




Guidelines for
**Salting
&
Drying**

Contact Us
Veraval Research Centre
ICAR- Central Institute of Fisheries Technology
Matsyabhavan, Bhidia, Veraval, Gujarat 362269

 veravalcift@gmail.com

 02876 231297



Veraval Research Centre
ICAR- Central Institute of Fisheries Technology
Matsyabhavan, Bhidia, Veraval, Gujarat

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 02876 231297

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Compilation & Editing

Sarika K.

Sreejith S.

Ashish Kumar Jha

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Veraval Research Centre
ICAR- Central Institute of Fisheries Technology
(Indian Council of Agricultural Research)

Matsyabhavan, Bhidia, Veraval, Gujarat



Published by: Dr. George Ninan
Director
ICAR-CIFT, Cochin

Produced by: Dr. Ashish Kumar Jha
Scientist-in-Charge
ICAR-CIFT, Veraval, Gujarat

**Compiled &
Edited by : Sarika K.**
Sreejith S.
Ashish Kumar Jha

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Technical Assistance

Parmar Ejaz A. Rahim
Kriplani Yogeshkumar Dharamdas

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Veraval Research Centre
ICAR- Central Institute of Fisheries Technology
Matsyabhavan, Bhidia, Veraval, Gujarat
e-mail: veravalcift@gmail.com
Phone: 02876 231297
Fax: 02876 231576



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Introduction

Fish curing is a time-honored practice employed for the preservation of fish that are not immediately consumed or sold in their fresh state. In India, approximately 30% of the total fish catch is preserved through curing, which encompasses salting, drying, smoking or a combination of these techniques. Export data during 2018–2021 period showed an annual dried fish products export contributed about 85000–95000 MT quantity, valued about 1200 crores. Despite advancements in fishing methods and modern processing facilities that have increased the availability of fresh fish and the production of value-added products, curing remains the most cost-effective means of fish preservation.

Traditional fish processing methods, including salting, drying, smoking, marination and fermentation collectively fall under the category of curing. These techniques can be applied individually or in combination. Salting involves various approaches such as brining, wet-salting, dry-salting or pickling all conducted under stringent hygiene and temperature control measures. Drying fish entails the removal of moisture through evaporation and can be accomplished using traditional sun-drying techniques or artificial/mechanical drying methods. The smoking of fish involves subjecting it to smoke generated from smoldering wood or plant materials. This process typically combines salting, drying, heating, and smoking within a smoking chamber. Fermentation, on the other hand, is the process by which organic substances transformed into simpler compounds either through the action of microorganisms or enzymes. Salt and carbohydrates are often used to expedite this process in most cases.

Guidelines for salting and drying of fish

General

- Fish after catch should immediately washed in potable water to remove slime, adhering dirt, etc. and can be taken to the fish curing yard, where strict hygienic measures have to be taken to maintain the quality of material
- **Gutting and Cleaning:** Fishes (medium & large varieties) should be gutted and washed to remove blood and other unwanted matter. For small fish varieties gutting is not required, but have to be washed properly before drying
- It is advisable to remove the scales to improve the appearance of the final cured product
- **Preparing for salting:** Fish should be dressed in butterfly style (split by a cut made parallel to the backbone straight down from the throat or nape to the tail). If the backbone is to be removed, the fish should be split so deeply that the remains of the backbone (the tail-bone) lie free
- The dressed fish is then washed in potable water and allowed to drain completely using perforated plastic containers
- All processing work should be done on cleaned tables to avoid contamination from sand, dirt etc.
- It is advisable to use potable water or chlorinated water of 2 ppm for washing fish and up to 10 ppm for cleaning utensils, crates etc.

Salting

- Separate room shall be provided for salting, away from other processing areas, with proper drainage facilities to drain the waste water directly into drain
- The room shall have enough ventilation and exhaust facilities to prevent excess humidity
- The processing lines should be designed in a continuous and sequential way, to permit uniform flow without delay and removal of waste
- The containers used for salting shall be smooth, easy to clean and shall be constructed in such a way to avoid contamination
- Containers /vats should be cleaned with bleaching powder and use lids for covering the containers/vats

Salt requirements

- Salt used for salting of fish should be food grade and meet adequate quality standards
- Salt used for salting shall be free from halophilic bacteria and mould and tested batch-wise for purity, Coagulase +ve Staphylococcus and sulphite reducing Clostridium bacteria
- Salt should be clean, not used before, free from foreign matter or other extraneous materials
- The size of the salt granules used should be carefully considered. The use of very fine or very coarse salt granules is not favorable. A mixture of two is advisable
- Salt used should be stored dry and hygienically in salt bins/storerrooms/containers or in plastic sacks

