Preservation 5

CANNING (THERMAL PROCESSING OR THERMAL PRESERVATION)

- Canning was first done by the French Biochemist, Nicholas Appert, in 1809 discovered the method of hermetically (without any hole) sealing glass jars filled with various foods, after heating it in a water bath, to overcome the problem of preservation of meat in the armed forces,.
- In most canning process, the effect of heating on spoilage organisms is to destroy them and the permanent sealing of the container preventing the re-infection of the food by further organisms.

CANS - TYPES OF CANS

- The actual amount of tin being only about 1.5 % of can's weight. It is important that the tin used should not contain more than 1% of lead.
- Although, the term 'can' is applied to modern containers, this is somewhat of a misnomer, as they are constructed of mild steel with a thin coating of pure tin.
- Coating of steel plate is necessary to prevent corrosion for steel is an unstable compound and in some foodstuffs, such as fish or fruit. The tin plate is protected by a fish or fruit lacquers.

Can types

Three Piece Food Can

- Such individual strips are then rolled into cylinders and the two edges of the cylinder drawn with an overlap, which is electrically welded.
- Seperate ends (lids and bases) are made in a different area and the rims of these ends are curled and a sealing compund is injected into the curl.
- The base is next joined to the cylinder body, the sealing compound forming an airtight seal. The cans, with the seperate lids are ready for use.

Two Piece Drawn and Wall Ironed Can

- These cans consists of two pieces of tinplate, the body and base being formed from one piece of metal and the lid from another. The body and base are shaped from a thick piece of tinplate which is drawn up, ironed and ridged for strength and then given a coat of lacquer.

Drawn and Redrawn Can

- Drawn and redrawn cans are manufactured from two pieces of tinplate , the body being made from a disc shaped piece lacquered on both sides and drawn up to form a shallow cup and then drawn and redrawn to form a deep cup.

OUTLINE OF CANNING OPERATION

Preparation of the raw material (meat)

- The long-term storage of meat intended for canning should be preserved under a temperature of –12°C to –18°C and thawed before cooking.

Precooking / Blanching

- Products like meat is precooked whereas, vegetables and fruits are scalded or blanched in hot water at a temperature of 87°C to 95°C or exposed to steam. Precooking leads to -
  - Remove the respiratory gases, which would reduce vacuum in the can.
  - Inhibit the enzymatic action and Cause shrinkage of the product.

Filling of cans

- Filling of cans is the critical part of the canning operation, which can be done mechanically or by hand, which should be done carefully. By Hand filling or Mechanical filling (Machines)

Exhausting

- The exhaustion is done by removal of air from the can before it is sealed.
- Can sealed without previous exhausting may show such expansion of the contents during possessing as to force the seams and produce a ‘Leaker’

    Heat exhausting

    Vacuumizing or Mechanical Exhaust

    Steam Injection

Sealing or seaming of the container (closure)

- The sealing is achieved by curling the edge of the lid over the can. The sealing material often a synthetic rubber compound must retain its resilience over a temperature range from below room temperature to above 130°C. Sealing is done by a double seamer and the sealing operation takes about one second. First is seam operation and the other is the hermetic seal operation.

Thermal Processing / Sterilization

- After exhausting and closing the cans must be heated for an accurately predetermined time and temperature in an atmosphere of saturated steam in heated water or occasionally in an air steam mixture.
- The temperature must be sufficient to kill yeast, moulds and certain bacteria capable of growing in medium.
- In the solid meat pack the diffusion of heat is brought about by conduction and the process is therefore slow.
- Solid loosely packed in a liquid will, therefore, heat more rapidly due to convection current than those, which are tightly packed.
- The cooking takes place under steam pressure.
- The presence of headspace is needed to minimizes the uneven heat treatment and ensures effective temperature and time required for safe processing.

Cooling

Prompt cooling after processing is important and the cans should be cooled to an average temperature of 37°C.

Can washing

- Can which has been just cooled are dirty and greasy on the outside and are therefore passed through a detergent bath to facilitate subsequent handling, lacquering and labeling. This bath is usually composed of soap or sulphonated fatty alcohol.

