Canned Tuna

Prof.dr/ Fahim Shaltout

Canned Tuna

Canned tuna was first produced in Australia in 1903, and quickly became popular. Tuna is canned in edible oils, in brine, in water, and in various sauces. Tuna may be processed and labeled as "solid", "chunked" ("chunk") or "flaked". When tuna is canned and packaged for sale, the product is sometimes called **tuna fish**

In the United States, 52% of canned tuna is used for sandwiches; 22% for tuna salads; and 15% for tuna casseroles and dried, prepackaged meal kits, such as General Mills's Tuna Helper line.

Fresh and frozen

The fresh or frozen flesh of tuna is widely regarded as a delicacy in most areas where it is shipped, being prepared in a variety of ways for the sake of achieving specific flavors or textures. One way that fresh tuna is served is in sushi. When served as a steak, the meat of most species is known for its thickness and tough texture. In the U.K., supermarkets began flying in fresh tuna steaks in the late 1990s, which helped to increase the popularity of using fresh tuna in cooking; by 2009, celebrity chefs regularly featured fresh tuna in salads, wraps, and char-grilled dishes. Fresh bluefin tuna is considered a "cultural institution in Japan and there is still an enormous demand for this delicacy" at restaurants.

CANNED TUNA PROCESSING

The tuna canning industry only utilizes the meat for the production of tuna loins. These are used in canned tuna and in pouched tuna that can be found in different flavours, and also as frozen tuna loins. Tuna canneries supply both export and domestic markets. The species of tuna processed by the canning industry are skipjack and yellowfin (maximum weight of 2.5 kilograms). Tuna by-products that can be identified are head (including eyes), tail, visceral organs, skin, bones, fins and black (dark/blood) meat. These by-products are generated during the process of tuna loining for canning or for freezing. The removal of these by-products occurs after the pre-cooking process, therefore all of these are already considered as “cooked”. The amounts of by-products generated comprise 35–40 percent of the total weight of the raw material. During the beheading and skinning process, the head, visceral organs and skin are removed; these make up 17–18 percent. Other tuna by-products removed during loining are black meat and bones, which make up 20–22 percent. Meat recovery for the final product is about 40 percent, while the other 20 percent is considered weight loss during pre-cooking, cooling, and retorting. In the Philippines, the canning industry’s tuna by-products go to fishmeal production.

Most of the tuna canneries have their own fishmeal production plants. While the tuna portion needed for primary product is being processed, these tuna by-products go directly to the fishmeal plant for processing. These by-products are put in separate containers. Of the tuna by-products, 40–45 percent of the total weight is produced as fishmeal products. The fishmeal product has 55–60 percent crude protein to be used by feed mills as the protein component. Fishmeal goes to both the export and domestic markets. Black meat is also considered as a tuna by-product comprising 10 percent of the total weight of the raw material and is sometimes processed as canned product. Canned black meat is exported to countries such as Papua New Guinea. The product comes with 100 percent black meat, or a mixture of white meat and black meat, depending on the buyers' requirements. Fish oil production from tuna by-products is not yet available in the Philippines. The technology is considered very expensive for the industry. It is preferable to convert all 18 tuna by-products to fishmeal because of the high demand in domestic market. A small percentage of these tuna by-products goes for research study purposes.

1-PRODUCTION RAW MATERIALS Prior to manufacturing the tuna, raw materials must be examined for good quality by looking at the physical properties of gills, eyes, skin, and texture of the fish. Histamine contents must be checked as well.

2. THAWING After passing inspection frozen tuna is thawed at room temperature, by cold storage or using water. The duration will vary depending on the fish size. It usually takes about 2–3 hours to raise the temperature up to 5 °C. The temperature of the fish should be kept as low as possible because higher temperatures will cause the fish to deteriorate as a result of the activity of microbes and enzymes**.**

3. GUTTING Thawed fish is gutted to remove blood (7–12 percent) and viscera (5–7 percent), then washed with water to reduce microbial growth and deterioration (Figure 2).

4. PRE-COOKING Gutted fish is steamed in a pre-cooker at a temperature of about 95 °C and pressure of about 1–2 bar for 60–90 minutes depending on the size and species of fish. This process can help to remove skins and bones from fish meat more easily.

5. COOLING Steamed fish is taken to the cooling area and sprayed with cold water to reduce the temperature to prevent overcooking. After this process, the weight of the fish will be less because a considerable amount of water will have evaporated.

6. TRIMMING Cooled fish skin and bone are removed (20–30 percent). The white meat yield of about 32–40 percent will be used for human consumption in cans and pouched products (35.45 percent). The dark meat yield of about 10–13 percent will be used for animal or pet food in cans and pouched products (12.44 percent) (Figure 2).

7. PACKING Canned fish is packed in various sizes using machine or by hand, followed by the addition of tomato sauce, vegetable oil, brine or other seasoning sauce for preserving fish quality and to meet customer's needs.

8. RETORTING After steaming, the canned fish is heated at 116 °C for 90 minutes (commercial sterilization). If a higher temperature is used the fish losses its good physical characteristics as well as smell, taste and nutritional value.

