

The Oil Sardine-

AN ENERGETIC FOOD AND POTENT INDUSTRIAL RAW MATERIAL

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INTRODUCTION

The oil sardine scientifically known as *Sardinella longiceps*, stands unique among the Indian fishes for reasons more than one, viz; the quantity landed (which is the highest), food value (for both animal and plant world) and vast potentialities as an industrial raw material. The following landing figures of oil sardines in India during the past one decade give some idea as to their quantitative importance in our fishery.

Quantity landed : Metric tonnes

Year	Oil sardines	Other sardines	Total marine fish
1961	1,67,884	19,763	6,83,569
1962	1,10,299	19,551	6,44,244
1963	63,647	27,174	6,55,484
1964	2,74,333	40,398	8,59,503
1965	2,61,863	42,770	8,32,306
1966	2,47,214	64,643	8,89,651
1967	2,56,324	34,980	8,62,631
1968	3,01,456	35,820	8,97,587
1969	1,74,249	52,467	9,12,856
1970	2,26,984	55,239	10,77,466

An examination of these figures shows that oil sardines account for 24.6% of the total marine fish landings in India on the average, extreme figures being 9.8% (1963) and 33.5% (1968). The species listed under the category 'Other sardines' are mainly *Sardinella fimbriata*, *S. albella* and *S. gibbosa*.

OIL SARDINE FISHERY IN INDIA

Oil sardines are caught in India from the Maharashtra coast downwards, around Cape Comorin and upto the Andhra coast. Nevertheless, Kerala and Mysore coasts are the places of heaviest landings of this fish. Starting from July, the fishery extends upto about March, the peak months being October to December. Oil sardine is one of the most important items occurring in the mudbanks of Kerala coast every year during the heaviest south west monsoon period which incidentally happens to be a lean, if not famine affected season especially among the coastal population. Many a time, this fish has come to the rescue of especially the poorer sector

of the people during such seasons, when its cost also goes down due to heavy landings. Along with tapioca, a very cheap source of carbohydrates, sardine constitutes a balanced food, yielding high concentrations of fat, protein and mineral constituents.

BIOLOGY

The spawning grounds of oil sardines have not yet been correctly located. Biologists have estimated the life span of the fish to be three to four years and their lengths to be 10, 15 and 19 cm at the end of the first, second and third year of life respectively. It is supposed to spawn only once in its life time. The wide fluctuations occurring in the landings of the fish from year to year have also not yet been explained satisfactorily, even though some correlation has been shown to exist between its abundance and the presence of its chief food viz; *Fragilaria oceanica*, a diatom.

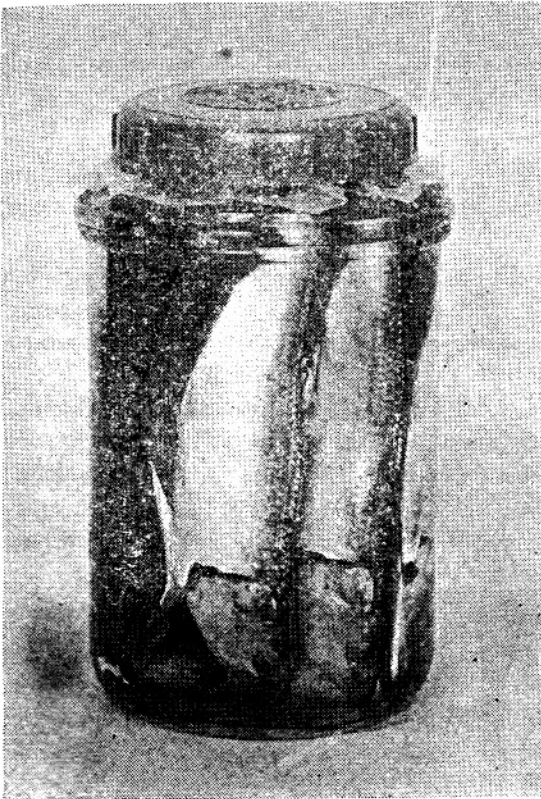
PRESERVATION

As indicated earlier, sardine fishery is a seasonal and localised one. There had been occasions in Kerala, especially during the mudbank seasons, when oil sardines had to be buried in coconut gardens as manure due to the heavy landings and lack of quick means of transport and scientific methods of preservation. But now times have changed for the better. Plenty of ice is used for its preservation and quick means of transport like trucks and lorries are engaged to transport fresh oil sardines to interior markets.