Outside lacquering, labelling and storage

Commercial lacquer or enamel is a coloured varnish containing vegetable resins or synthetic resins.

SPOILAGES OF CANNED FOODS - DISTORTION OF CANS

- Swell or blower- A can with it ends bulged by positive internal pressure due to gas generated by microbial or chemical activity is termed as swell or blower.
- Flipper- A flipper is a can of normal appearance in which one end flips out when the can is struck against a solid object but the end snaps back to the normal when very slight pressure is applied.
- Springer- A springer is the term used to describe a can in which one end is bulged but can be forced back into normal position, where upon the opposite end bulges.
- Leaker- A leaker is a can containing a perforation from any cause whereby atmospheric air may enter the can or its contents escape. May be detected by disappearance of vacuum from the sides and ends of the cans and the bubbles that appear from the can when held under water and squeezed.

- Over filled can- An overfilled can is one in which the ends are convex due to overfilling.
- Slack caps- The term slack cap is used in the trade to denote a can, which has a movement of one of the ends similar to a can in the early stages of blowing, and the great majority of can classed as slack caps are blown and should be treated as such.
- Flat souring-The flat souring in canned goods is manifested by the presence of a sour odour of foodstuffs, but without the can becoming blown commonly caused by the growth of thermophilic organisms (*B.coagulans, B.stearothermophilus, B.circulans*), which attack carbohydrates with production of acid but not gas.
- Hydrogen Swell- Hydrogen swell happens independent of microbial spoilage, and is associated with the formation of hydrigen gas in the can following internal corrosion. Imperfection or scratches on the inner coating may expose small areas of steel and when the contents are acid, an electric couple may result, the reaction producing hydrogen gas.

Sulphiding-

- Purple staining on the inner surface of the cans in which sulphur-containing foods are packed may occur with all fish and meat products, especially, liver, kidneys and tongue.
- It is due to the breaking down of sulphur containing proteins at a high processing temperature with a result that, hydrogen sulphide is liberated and a thin layer of tin sulphide is formed on the inside of the can.
- This discoloration, which does not involves foodstuffs itself and varies from a light pink to a dark purple but a blackening of both inside of the can and the surface of the foodstuffs may accompany it.
- These latter changes are due to attack of hydrogen sulphide on the steel base with a formation of iron sulphide.
- It is of more serious impart than the deposition of tin sulphide as it may lead to pitting of the steel and disfigurement of the surface of the meat pack.

Prevention or Treatment of the Can

- The basis of which is, copal gum, dissolved in a suitable solvent to which an added substance capable of uniting with volatile “sulphur” gases released while the food is being processed.

PUBLIC HEALTH ASPECT OF CANNED FOODS

- Botulism is caused by the botulinal toxin produced by Cl. botulinum an obligate anaerobe which is ubiquitous, being found in the air, soil, waters, intestinal tracts of fish and mammals, and gills and viscera of crabs and other shellfish.
- Cl. botulinum grows well in low-acid foods such as canned vegetables, processed meats, sausages, smoked fish, and other seafood products.
- Inactive Cl. botulinum spores are found in soil and water throughout the world. It is comparatively harmless in the spore form.
- A lower processing temperature is however permissible in the case of a few special packs such as cured meats, in which the curing salts have an inhibitory effect on the growth of organisms and the production of its toxins.
- Cans may occasionally become infected if these organisms gain entrance through a leaking can and in absence of accompanying gas-forming bacteria, the can will not blow. While its contents, though, they appear normal may contain large amount of the organisms and its toxins.
- The possibility of canned foods being rendered dangerous by secondary contaminated with pathogenic bacteria also raises the question of the wisdom or otherwise of leaving food in a can after it has been opened.

