

A REVIEW ON OIL SARDINE

II. PRESERVATION BY CANNING, CURING AND SMOKING

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CANNING

Commercial canning of sardine is of relatively recent introduction in India, even though methods have been evolved for canning of this fish in oil and quality specification laid down by the Indian Standards Institution (Anon, 1963). Even now, there is no regular canning and no industry worth its name commensurate with the abundance of this fish exists. The seasonal nature of the fishery lasting for a period of 4-6 months in an year as well as the erratic behaviour of this resource as reflected in the wide variation noticed in the annual landings have discouraged the entrepreneurs to enter into this industry, besides several other factors detailed elsewhere.

In spite of these, a few firms at least, have started production of canned sardine. The pioneers among them are M/s. Cochin Fish Canning Company (1959) with an installed capacity of only 500 cans per day, followed by M/s. Coronet Canning Co., Malpe (1959) with an installed capacity of 2000 cans per day and M/s. Kerala Food Packers, Alleppey (1960). During the succeeding five years there was no increase in the number of processing units though some of the existing units increased their processing capacity. How-

ever, by the end of sixties there emerged few more firms, though some of them failed to survive. There are now about 7 firms engaged in canning of sardine either fully or partly. Owing to the seasonal nature of sardine fishery, canning is only a minor activity for these firms and are engaged mostly in packing shrimps and other fishes with the exception of one firm in Tuticorin, M/s. Corera Ocean Foods, packing sardine exclusively.

There occur wide variations in the quality of the canned sardine turned out by different processors and again with the same processor among different batches. This is largely due to the variation in the quality of the raw material, seasonal variation in the composition of the fish, and the variation in the methods employed by the trade.

Apart from this, there are various physical and chemical changes, which perhaps may be still more significant. Most of these processors procure the required raw material from important landing centres through agents or brokers and generally a time lag from few hours to a couple of days occurs in certain cases by the time it is ready for processing. During this period, the fish is generally not properly iced with resultant chances

TABLE I

DETAILS OF FIRMS ENGAGED IN CANNING OF SARDINE

Name of firm	Year of commencement of sardine canning	Initial capacity cans/day	Present capacity cans/day	Canning medium used	Type of can
M/s. Cochin Fish Canning Co., Cochin.	1959	500	10,000	Oil and Sauce	Quarter Dingly
M/s. Coronet Canning Co., Malpe.	1959	2000	48,000	Oil	301x206, 12 oz tall Quarter Dingly
M/s. Kerala Food Packers, Alleppey.	1960		10,000	Oil and sauce	12 oz tall Quarter Dingly
M/s. Canning Industries, Cochin Ltd., Trichur.	1966		10,000	Oil	Quarter Dingly
M/s. Excel Seafoods Cochin.	1967		15,000	Oil and sauce	12 oz tall Quarter Dingly
M/s. Mermaid Foods, Calicut.	1967		5,000	Oil	12 oz tall, Quarter Dingly
M/s. Corera Ocean Foods, Tuticorin.	1969		5,000	Oil	301 x 206

for incidence of spoilage. Even in properly iced fish, it has been established that losses of nutrients and flavour, development of rancidity and textural changes occur. While studying the biochemical changes occurring in chill-stored sardine, it has been observed that considerable changes occur in the major protein nitrogen fractions, viz. sarcoplasmic, myofibrillar and stroma protein (Devadasan & Nair, 1970). There took place a reduction of 3-6% in sarcoplasmic proteins in about 2 weeks chill storage whereas only slight variation did occur in the case of stroma proteins. The yield of myofibrillar proteins was inhibited presumably owing to the presence of free fatty acids. Further

studies conducted correlating the physical, chemical and organoleptic changes of properly iced sardine and their effect on the quality of canned product prepared out of them have shown that the fish stored for more than two days is not satisfactory for canning (Madhavan, Balachandran & Choudhuri, 1970).

It is very interesting to note that the period of heaviest landing of sardine coincides with the season when the oil content is the highest bringing with it the innate problem of oxidative rancidity and the consequent loss of flavour to be faced by the industry. During the spawning season covering about 4 months from

June to September, with intense activity during July and August (Antony Raja, 1969), the problem faced by the industry is the poor appearance of the finished product resulting from belly bursting as the fish is more vulnerable to this phenomenon during this season.

