**Microbiology of Canned Food**

Canning is a method of preserving food in which the food contents are processed and sealed in an airtight container. Canning provides a shelf life typically ranging from one to five years, although under specific circumstances it can be much longer.

. Food spoilage is caused by:

**- Microorganisms**

**- Or by internal chemical changes which are caused by enzymes.**

The incidence of spoilage in canned foods is low, but when it occurs it must be investigated properly. Swollen cans often indicate a spoiled product. During spoilage, cans may progress from normal to flipper, to springer, to soft swell, to hard swell. However, spoilage is not the only cause of abnormal cans. Overfilling, buckling, denting, or closing while cool may also be responsible. Microbial spoilage and hydrogen, produced by the interaction of acids in the food product with the metals of the can, are the principal causes of swelling. High summer temperatures and high altitudes may also increase the degree of swelling. Some microorganisms that grow in canned foods, however, do not produce gas and therefore cause no abnormal appearance of the can; nevertheless, they cause spoilage of the product.

Spoilage is usually caused by growth of microorganisms following leakage or underprocessing. Leakage occurs from can defects, punctures, or rough handling. Contaminated cooling water sometimes leaks to the interior through pinholes or poor seams and introduces bacteria that cause spoilage. A viable mixed microflora of bacterial rods and cocci is indicative of leakage, which may usually be confirmed by can examination. Underprocessing may be caused by undercooking.

**Chemical spoilage:**

**.**Hydrogen swell: this is caused to the formation of hydrogen and is followed by internal corrosion of the can, due to the foods containing organic acids such as fruit and other acid products which corrode the interior of the cans. Changing color of food because of reaction with the can. Also browning reaction of some foods such as potato.

**Microbial spoilage:**

**1-Spoilage by Thermophilic Spore forming Bacteria**

**A-Thermophilic Anaerobic spoilage**

This type of spoilage is caused by *Clostridium thermosaccharolyticum*

Which analysis sugar and produce acid(butyric and acetic acid) and gas(CO2 and hydrogen)

Steps of swelling of canned food:

**Flipper -** a can that normally appears flat; when brought down sharply on its end on a flat surface, one end flips out. When pressure is applied to this end, it flips in again and the can appears flat

**Springer** **-** a can with one end permanently bulged. When sufficient pressure is applied to this end, it will flip in, but the other end will flip out

**Soft swell -** a can bulged at both ends, but not so tightly that the ends cannot be pushed in somewhat with thumb pressure

**Hard swell** - a can bulged at both ends, and so tightly that no indentation can be made with thumb pressure. A hard swell will generally "buckle" before the can bursts. Bursting usually occurs at the double seam over the side seam lap, or in the middle of the side seam

**B-Flat Sour Spoilage:**

Flat sour spoilage occurs chiefly in low-acid foods such as peas, corn, and lima beans ,but can also occur in medium-acid foods, e.g., spinach

green beans, asparagus, beets which caused by *Bacillus stearothermophilus* and *Bacillus coagulans* cause spoilage of tomato juice.

**C-Sulfide Stinker:**

*Clostridium nigrificans* is a thermophilic anaerobe that produces hydrogen sulfide(black precipitate) and discoloration upon spoilage, such as peas and corn

**2-Spoilage by mesophilic spore forming Bacteria**

The bacteria that cause this type of spoilage is types of Bacillus and Clostridium

Putrefactive a anaerobic bacteria mesophilic spore and gas formers: *Clostridium botulinum* and *Clostridium buytiricum*

Aerobic mesophilic spore formers they are less important than putrefactive anaerobes because vaccum in canned foods which inhibits their growth species of this group heating to 100 ̊C for short time destroy most spores *Bacillus subtilus*

**3-Spoilage by Nonsporeforming Bacteria**

Spoilage is usually caused by growth of microorganisms following leakage or insufficient heat treatment

Streptococcus thermophilus ,*Staphylococcus aureus* ,Microccus ,Lactobacillus,Leuconostoc in canned tomato and *Streptococcus faecalis* in canned meat ,Coliform,Flavobacterium, Pseudomonas,Proteus …

**4-Spoilage by yeasts and molds**

Spoilage is caused by growth of microorganisms following leakage or insufficient heat treatment fermentative yeast cause the spoilage of juices jam and cucumber pickles

Molds such as penicillium and aspergillus cause spoilage of jam and jelly

**First: Physical tests for canned foods**

1-Register all written information on the cans, including trade mark, the size of the cans, the weight of the food and the type of food. . . . . etc

2-Remove mark of the cans, then notes the existence of any oxidation or scratching or wrinkles or the presence of defect in the process of closing down and others.

3-Notes the cans if the normal flat, or if swollen of the side, and if this swelling strong (hard) or light(soft) and if the swollen convert of the side to the other side when pressed thumb (flipper) and if the ends of the can swollen indicate of the presence of gas inside, which examines this gas

4-Wash the surface of the can with soap and water well. The flat sides of the can exposed to flame lamp carefully with moving continuously for sterilizing until a little swelling occurring of cans as indicater of sufficient heating. But if the end of cans was swelling should not be exposed to sterilization by heat, but should be sterilized one side by 1/1000 of mercury chloride HgCl2solution for a few seconds and then dry the sides of sterilized can by sterilized cloth, or by sterilizing process of the sides of opened can with washing by ethyl alcohol 70%. If the can was swell, before opening the can it should be placed in the suitable beaker.

5-Empty the can from the food contents, wash and dry well, then check the closingnature,the presence of oxidants , scratches , holes , coloring or any other defect in the internal surface of the can, also can be re-close the can and examined for the presence of the holes by using high pressure air.

6-Check for gas and kind it’s done by a special device to receive gas from inside the swelling cans and then test whether this gas is carbon dioxide CO2by means of its reaction with 5% solution of potassium hydroxide KOH, which is placed in a tube filled with carbon dioxide gas. Plugging the end of the tube by thumb finger and the tube moves notes clearly rarefaction in tube felt by thumb. The screening process for hydrogen gas will be by a match flame to the slot of tube that contains the gas from the can immediately after the uplift of the thumb finger from the opening of slot tube and flame indicate of the presence of hydrogen gas.

Second: Microbial examination for cannedfoods

Examines all natural canned does not show signs of spoilage, either by examination of the effectiveness of sterilized or the possibility of preserve it.

Examination of sterilization activity

1-Sample Preparation

After examining process and the preparation and opening canned food, as stated in the first part of this experiment eliminate the can cover by tongs or sterile key boxes spiral and by sterile method. Cans covered directly by half a sterile Petri dish or other suitable cover

Taken the sample of canned food,for liquid food and semi-liquid foods by sterile pipette for the solid food sample taken from the canned food by a sterile cork drilling machine , spoon or other.

2-Inoculation of the media by food

Use the amount of 1-9ml of liquid food (milk, etc.).and take the same amount of solid food and semi-solid (meat, fish, cheese, etc.) after doubling the size of the food with sterile distilled water add the food to be testing it to one or some of the culture media. Then incubate for the different temperature and note the results

Media used for methods such as:

Nutrient agar for growth of total count bacteria (30-32°c for 2-3 days for mesophilic bacteria) and 55°c for 2 day for thermopilic bacteria

MacConkey agar for *E.coli*

Manitol salt agar for *staphylococcus aureus*

Potato dextrose agar for fungi (molds and yeasts)