

The Processing of the Anchovy: *Engraulis encrasicolus* Linnaeus

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I. Gastronomic Characteristics and Types of Products

Genuine cured anchovies are prepared exclusively from the fish of the species *Engraulis encrasicolus* Linnaeus of the clupeid family, by a process of salting and fermentation. This process goes back to ancient times and is common all along the Mediterranean coast and the Atlantic coast from the Gulf of Biscay down to the Straits of Gibraltar.

It is not known which particular factors in the composition of the fish give the final product its distinctive flavor. Experience has, however, demonstrated that the same process applied to sardines *Clupea pilchardus* or to sprats *Clupea sprattus* does not yield a product of a comparable quality by far. As a consequence, in France sardines and sprats are not used for salting—unless under exceptional circumstances, e.g., during the war when salting was almost the only available method for preserving fish.

Cured anchovies are sold on the retail market in the salted state, in 1/2- and 1-kg. containers, usually tin plate cans; in this case the consumer does the desalting and filleting, and usually lays the fillets overnight in oil. More often, however, the preparation is done in factories, and the fillets, either plain or each one rolled around a caper, are packed in small cans in oil, generally olive oil.

Anchovies are also ground to give anchovy paste, which, mixed with oil or butter, is sold in aluminum tubes or small jars under the names “anchovy cream” and “anchovy butter.”

II. Salting

The best anchovies for curing should be of a size corresponding to 35 to 40 fish per kilogram (16–18 fish per pound), and as fat as possible, which depends on the season.

As soon as they are brought to the factories from the fishing grounds, which are not far from the shores, the fish, when not beheaded and gutted immediately, are sprinkled with salt and placed in concrete vats or large wooden casks, and may be kept 2–3 days under these conditions.

It is, however, preferable to treat them as soon as they are landed.

If presalted, the anchovies are first rinsed with saturated brine. They are then beheaded and gutted, an operation done by hand by just breaking and pulling off the head, at which most of the entrails follow. No particular care is needed, and the operation is much easier and speedier than in the case of the sardines. Beheading results in a loss in weight of about 30%.

A layer of salt about 5 mm. ($3/16$ in.) thick is put at the bottom of the container; a layer of fish, arranged parallel to each other, is put over it, then a layer of salt, another layer of fish placed at right angles to the preceding ones, a layer of salt, and so on. A final layer of salt comes on top, and over it a wooden disk charged with weights (large stones or blocks of concrete) to keep the fish well pressed. It is estimated that this requires weights of about 5–6 kg. (11–13 lb.) per 10 kg. (22 lb.) of anchovies.

Two or three days later the fish will have sunk considerably; the top layer of salt is then removed, more fish added with fresh salt, and the pile again weighed down. Sometimes the weights are increased gradually, but there are no precise rules for this, and it is not known how much compression is necessary. The essential point is to expel all air bubbles and to avoid the access of air.

The containers used are wooden barrels with a capacity of 50, 100, or 200 kg. (110, 220, or 440 lb.), and also hot-dipped tin-plate cans, plain on the inside and generally lacquered on the outside, holding 20 kg. (44 lb.). Smaller cans, as a rule, are not used for curing, but only for packing and shipping the already cured anchovies.

It is considered very important that the salt be at least 99% pure, and particular virtues are attributed to salts of certain origins; no experimental research appears ever to have been carried out in these respects. No mention is made by practitioners of the bacteriological purity of the salt, although it may well be important for the subsequent keeping of the filleted fish, if not for the curing process itself.

III. Curing

Water and fat are pressed out of the fish and form on top of it a layer of brine, covered with fat. This liquid overflows and is collected and subsequently used to spray over the anchovies during the cure. This spraying is done regularly in order to maintain the level of the liquid layer above the fish, when the overflowing facilitates the elimination of fat, blood, and other organic matter brought out by the salting and the compression. Great importance is attached to the collection of this brine to which is attributed a great influence on the quality of the final product. If this brine is not available in sufficient quantity, then a fresh 25% brine is used.

The treatment is thus continued at room temperature, for at least 6–7 months, sometimes more, depending upon the actual temperature, until the odor, appearance, and taste show that the cure has reached the desired degree.

