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CANNING OF TUNA IN OIL

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This paper provides the experimental details of canning of tuna in oil. The species utilized in the experiments were the skipjack *(Katsuwonus pelamis)*, yellowfin tuna *(Neothunnus macropterus)* and bigeye tuna *Parathunnus obesus mebachi)* ranging in weight from 2.5–82 kg. The method worked out is applicable to all species of different size grades.

INTRODUCTION

Occurrence of tuna, though reported from many regions on the west and east coasts of India, is mainly confined to the regions around Laccadives. The spices of larger sizes are generally adapted to the ocean. The skipjack is caught in appreciable amounts around Minicoy. Though the smaller species like *Euthunnus affinis*, and *E. auxis* are met with in all warm waters they are not generally used for canning or freezing. Species like *Kishionella tunggol, Neothunnus macropterus, Parathunnus obesus* are larger in size, but are caught in relatively fewer numbers. However, with the introduction of tuna long lining and other improved gears the catch of these species is expected to increase to a very appreciable extent. In 1968 India landed 3690 tonnes of tuna. (CMFRI, 1969).

Of the large catches of skipjack in Minicoy island and other available catches elsewhere in the main coast, a portion is locally consumed in fresh condition and the rest cured and exported in the form of *mas min*, the process of preparation of which has been described by Valsan (1968), until a canning plant was established recently by the Laccadive Administration in the island of Kavarathy. Canned tuna is a product commanding a large market in U. S. A., Canada, U. K. and also Western and Eastern Europe. Canning of this fish has not been practised to any appreciable degree, although efforts are currently being made in regions where this fish is available. However, there occurs wide variations in the method adopted for canning this fish in different regions. Realising the vast scope for the development of the internal trade as also the good international market for this commodity, the Indian Standards Institution has laid down quality standards for tuna canned in oil (IS: 4304–1967).

As regards the technological aspects of processing, tuna canning has not received the attention it deserves. *Finch* (1962) has given a detailed account of canning of tuna in U. S. A. Recently Central Institute of Fisheries Technology published (Anon., 1964) a method for canning of tuna in oil, but did not discuss the various technological aspects when applied to fishes of different size grades. Considering this, further detailed work was undertaken paying due attention to the various aspects of the problem with a view to turning out a product conforming to the IS specifications using different sizes and species of fish, the results of which are reported here.

MATERIALS AND METHODS

Skipjack caught from the sea around the island of Minicoy, yellowfin and big eye tuna caught by the exploratory vessels of Offshore Fishing Station, Cochin were utilised in these experiments. Fishes were kept in ice for 2–3 days before processing. Weight ranges of the fish used from different species were:

Skipjack	2.5	—	4.0 kg.
Yellowfin	30.0	—	43.0 ,,
Big eye	70.0	—	82.0 ,,

The procedure adopted for canning of the fish was as follows: i) Cleaning: The fish after removal of viscera, heads and fins were washed thoroughly till free from slime and blood. They were then cut into chunks of suitable size for cooking in the autoclave.

ii) Cooking: The pieces were arranged in cooking racks holding approximately 20–25 kg and cooked in steam at 0.84 kg/sq cm, selected at random until such time that the surface of the back bone attained a temperature of 93°–94°C.

iii) Preparation: Cooked fish were cooled either in a current of air or a cold room (3–5°C). The softend skin was scraped off using a stainless steel knife and the flesh seperated into halves from both sides of the backbone. The portions were again divided horizontally and the black meat removed completely. The loins were polished by rubbing off the loose fragments of flesh.

iv) Processing: The loins were cut to suit the size of the can. 170 g material was packed in cans of size 301 x 206 followed by 50 ml hot refined groundnut oil providing for sufficient head space. Cans were exhausted in an exhaust box, seamed in a double seamer and sterilized in an autoclave in steam at 0.84 kg/sq cm for 1 hour, immediately cooled and stored.