The commonest method of preservation of fish in our country, viz; salt

curing and drying, has limited application in the case of oil sardines because of their high fat content, which being rich in unsaturated fatty acids, undergoes rapid oxidation resulting in development of rancidity. However, wet curing is generally employed for preservation of this fish. In this method, the fish is cleaned, eviscerated and washed. Common salt is then applied in the ratio 1:5 (salt to fish) and stacked in cement tanks. The self brine formed covers the fish in about 48 hours. Generally, some weight is placed over the fish to ensure that they always remain under the brine which protects them from fungal, bacterial and oxidative deterioration. The fish is taken out of the brine according to demand and sent to the market without any drying. One serious defect in this method is that when once the fish is taken out of the brine it becomes inedible in about 10 to 15 days — fungus and red halophilic attack, severe rancidity and general putrefaction being the main causes of spoilage. But in case the salted fish is taken out of the salting tanks and packed in wooden barrels or earthenware vessels under a saturated solution of common salt, it remains well for a fairly long time during which it can be transported and disposed off in interior markets. This process is called "pickling" and involves the same principle as those of pickling of mangoes, limes etc. In case some bacteriostatic and fungistatic chemical compounds like benzoic acid or propionic acid or their sodium salts are incorporated in

the brine, the fish remains in edible condition for even an year.



"The Oil Sardine....."

The figure shows oil sardines pickled in saturated brine containing 0.1% propionic acid and photographed after six months of storage. The shining appearance of the surface is strikingly exhibited.

FREEZING

Even though freezing is the best method for preserving prawns, frog-legs, lobster tails etc., it is not quite suitable for preserving sardines because of their high fat contents which get rancid quickly even under frozen

storage. Another defect observed when oil sardines are frozen and thawed and when they are stored in ice, is the bursting of their bellies and oozing out of the intestines. Even though this does not affect the edibility of the fish to any extent, their consumer appeal and marketability go down. A simple method that has been reported recently to overcome this difficulty is to give a predrip treatment to the fish in 15% brine for 30 minutes before freezing or packing with ice and to avoid undue pressure on the fish during holding and transportation. Lack of demand in foreign markets for frozen sardines is yet another reason why freezing for preservation is not generally resorted to for oil sardines. The expenditure involved in freezing and storage enhances its cost beyond the reach of the common man which is a deterrent to application of this method of preservation for internal distribution. However, in case oil sardines are block frozen and immediately transported in thermocole insulated boxes to markets like Calcutta, they can be sold at a fairly good margin of profit. The insulation gives protection to the fish for the duration of transportation in the ordinary (uninsulated) brakevan of express trains involving a journey of upto three days at our ambient temperatures.

CANNING

A good portion of the oil sardines landed in India is preserved by the method of canning. Even though a part of our canned sardines is exported to the middle eastern and some European countries, the product mainly caters to our defence needs. A very small quantity of the product is sold in the internal markets also. Considering the magnitude of our oil sardine landings, we

could have easily captured the monopoly for this product in the international market but for the high cost of processing on account of the high prices of the imported tin container material and the vegetable oil used as the filling medium. This prevents us from competing with other producers of this commodity.

The fish is dressed and cleaned and salted by immersing in 15% brine for 15 minutes. The brine is then drained off, the fish arranged in cans and precooked at 0.35 kg/cm^2 steam pressure in an autoclave for 30 to 40 minutes. The 'cook drip' formed is drained off by keeping the can and contents inverted for a while, filled weight adjusted to the required level, hot refined vegetable oil added leaving a head space of about 3 mm, exhausted, double seamed and processed at 0.84 kg/cm^2 steam pressure for 70 to 75 minutes. After retorting, the cans are plunged into cold water, surface cleaned, labelled and packed.