At this point the top layer of salt is removed, the uppermost layer of fish is rinsed with brine, fresh salt is added, and the container is closed and is ready for shipping.

Very little experimental work has been done on the curing of anchovies, and even less published; as a consequence, the process is carried out according to tradition, and most of what is known about it is empirical.

The main research work, to our knowledge, can be accredited to Charles Lepierre, of Instituto Português de Conservas de Peixe, followed up in recent years by J. Mercier Marques. It has been summed up in a report given at the 2nd International Congress on Canned Foods¹ and published in the papers of the Congress in French and in English.

Two important points result from Lepierre's work.

A. The curing process carried out in sterile containers and using sterile salt and new and sterile brine gives a product which is identical with the one obtained under standard conditions.

These findings upset the traditional belief that the use of old barrels and of old brine is indispensable to successful curing. As a consequence, it will be possible to insist on cleanliness where this is not sufficiently understood or practiced. This will definitely be to the advantage of the quality and uniformity of the finished product.

B. Too high a temperature, far from accelerating the curing, slows down the process and results in an unacceptable product.

¹ Lepierre, Ch., and Mercier Marques, J. (1951). Studies on the production of anchovies at the Portuguese Institute for Fish Preservation. *Proc. 2nd Intern. Congr. Canned Foods, Paris, 1951*, 6 pp.

The optimum temperature for the curing process has not yet been determined, nor the upper and lower limits of temperature range. From what is known from practice, it would appear that 15–20°C. (59–68°F.) is probably the most favorable range.

Lepierre concluded, at the end of his work, that no bacteria took part in the curing process, and that it was exclusively enzymic. Mercier Marques has definitely confirmed this conclusion; by following the increase of soluble nitrogen in the brine at various pH's, he has found that a pH of about 7.0 is the most favorable; furthermore, while malt extract or pepsin do not influence the curing, trypsin at pH 7.0 has a very marked accelerating effect: a perfectly cured product of very good quality could be obtained in 4 months by adding trypsin whereas the controls required 12 months. Research along these lines has been continued by J. Mercier Marques.²

Curing anchovies under almost sterile conditions may also improve the keeping quality of the fillets packed in oil. Due to the fact that the latter are partly desalted, they are apt to support the growth of certain halophilic bacteria and may sometimes spoil.

IV. Packing

A. WHOLE, SALTED

When the curing process is ended, as judged by the appearance and the flavor, the product has to be stored in a cool place, or the breakdown of the fish proteins will proceed too far and end in total liquefaction of the anchovies.

In most cases, salted anchovies are stored and shipped in the containers, barrels or large cans, in which they have been cured. Only a small proportion is repacked as such in smaller containers—mostly 1/2-kg. or 1-kg. cans, but also earthenware jugs and glass jars—for the retail market.

B. FILLETS IN OIL

Cured anchovies, as such, need to be desalted and filleted before eating, and while this operation is still practiced in restaurants, the home consumer generally prefers to purchase the product ready for the table.

This final preparation takes place to a certain extent in some of the factories where the salting and curing have been performed; in most cases, however, separate establishments specialize either in the salting and curing or in the packing as fillets in oil, generally olive.

² Mercier Marques, J. (1959). Le procédé industriel de l'anchoïtage. *Rept. Intern. Permanent Comm. Canned Foods, Lisbon, 1959*, 7 pp.

Desalting and filleting are done entirely by hand, and are a costly operation because of the labor involved.

1. The cured anchovies are given a rapid washing, of about 15 seconds, in a more or less concentrated brine. The tendency is to use a brine of as low concentration as is compatible with the keeping quality of the final product; and this depends of course on the subsequent marketing, whether for rapid consumption in cool climates and nearby markets, or for shipping to large distances and for distribution in warm countries. Anchovy fillets of lower salt content are preferred, but will not keep long.

