
Spoilage of Canned food and its causes

1. Physical damage leading to spoilage

The physical damages are caused by the following reasons which lead to microbial or chemical spoilages.

- The scheduled process was not delivered because of mechanical or personnel failure.
- Improperly or inadequately formed seals/seams
- Defective containers or defective lids of the containers
- Overfilling of the food

2. Chemical spoilages

The chemical spoilage is caused by the following reasons:

- Storage temperature
- Acidity of food
- The reaction between food and metal cans
- Insufficient exhausting during canning
- Presence of soluble Sulphur and Phosphorus in food
- The enzymatic action of food

This cause the defects such as:

- Swelling of can
- Discoloration of food
- Produces off-flavors in food
- Corrosion of the metals can leads to loss of nutritive quality of food.
- Cloudiness can be observed on syrups or brine or gravy.

3. Microbial spoilages

The microbial spoilage of canned food is caused by three reasons:

1. Survival of spores of thermophilic bacteria
 2. Growth of survived thermophilic bacteria due to inadequate cooling, inadequate heat treatment, and improper storage temperature.
 3. Recontamination of microorganisms due to can leakage.
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A. Spoilage by spore-forming thermophilic bacteria

1. Flat sour spoilage

- In flat-sour spoilage, the products become sour due to the production of acid from carbohydrates with no can swelling.
- It only occurs in low acids foods and acid foods
- It is caused due to germination and growth of facultative anaerobic *Geobacillus stearothermophilus*, *Bacillus coagulans*, *Bacillus thermoacidurans*, and *Bacillus stearothermophilus*.
- The source of the organisms is usually plant equipment, sugar, starch, and soil.

2. Thermophilic anaerobic spoilage

- It is caused by anaerobic *Thermoanaerobacter* and *Thermoanaerobacterium* (eg *Clostridium thermosaccharolyticum*).
- There is a production of H₂ and CO₂ gases.
- The sour fermentation occurs at high temperatures in medium-acid canned foods.
- The gases swell the can resulting in the bursting of a can.
- They often produce a butyric or "cheesy" odor on food.
- This canned food spoilage occurs due to slow cooling, or hot storage

3. Thermophilic Anaerobic Sulfide Spoilage

- This spoilage is caused by Gram-negative obligate anaerobic spore formers *Disulfotomacillum nigrificans*, *Clostridium bifermentans*, and *Clostridium sporogenes* in low-acid canned food.
- There is an H₂S production, and "rotten egg" odor in canned food with no swelling.

- The H₂S thus produced are absorbed by food to produce iron sulfide resulting in black coloration of food and inside of cans.
- This canned food spoilage occurs due to under-processing, slow cooling, or hot storage

D. Spoilage by yeast and mold

- The presence of yeast and mold in canned foods indicates under processing, leakage, recontamination, and poor evacuation.
- Fermentative yeast produces CO₂ leading to swelling of a can.
- Commonly yeasts are found to grow on the surface of high acid foods such as pickled products.
- *Torulopsis lactis* and *T. globosa* cause blowing or gaseous spoilage on sweetened condensed milk, which is not heat processed.
- *T. stellata* causes spoilage in canned lemon and grows at a pH of 2.5.
- Molds species such as *Aspergillus*, *Byssochlamys*, *Penicillium*, and *Citromyces* are commonly found in canned food having high sugar content of up to 70-72%.
- The mold spoilage of canned food is characterized by moldy taste, odor, color fading, and presence of mold mycelia, and sometimes by slight swelling of the container.

Preservation of canned food from microbial spoilage

- Canned food is thermally processed to ensure the "commercial sterility" of the food product for long-term storage.
- Canning itself is one of the heat-treated methods of food preservation however it doesn't comply that it is free from microbial spoilage.
- The recontamination of canned food is more likely to occur due to various factors.
- To prevent microbial spoilage of canned food several other food preservation methods can be applied in combination with canning to extend its shelf life without deteriorating the nutritive quality of food.

1. Radiation

- Radiation sterilization of food (radappertization) requires exposing food in sealed containers to ionizing radiation to kill all spoilage-causing organisms.
- It is used to eliminate microorganisms on the surfaces of canned jars and their lids.

2. Preservatives agents

- Preservatives are substances that are capable of inhibiting or retarding the growth of microorganisms and are categorized as "Generally Regarded As Safe (GRAS)".
- They include simple organic acids, sulfite, ethylene oxide, sodium nitrite, ethyl formate, LAB and bacteriocin,

3. Chilling storage

- The canned foods are stored at temperatures 0–5 °C.
- The main objective of chilling is to reduce the rate of microbial growth and its enzymatic activities which extends the shelf life of canned food.