9. COOLING After sterilization , the temperature of the canned fish should be reduced as soon as possible to prevent heat accumulation making the fish meat tender, changing the color, taste and decreasing nutritional value. It also prevents the growth of thermophilic microbes that may have been left after the heating process. The cans are cooled down to about 35–40 °C. The remaining heat helps to evaporate the water on the outside of the cans.

10. LABELING AND PACKAGING After the dried canned fish has been cooled to room temperature, it is then labeled and packed in cardboard boxes for storage and further transportation.

Sensory evaluation of canned tuna

1. Taint

A unit will be considered tainted when any of the following conditions exist: a) Rancid Odour characterized by the distinct or readily detectable persistent odour of oxidized oil, (this may be characterized by a pungent sensation in the nasal passage); or

Flavour characterized by distinct flavours present individually or in combination as follows: bitter, sour, metallic flavours detected at the sides and back of the tongue leaving a lingering aftertaste. b) Abnormal Distinct and persistent odours and/or flavour that are burnt or acrid, (e.g as associated with excess scorch). 95 Odours and/or flavours resulting from contamination by solvents, soaps, fuel, oils, grease, etc. that are organoleptically detectable.

2. Decomposition

A unit will be considered decomposed when any of the following conditions exist: a) Persistent, distinct and uncharacteristic odour characterized by:

i) fruity (aldehyde odours similar to pineapple of other fruits);
ii) vegetable odours - (e.g. turnip and cabbage-like but not associated with packing medium);
iii) sour, yeasty fermented odours;
iv) ammonia odours, hydrogen sulphideodours; or
v) other pungent odours such as putrid or faecal.

b) Persistent distinct and uncharacteristic flavours characterized by:
i) sweet fruity flavours (e.g pineapple-like); or
ii) vegetableflavours (e.g. turnip and cabbage-like but not associated with packing medium); or
iii) putrid or sour or faecalflavours.
c) Texture Breakdown of muscle structure characterized by muscle fibres no longer being detectable resulting in the presence of small particles and/or granular, gritty or pasty texture exceeding 20% o f the drained content. d) Appearance
i) Discolouration characterized by persistent flushed pink, orange or green colours in the flesh exceeding 5% drained contents.

ii) True Honeycombing exceeding 5 % of drained contents.

Physical examination

- Perform net weight determinations on a representative number of cans examined (normal and abnormal).
- Determine drained weight, vacuum, and headspace on a representative number of normal-appearing and abnormal cans.
- Examine metal container integrity of a representative number of normal cans and all abnormal cans that are not too badly buckled for this purpose.

- After removing reserve sample from can, determine pH of remainder, using pH meter. DO NOT USE pH PAPER. Pour contents of cans into examination pans. Examine for odor, color, consistency, texture, and overall quality. DO NOT TASTE THE PRODUCT. Examine can lining for blackening, detaining, and pitting.

Organoleptic Analysis of Canned Tuna Products

Organoleptic Analysis involves the employment of one or more of the physical senses (sight, touch, taste, smell) for subjective testing and rating of food products. Physical Requirements of Organoleptic Examinations

1. Work in an area that is free of distractions. Don't try to examine a product in a room where other types of analyses are being conducted.

2. Work in an area that is free of foreign odours. a) No smoking at any time. b) Cosmetic odours should be avoided. c) Don't attempt to smell something that is held in another person's hands.

3. A slight positive pressure should be maintained in the testing area so that extraneous odours cannot enter into the testing area. Proper ventilation also removes product odours.

4. Separate participant if possible. a) One person's reaction may affect another's judgement.

5. Lighting should be uniform, as near natural light as possible and not influence the appearance of product being tested.

6. Product to be tested should be a room temperature or slightly above. (This can vary some depending on product). Other considerations:

1. Be as knowledgeable as possible about the product being examined.

2. Examine only one species or fish product at a time.

3. Take periodic rest breaks during the examinations.

4. Conduct all determinations independently of other examiners and immediately record results.

Chemical Examination

- The chemical indices for the product are in somewhat of a flux:
- CANADA methods: Histamine 300ppm Putrescine >0.8ppm early stages of decomposition (Note: not official limits) Cadaverine

>0.5ppm early stages of decomposition (indices used for comparative tests with sensory).

- USFDA methods: Histamine 500 ppm for adulteration Putrescine 0.5 - 0.7 ppm decomposed (Note: not official limit - studies in progress) Cadaverine 0.6 - 0.7 ppm decomposed (Note : not official limit - studies in progress).
- 1. Determination of mercury in seafood - official method
- 2. Determination of histamine in seafood - official method - fluorometric method
- 3. Determination of histamine in canned fish by HPLC 4. Putrescine and cadaverine in canned tuna - DFO (Canada)
- 5. Putrescine and cadaverine in canned tune - USFDA 6. Putrescine and cadaverine in canned tuna - Thailand modification
- 7. Examples of some results for putrescine and cadaverine