bacterial cells of other closely related bacterial species (bactericidal) or inhibit their growth (bacteriostatic). The mode of action of these bactericidal compounds involves rupturing the cell membrane of the microbe, thus destroying the lipid bilayer structure and forcing some cytoplasmic contents out. Examples of bacteriocins include nisin, pediocin and sakacins.

5. Food irradiation

Food irradiation is the use of ionising radiation to reduce or eliminate the microbial burden of foodstuffs.

A number of different levels of irradiation treatment can be used to achieve different process objectives.Sources of ionizing radiation that have been used include gamma rays, electron beams and X-rays.

- ***Gamma irradiation***

Gamma irradiation is produced from the radioisotopes cobalt-60 and caesium-137, which are derived by neutron bombardment of cobalt-59 and as a nuclear source by-product, respectively. Gamma irradiation is widely used due to its high penetration depth and dose uniformity, allowing for large-scale applications with high through puts. Additionally, gamma irradiation is significantly less expensive than using an X-ray source.

- ***Electron beams***

Treatment of electron beams is created as a result of high energy electrons in an accelerator that generates electrons accelerated to 99% the speed of light. This system uses electrical energy and can be powered on and off. The dose applied to a product is the most important factor of the process. At high doses, food is essentially sterilized, just as occurs in canning. Products so treated can be stored at room temperature almost indefinitely.

- ***X-ray***

X-rays are produced by bombardment of dense target material with high energy accelerated electrons, giving rise to a continuous energy spectrum. Heavy metals, such as tantalum and tungsten, are used because of their high atomic numbers and high melting temperatures. Tantalum is usually preferred versus tungsten for industrial, large-area, high-power targets because it is more workable than tungsten and has a higher threshold energy for induced reactions. Like electron beams, X-rays do not require the use of radioactive materials and can be turned off when not in use. X-rays have high penetration depths and high dose uniformity but they are a very expensive source of irradiation as only 8% of the incident energy is converted into X-rays.

Irradiated food does not become radioactive.

The safety of irradiation facilities is regulated by the United Nations International Atomic Energy Agency and monitored by the different national Nuclear Regulatory Commissions. The regulators enforce a safety culture that mandates that all incidents that occur are documented and thoroughly analyzed to determine the cause and improvement potential. Such incidents are studied by personnel at multiple facilities, and improvements are mandated to retrofit existing facilities and future design.

The international **'RADURA'** logo, used to show a food has been treated with ionizing radiation.