SARDINE OIL

The industrial potentiality of the fish lies in its oil content, which of course fluctuates according to the season. Maximum oil content is met with in the months of October and November, the figure recorded being 56.8% of the dried fish. The minimum oil content occurs in the months of June and July, 7.7% on dry weight basis. An inverse relationship is found to exist between the oil and moisture contents of the oil sardines. The fat content increases with the size of the fish which is attributable to the fact that the food ingested is utilised for growth in the younger fish, whereas after attaining maturity, the food is stored in the body in the form of fat. Maximum fat content is observed

in the post monsoon period when there is intense feeding activity.

EXTRACTION OF THE OIL

The method employed at present in our country for extracting oil from the fish is an age-old and unscientific one handed down from father to son without the slightest improvement. The fish is taken in large iron vats and cooked with water. The oil that floats to the surface in this process is laddled off. The cooked fish is then taken in canvas bags and pressed in screw press. The mixture of oil and stick water that is squeezed out is collected in large cement tanks and allowed to settle for about two days when all the oil floats to the surface. The oil is separated and heated further to remove any traces water. The press cake is dried, powdered and used either as manure or for compounding cattle/poultry feed.

The method of extraction is defective in many ways. Since the iron vats used for cooking are not properly cleaned, they are invariably rusty and contamination of the oil with iron takes place in the process, which causes quick discolouration of the oil. As sufficient quantity of water is not often used during cooking, the fish undergoes partial charring and stick to the vat, which also contributes to the discolouration of the oil. Water and protein particles are not completely removed from the oil and hence they deteriorate during storage and impart a foul smell to the oil. This oil is generally employed for smearing on country crafts as a protective coating for the wooden surface against marine fouling organisms.

IMPROVED METHOD OF EXTRACTION OF OIL

An improved method of extraction of oil which takes care of all the above defects has been reported recently. It consists in using aluminium vessels instead of iron vats for cooking the fish, using sufficient water while cooking so as to ensure uniform cooking and prevent charring of the fish and salting out the oil from the oil-stick water emulsion which eliminates decomposition of the oil due to long contact with water in the usual settling process. The oil obtained in this way is golden yellow in colour with characteristic sardine odour and can straightaway be used for any industrial purpose, whereas that obtained by the traditional method has necessarily to be refined before putting to any industrial use, involving refining losses upto 50%. A method has also been reported recently for extracting good quality protein for human consumption from the press cake ('guano') obtained in this process.

INDUSTRIAL USES

Even though fish oils have been put to a variety of industrial uses in the developed countries, it is not so in our country. Sardine oil is put to very limited use at present in India in the steel industry for tempering and in the leather industry for fat liquoring. Many methods of industrial application of sardine oil have recently been reported in our country. If the oil is preheated and treated with sulphur at higher temperatures, a spongy mass resembling rubber is obtained which can be used as a rubber filling compound. The saturated portion of the fat called "Stearin" can be made to settle down by cooling (winterisation) and separated by filtration. The unsaturated portion, when heated for specified time

intervals and treated with rosin gives a resinous product well suited for use as a paint vehicle. If air is blown through the stearin separated fraction until the oil attains the required viscosity, it can be used as a lubricating oil either alone or in combination with other standard lubricating oils of mineral origin. When the stearin separated fraction is treated with small quantities of rosin and sulphur at higher temperatures and thoroughly mixed with lamp black, a good printing ink is obtained. Attempts have already been made for decolourising and deodourising sardine oil and hydrogenating it to yield a 'vanaspati' like product. The oil can also be used for preparing margarine as is done in other countries.

CONCLUSION

Oil sardine is the only one among the Indian fishes which offers so much potentialities as an industrial raw material, besides providing a cheap, delicious and nutritious food to the protein-starved millions of our country. But the purely seasonal nature and fluctuations in fishery as well as the oil content of the fish are powerful deterrents in starting an industry based on this fish alone. A good proposition will be to put up an oil extraction cum fish meal plant and extract and store as much oil as possible in the months of October-December for industrial uses and utilise the plant for fish meal production during the other season. All the small varieties of miscellaneous fish can be used for this latter purpose and the product is in great demand both in India and abroad for formulating cattle and poultry feed. A scientific approach on the lines indicated above is sure to go a long way in the economic utilisation of our largest marine fishery and consequently to the improvement of the economic condition of the fishermen and the country in general. ●●