2. After rinsing, the entrails are removed, starting from the collar, with a finger, and without opening up the belly.

3. The skin is then rubbed off with the help of a coarse cotton cloth.

4. The next operation consists in trimming the tail fin, with scissors.

5. The fish is now ready for filleting: (a) the anchovy is opened up along the middle of the back; (b) one fillet is removed, trimmed and cleaned by scraping lightly with a knife; (c) the backbone, which is on the other fillet, is broken in the middle, and removed in two parts; (d) the second fillet is then handled as the first one; (e) the individual fillets are laid, inside up, on a clean and dry towel or on blotting paper.

6. A second towel is laid on the fillets, and pressed lightly upon them either by hand or with a rolling pin. This step has been improved in some Spanish factories by the use of a small centrifuge, in which the "sandwiches" of anchovy fillets between cotton cloths are placed vertically all around the rotating basket. The elimination of moisture is thus accelerated.

7. The fillets are finally packed in cans, in which some oil has previously been put. The fillets are carefully laid in successive layers, and the whole is covered with oil, usually olive. Plain cans are generally used, but some packers prefer inside-lacquered ones. After closing, the cans are not given any heat treatment.

C. APPETIZERS AND OTHER PREPARATIONS

The anchovies are filleted as above, and each fillet is rolled around a cured olive, a caper, or some other vinegar-pickled vegetable; the rolls are then put into the cans and covered with oil. Lacquered cans are preferred.

Fillets of anchovies, flat or rolled, are also prepared in "sauce piquante," a spiced sauce containing oil, vinegar, and mustard.

Furthermore, the following pasty products, usually packed in soft aluminum tubes, are on the market:

(a) "pâte d'anchois" (anchovy paste), with a minimum content of 90% anchovies;

(b) "crème d'anchois" (anchovy cream), made with at least 75% anchovies and 10% oil;

(c) "beurre d'anchois" (anchovy butter), made with at least 75% anchovies and 10% butter.

V. Warehousing

Anchovies, whether in salt as cured or as fillets in oil, are what is termed a semi-preserve (in French, "semi-conserve") and will not keep long unless stored cool.

One type of spoilage is unavoidable even at low temperatures: it results from the enzymic processes, which go on and may end in complete digestion of the flesh proteins. Cool storage slows it down, however, and is in effect the only method which makes it possible to increase the keeping period.

Bacterial spoilage occurs, too, not in the salted cured stock, but in fillets in oil or similar preparations. It is erratic, and depends, as may be expected, upon the initial contamination of the fish, upon the sanitary conditions of the factory, and the degree of desalting.

Experimental investigations carried out in the author's laboratory indicate that desalting should go hand in hand with a certain degree of drying, so that the water remaining in the tissues of the fish may always be saturated with salt. Excessive removal of water, however, will result in a tough texture—and does not preclude the necessity of cool storage, unless a preservative is used. This is not permitted in all countries, e.g., in France.

VI. Regulations

French regulations concerning canned marine products are issued at two levels (see also Volume IV, Chapter 5): general rules are embodied in decrees and "arrêtés," issued under the authority of the Ministry of Agriculture by the Service de la Répression des Fraudes (corresponding to the U.S. Food and Drug Administration), and more detailed definitions and specifications are given by "décisions" of the Confédération des Industries de Traitement des Produits des Pêches Maritimes.

The general definition of "semi-conserves" (semi-preserved) is contained in the decree of February 10, 1955.

Decisions Nos. 60 and 61 of the Confédération des Industries de Traitement des Produits des Pêches Maritimes give more detailed rules

relating to the preparation and labeling of "semi-conserves" of fish, and particularly of anchovies.

Regarding the latter, it is stated that anchovy fillets in oil shall show a drained weight of at least 75% when packed flat, and 70% when rolled; the net weight for any single can shall not be less than 96% of the weight stated on the label.

All containers shall bear the words "semi-serve" and "à tenir au frais" (to be kept cool) in type not less than 4 mm. (0.16 in.) high, as well as the name or identification number of the factory and the date of packing. Guaranty of good preservation is limited to 6 months.

Like all other canned fish products, canned anchovies intended for export are submitted to a special inspection, and cannot be shipped unless they have obtained a "certificat de contrôle à l'exportation" (export inspection certificate).

Closely related regulations are applied in other anchovy-producing countries, principally Yugoslavia and Italy.