These factors also contribute in varying degrees of importance to the high degree of variation in the quality of the canned sardine processed by different factories and also for the differences among different batches of the same factory.

There is at present available in the country a total installed capacity for production of over a lakh cans of sardine per day. However, the annual production varied from 12 to 33 lakh cans with the

maximum output being in 1968; thereafter the production has shown a declining trend which may be attributed partly to the fall in domestic demand and partly to the increase in packing of other lucrative items like shrimp.

TABLE II
PRODUCTION OF CANNED
SARDINE IN INDIA

Year	No. of cans
1965	1213159
1966	2647172
1967	3296051
1968	1768082
1969	1576417

TABLE III

*EXPORT OF CANNED MARINE FISH

Year	Country	Fish other than shrimp			Total value Rs.
		Qty. in kg.	Value in Rs.	Total Qty. kg.	
1964	Bahrein	185	1680.00		
	France	35	192.00		
	Mauritius	53	738.00	273	2620.00
1965	Nil	—	—	—	—
1966	Qatar	155	833.00	155	833.00
1967	T. Oman	402	2300.00	402	2300.00
1968	Canada	82	525.00		
	UAR	65	300.00	147	825.00
1969	T. Coast	231	1423.00	231	1423.00
1970	Belgium	323	1790.00		
	Qatar	7869	68427.00		
	UK	54	1872.00		
	W. Germany	1020	4994.00	9226	71083.00
1971	Malawi	1320	4780.00		
	Sudan	1050	9630.00	3270	14410.00

*Statistics of marine products exports, 1971 (Marine Products Export Promotion Council, Cochin)

No concerted attempt has been made so far to exploit the overseas market. Only negligible quantities have been exported to Sudan, Qatar and other developing countries and we could not push up this item to any considerable extent due to strong competition from other exporting countries.

METHODS

Unlacquered quarter dingly cans (capacity 3½ oz.) is the container most generally used for packing sardine. Lacquered round cans of capacity 12 oz. (301 x 307) and 8 oz. (301 x 206) are also rarely used. M/s. Metal Box Company of India and M/s. Poysha Industrial Co. are the only suppliers of these types of cans to the industry. The former company is attempting to introduce lacquered dingly cans also for this purpose. The canning medium now used in India is mainly refined ground nut oil though small quantities are packed in tomato sauce. These cans are

packed in wooden cases, 100 cans in the case of quarter dingly and 24 or 48 with respect to round cans per case, each can after labelling or enclosing individually in small cartons. Lithographed dingly cans are being slowly introduced.

PRODUCTION OF CANNED SARDINE IN OTHER COUNTRIES

The fish called by the generalised name "sardine" in different countries are of different species and differ in many respects such as appearance, size, taste, composition etc. These can be classified into three groups.

1. Brisling or Sprat - obtained only in West European waters.
2. Sea-herring or Sild - obtained in the North Atlantic.
3. Pilchard - obtained mainly in the Mediterranean and off the Atlantic coasts of Spain, Portugal, France and South Africa.

TABLE IV

*PRODUCTION OF CANNED SARDINE BY DIFFERENT COUNTRIES 1965-'70
(Qty. in tons)

Country	1965	1966	1967	1968	1969	1970
South Africa	64,500	67,500	81,900	54,200	51,600	DNA
Portugal	56,200	52,400	48,800	35,400	23,600	30,700
Spain	19,000	25,300	22,400	28,200	34,400	DNA
Norway	22,400	27,200	26,800	26,100	27,500	DNA
Morocco	43,800	42,000	43,700	42,000	39,000	57,700
Canada	11,600	13,300	11,200	14,900	12,800	11,800
U. S. A.	13,600	14,200	13,300	18,400	11,100	8,600
Brazil	29,500	22,300	23,500	21,200	28,300	DNA
France	21,600	30,400	34,400	24,400	30,800	31,300
W. Germany	50,400	54,200	52,700	52,300	56,700	52,900

*Year book of Fishery Statistics, Fishery Commodities, FAO, 1970. 31, E 1-3 : 188-190.

By analogy to their characteristics the 'oil sardine' available in the west coast of India is coming under the group of pilchards and 'other sardines' of east coast under the group of small herrings or sild. The main world producers of canned sardine are Portugal, Spain, Morocco, Norway, South Africa, the USA and Canada.