PRESERVATION BY USE OF ANTIBIOTICS

- The antibiotics when used in the required concentration impart no flavour or odour to the meat and do not discolour the product, while most of them are considered relatively harmless to humans.
- Broad-spectrum antibiotics such as Chlortetracycline, Oxytetracycline and Chloramphenicol are commonly used.
- Antibiotics can also be injected into the living animal just prior to slaughter. These antibiotics are also used in the preservation of foods such as poultry and fish also.
- Can be adopted in countries lacking refrigeration. Added to water in a proportion of 5- 40 ppm, poultry dipped into treated water for chilling.
- Objection -it will create antibiotic resistant strains of pathogenic bacteria and the antibiotics are ineffective against yeast and moulds.
- Antibiotics should not be used to replace good hygiene, but when employed such that all the above dangers are avoided, and in conjunction with mild refrigeration or pasteurising doses of irradiation they afford a means of preservation without materially altering the product.

RADIATION PRESERVATION OF MEAT

- Food and meat preservation by the application of radiation, either ionising or non-ionising, known as irradiation
- Ionising radiation -- radiation having energy sufficient to cause loss of electrons from atoms to produce ions.
- Non- ionising radiation--radiation not having sufficient energy to cause loss of electrons from atoms to produce ions.

Ionising radiations

- High speed electrons produced from a variety of electron generators such as cathode ray tubes, X-rays generated by electrons when they strike heavy metal, and electrons and gamma particles emitted from radio–isotopes such as cobalt 60, cesium 137.
- Preservation of meat without raising temperature, hence referred to as cold sterilisation. The amount of radiation energy absorbed by meat is expressed in rads (or) gray which is equal to 100 rads. A mega rad is a million rads or 10,000 Gray or 10 kGy.

- Radappertisation- which brings about sterility in meat, involves the application of radiation in the range 0f 20 -30 kGy.
- Hence it is also referred to as radiation sterilisation. It is oftern asWet Dog Hair odour.sociated with development of unpleasant odours, flavors and off colours.
- Radurization also known as radiation pasteurisation, uses doses less than that required for sterilisation, typically in the range 1- 10 kGy, this dosage is sufficient to kill many soilage organisms and thus can extend shelf life of meat under refrigeration significantly.
- Radicidation - doses less than 1kGy are employed to increase shelf life, prevent sprouting in vegetables and for rendering pork free of *Trichinella spiralis.*

Non-ionizing radiation

- Microwave and infrared rays have wavelength greater than visible lights are capable of generation of heat in the irradiated object and thus impart preservative effect, if any.
- Ultra violet rays when absorbed by micro-organisms is lethal to them and thus germicidal.
  - It is used mainly in aging of meat.
  - Limitation of using ultra–violet rays are
    - Poor penetration, so can be used only for sterilising surfaces of carcasses and meat products.
    - Catalyzes many oxidative changes in the irradiated products. So, cause rancidity, discoloration and other type of oxidative deterioration and
    - Infra-red rays have been used to dry fruits and vegetables and for heat blanching in the same way as high frequency radiation.

CHEMICAL PRESERVATION

- **Preservative means any substance, capable of inhibiting, retarding or arresting the process of fermentation, acidification or other deterioration of food or of masking any of the evidence putrefaction but does not include common salt, lecithins, sugars or tocopherols; nicotinic acid or its amide, vinegar or acetic acid, lactic acid, ascorbic acid, citric acid, malic acid, phosphoric acid, pyrophosphoric acid or tartaric acid or the calcium, sodium or potassium saltsof them, glycerol, alcohol, or portable spirits, isopropyl alcohol, propylene glycol, monoacetin, diacetin, or triacetin, herbs, spices or their extracts, or essential oils when used for the purposes of flavouring.**

- **Several organic acids have been *Generally Recognized As Safe (GRAS)* for use as chemical preservatives.**

- **Spices and essential oils are excluded from preservatives in food, when used for flavoring purpose as per regulations.**
- **Various essential oils have preservation properties and have been used to extend the storage life of meat products.**
- **These include eugenol in cloves and alkyl isothiocyanate in mustard seed and 0.3 percent of sage or rosemary was inhibitory and 0.5 percent bactericidal.**
- **Citric acid, propionic acid, benzoic acid and their salts are effective mould inhibitors.**
- **Acetic acid and lactic acid prevent bacterial growth.**
- **Sorbate and benzoate are capable of arresting the growth of yeast in foods.**