RESULTS AND DISCUSSION

The earlier method (Anon, 1964) specifies the cooking time as 1½–2 hrs in steam at 0 84 kg/sq cm but this was found to be far from satisfactory with big size fishes, where under the above conditions of cooking, the water content in filling medium used to be above 5%. *Finch (loc cit)* has reported that the fish is cooked for a length of time corresponding to its size, based upon the routine in each plant, generally such as will give a backbone temperature of 71.1–76.6°C (160–170°F). The results of our experiments on the temperature of the meat attained over the surface of the backbone and its relation with the final water content in filling oil when the fish was packed adding crystal salt are given in Table I. The fish used for the experiment had an initial temperature of 1.5° C at the surface of the backbone.

The results show that in order that the water content in filling oil be below 5%, the fish should be cooked to a temperature of 90.5°C at the surface of the backbone, in which case the water content was 3%. To be on the safer side when

TABLE I RELATIONSHIP BETWEEN TIME OF COOKING AND WATER IN FILLING OIL

Size of fish : 8" (length), 10" max. thickness, Weight: 10 kg. (Big eye tuna)

Steam pressure: 0.84 kg/sq cm.

Time in minutes	Temperature (° C) attained by surface of backbone	Water content in oil as % of total volume.
125	65.5	20
135	74.5	14
150	82.0	7
160	90.5	3
165	93.3	1
170	97.5	Nil.

bulk quantities are cooked as in commercial practice, it is advisable to prolong the cooking to such a period that the backbone attains a temperature of 93-94°C when the water in filling medium can be kept minimum. The same conditions were found to be applicable to fishes of all size grades.

Time taken by fish of different sizes to attain a temperature of 93.5°C at the surface of the backbone is presented in Table II.

TABLE II TIME TAKEN BY FISH OF DIFFERENT SIZES TO ATTAIN 93.5°C

Steam pressure; 0 84 kg/sq cm.

Species	Length in.	Thickness in.	Weight kg.	Time to reach 93.5°C Hrs	Min.
Big eye tuna (round piece)	12	10	16	3	00
,,	10	8	12	2	45
Skipjack (Whole fish)	14	4	3	1	10
Big eye tuna (fillet)	10	5	6	1	15

The temperature was measured by inserting a copper-constantan thermocouple (20 SWG) and read over a Cambridge pyrometer.

The cooked pieces can be cooled either in a current of air or in a cold room. The latter has got definite advantages over the former, since the flesh becomes hard enough to permit easy scraping off of the skin and cleaning the loins free from black meat with minimum flaking of flesh (Finch., *loc cit*).

Dipping of the cut pieces in 15% brine containing 0.075% sodium bicarbonate (added as a softening agent to give a tender texture to the product) for 22 minutes (Anon., 1964), though imparts a proper salt ish taste and good texture to the product, is invariably accompanied by the risk of increasing the volume of water in oil above that prescribed by I. S. specifications by the brine adhering to the pieces together with any water expelled from the flesh due to insufficient precooking.

Alternatively, addition of solid salt to the meat packed in cans can be advantageously adopted. 2% salt on the weight of the packed meat, containing 0.5% sodium bicarbonate, has been found to serve the same purpose as the brining mentioned earlier. Concentration of bicarbonate above 0.5% in salt definitely improves the texture, but is accompanied by bleaching of the natural pinkish colour of the flesh and impairing of the flavour.

SUMMARY

A process for canning tuna in oil which is applicable to all size grades is described as a modification of the process reported earlier from this laboratory. Fish has to be precooked for such a period that the surface of the backbone attains a temperature of 93-94°C so as to keep down the water content in the filling oil to the minimum and then cooled in a cold room to facilitate easy handling during the subsequent stages of processing. Addition of solid salt instead of brining dispenses

with the possibility of introducing any water into the filling oil in addition to that from the fish muscle. Incorporation of of 0.5% sodium bicarbonate on the basis of salt gives a good texture to the product.

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