The methods employed for canning vary from country to country due to local customs, the type of fish available and the medium used. Conventionally sardine is canned after evisceration, and beheading. However, Portugal and Morocco are producing canned sardine of the "skinless and boneless flesh" type. These countries as well as Spain pack pilchard sardine almost entirely in olive oil. In Norway, sea-herring and brisling lightly flavoured with oak-wood smoke are used for canning in oil and sauce. South African packs are mainly in tomato sauce though a small portion is packed in oil. Canning medium used in the USA and Canada is mainly soybean oil and to a lesser extent either tomato sauce or mustard sauce.

TYPE OF CONTAINERS

Sardine is packed in a number of different types of cans. In the USA, aluminium cans are mostly used, the rest being made out of tin plate; size varying from 2½ oz. to 15 oz. But the most abundant type is quarter size keyless can with a net weight of 3½ oz. having lithographed lid. Pull-tab lid is a recent introduction. Cans imported into the USA from countries other than Canada are often provided with lip and keys. Mediterranean packs are in the 'quarter club' cans with net weight 4⅜ oz. ½ lb. oval cans with net weight 8 oz. as well as 1 lb. tall or oval with net weight

15 oz. are being used in South Africa. Fish is packed in single layer, double layer or by the cross packing method depending upon the size of fish to be canned.

EXPORT FEASIBILITY

The sardine canned at present in India is almost entirely used either for the supply to Defence on annual tender basis or for internal consumption through distributors in big cities. Although sardine available in India is believed to be the cheapest in the world, we have so far failed in establishing a world market for canned sardine. There is a very large market for this commodity, particularly in the USA, France etc.

Most of these countries import canned sardine to fill up the gap between their domestic production and the internal demand. Countries which could produce in line with the demands existing in these countries could find a lucrative market for their products.

Here it requires a thorough thinking why India, with its vast potentialities, could not enter the world market as an effective competitor. Some of the reasons attributable are mentioned below:

1. Containers. The cost of containers in India is prohibitive and the conventional 3 piece round cans are not popular in the world market. This should be completely replaced by 'easy open' type cans like the dingly or pull-tab. While aluminium cans are most popular in the USA, India can very well replace the present tin plate cans by aluminium cans. Aluminium is a commodity which is available in plenty in India. The necessary know-how

TABLE V

****IMPORT OF CANNED SARDINE BY DIFFERENT COUNTRIES IN 1968-1970 FROM PRINCIPAL EXPORTING COUNTRIES**

Country	Import in tons		
	1968	1969	1970
U. S. A.	14,700	22,500	18,500
France	14,300	13,900	14,600
Italy	1,100	3,300	1,200
West Germany	7,400	9,200	6,600
U. K.	20,800	24,800	8,800*
Australia	4,800	5,100	4,700

* This figure does not include import from South Africa

** Year Book of Fishery Statistics, Fishery Commodities, FAO, 1968
29, E3-2 : e33-e36

Ibid, 1970. 31, E3-2 : 213-216.

should be developed or imported to fill the urgent need.

2. Packing medium. Packing medium used in India, viz. ground nut oil, is generally unknown and unpopular in most of the importing countries. In the world imports 70% are packed in soybean oil, olive oil etc. While soybean oil is most popular in the USA and Canada,

olive oil is finding increased use in Western Europe. India can do well by switching over to olive oil from ground nut oil to capture the world markets. Government can help processors by importing olive oil and supplying at subsidised price.

3. Poor display of the product.

4. Severe competition faced from

TABLE VI

**EXPORT OF CANNED SARDINE BY DIFFERENT COUNTRIES
1966-1970 (Qty. in tons)**

Country	1966	1967	1968	1969	1970
Morocco	36,800	34,900	41,100	39,100	36,300
S. Africa	32,200	32,800	35,900	33,300	24,400
Norway	23,600	22,400	23,900	22,000	23,700
Portugal	54,800	52,000	DNA	30,900	23,300
Spain	9,400	7,000	12,700	17,900	26,800

major exporting countries like Portugal, Morocco, Spain etc. Because of their higher production level, the unit cost of production is low. Government subsidy extended in countries like Spain have enabled them to quote much low price.

5. Fluctuation in day-today catch and insufficient cold storage facilities add to the overheads.

6. Uneconomical use of waste products.

If we can overcome these shortcomings we can very well make a good leap forward in our export of canned sardine to the Western Europe, France, Germany and the U.K. which consume about 80% of the total world exports, in addition to the USA.

In order to improve the quality of canned sardine and to bring down the cost by overcoming the technological problems associated with the production and suitably modifying the packing medium a good amount of work has been carried out at the Central Institute of Fisheries Technology and elsewhere in the country.

The most important outcome of such

TABLE VII
COMPARATIVE COST OF PRODUCTION OF CANNED SARDINE IN DIFFERENT MEDIA

Type of can used	Quarter Dingly cans
<i>Medium</i>	<i>Cost/can</i>
Oil (refined ground nut)	103 Paise
Tomato sauce	91 "
Mayonnaise sauce	116 "
Own juice (Natural pack)	78 "

work, done particularly in CIFT, is the development of a process of packing sardine in its own juice, thereby saving labour and cost of oil. This process also improves the quality of the product, particularly the flavour which is very close to its natural one, especially because the natural flavour-bearing constituents are not lost by pre-cooking. The use of tomato sauce and white sauce also as canning media have been tried out successfully. A comparative cost estimate for production of canned sardine in different media is given in Table VII.

With respect to oil packs, the presence of water in fill reduces the consumer acceptability in importing countries. This bears scientific testimony as it has been found out by investigations in CIFT that higher percentage of water in oil resulted in comparatively lower shelf-life and there occurred increased incidence of Peroxide Value (PV) and Free Fatty Acids (FFA) in the oil (Varma, Choudhuri & Pillai, 1970). Taking this aspect into consideration CIFT has worked out methods by which sardine can be packed in oil with only negligible quantity of water in the fill. CFTRI has shown that sardine packed in a 1:1 mixture of ground nut oil and sardine oil increases the acceptability (Sen & Revankar, 1971). M/s. Coronet Canning Co. Malpe are attempting to use refined sardine oil itself as the packing medium for sardine. There are reports that agar agar can very well be used as a canning medium (Joseph & Jayachandran, 1971). The suitability of sardine other than *sardinella longiceps*, available in commercial quantities along the east coast for canning has been reported from the Fisheries Technological Station, Tuticorin (Srinivasan, Jayachandran & Pitchaiah, 1966).

CURING

Curing finds importance as a method of preservation as it is the oldest known technique. Until recently a good portion of the catch used to be preserved by the technique of salt-curing - wet curing and dry curing. With the development of better transport and storage facilities and innovation of better methods of preservation by freezing and canning, there has been drastic reduction in the quantity of cured sardine year after year. Likewise, the export of cured sardine also has experienced a set back, though little trade remains still in vogue with Ceylon. However, the practice is sure to prevail for many years to come as this is the cheapest method of preservation without much of investment and the particular cured taste is liked by at least a portion of the consumers.

Conventional methods of curing gives a product of poor quality with limited storage life. Susceptibility to attack by fungus, red halophilic bacteria and occurrence of rancidity are the most important problems. Use of mixed preservatives consisting of salt, sodium propionate and B. H. A. have been found to be very efficient in controlling most of these defects (Valsan, 1963).

SMOKING

Smoked flavour is gaining importance in acceptance among the consumers the world over. In some Mediterranean countries, smoked fish is imported in relatively small quantities and marketed as 'Delicatessen' products. In Norway, smoked and canned sardine is produced and exported to the U.S.A. Smoking is a process which is applicable to both lean and fatty fishes. Naturally, sardine can

find a place among the smoked fish produced in our country. Capital investment in fish smoking equipment and plant is rather modest and to some extent proportionate to capacity. FAO Fisheries Technical Papers give the details of process and equipment for fish smoking (Anon, 1970, 1971).

Fish after evisceration and brining in concentrated brine is smoked in a smoking kiln at high temperature, the source of smoke often being coconut shell and saw dust. They are aerobically packed. Anaerobic packing involves the danger of toxin production by the action of *Clostridium Botulinum* Type E (Anon, 1964). Sardine is tented by hand through eyes and suspended on tenter frames and placed in the smoking oven and subjected to heavy smoke.

Canning of smoked sardine is still under experimental stage and will open a major field for entrepreneurship in India.

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