Brining requirements

- Potable water should be used for the preparation of brine
- The ratio of brine to fish and the concentration of the brine should be adjusted to the desired product
- Concentration of brine should be checked at regular intervals and should be adjusted prior to use
- During salting operation, care shall be taken so that even the top layer of the fish is properly kept immersed in brine solution. For submerging fish in brine, racks can be used which also reduces the infestation of blowfly larvae
- To ensure proper salt penetration, fishes should be of similar size

Types of salting

(a) Dry-salting

Most widely practiced method of drying and advisable to any size of fish, except fatty fishes. The process flow is as after cleaning, gutting and beheading of fish, salting can be done, then stacked in cement tanks or containers layered with salt and applied weight above for 24-48hrs to get better penetration of salt. Soon after salting, fishes were washed in brine to remove the excess salt and then drained properly before drying. Final products having a moisture content of 25% or below will have a shelf life of 3-4 months under ambient conditions.

- For dry salting the ratios of salt to fish 1:3 or 1:4 (big or medium sized) and 1:10 (small sized) depending upon the size of the fish
- Fish for dry salting should be carefully stacked (one layer salt and one layer fish) such that spaces between fishes are minimized and that drainage is adequate

- Fish should be re-stacked periodically with the top of the pile going to the bottom of the new pile, and with the addition of fresh salt to ensure that sufficient salt will be present to complete the cure

(b) Wet-salting

In wet salting, after cleaning, gutting and beheading, salting is done in similar way as in dry salting but the fish kept in tank is allowed to remain in the self-brine without further drying. Before marketing, fishes are taken, drained and packed. This particular method is suitable for only fatty fishes. The wet salted fishes having a moisture content in the range of 50-55% observed to have short shelf life.

- After salting, the fish can be stacked. This should not be done before the proper salt/water balance has been reached. In stacking, adequate amounts of salt should be added and evenly distributed over the whole surface of the fish
- Salted fish should be stored or maintained for a sufficient period under controlled temperatures to ensure proper curing and to prevent deterioration of the product

(c) Pickling/Pickle Salting

This method of curing is similar to wet salting, where fish is layered by granular salt, dissolves in the surface moisture of fish, forming solution. This will help in removing moisture from fish and the fish remain in self-brine.

- Pickling is primarily used for fatty fish
- The amount of salt must be adjusted to the quality of the fatty fish (fat content)
- Salt, sugar and spices should be weighed/measured and be evenly distributed
- During the pickling operation, all fish should be well immersed in the resulting pickle
- Fish should be allowed to settle in containers and then salt or pickle can be added before the container is closed
- Cured fatty fish should be kept in brine or pickle

Maturing

- Maturing time depends on the fish (species, size and quality), temperature and the amount of salt absorbed by the fish tissues
- In histamine forming fishes, salt curing should be done at temperatures between 0°C - 5 °C to prevent development of histamine
- The length of maturation period will vary from weeks to several months depending on the specific products. If the containers are to be held at lower temperatures, the maturing period will increase
- After maturation salted fish can be stored in chilled conditions
- The temperature during chilled storage should be between 1°C - 4 °C

- Temperature and storage time should be monitored and recorded at regular intervals
- The products should be handled carefully and not be over stacked
- Salted fish can be hygienically packed and stored

Drying

- Drying is the removal of water from fish by evaporation
 - Fishes either salted or not salted can be used for drying
 - In salted fish after salt maturation it has to be taken out and rinsed with fresh brine, drained and dried
 - The time and temperature used for drying will depend on fish species and size
 - Fish must be dried to moisture content of 25% or below
 - At every stage, extreme care must be taken to maintain proper standards of hygiene
- Basically two methods of fish drying are practiced

(i) Natural drying

- Fish shall not be kept on floor for drying
- Separate area, well protected from entry of flies, birds, dust etc., with drying platforms (raised cement platforms or bamboo lattices) or with smooth walls and floors for easy cleaning and sanitation shall be provided for drying
- Using a stackable rack or mats, which are easily carried indoors in case of sudden rains, is advisable in open drying

- If the drying yard is covered with transparent synthetic sheets like polypropylene, it shall be ensured that proper exhaust facilities are provided to avoid condensation / excess humidity
- Drying yard shall have separate entry and exit points to avoid cross contamination
- In case of scaffold drying, while hanging the fish on scaffolds, the lower row of fish shall be at least 0.8 meter above the ground level

(ii) Mechanical drying

- In mechanical dryer, drying chamber shall be smooth, easy to clean and disinfect and shall not impart contamination to the fishery products
- Use of high temperatures in dryer can causes problems like case hardening and should be avoided; proper exhaust facilities shall be provided to avoid condensation of moisture



- The drying chamber shall be fitted with temperature recording device and requires periodical monitoring

Packaging material

- Packaging material should be a food-grade material with good mechanical strength and barrier protection
- For bulk packaging of dried fish, high density polythene woven gusseted bags laminated with 100 gauge low density polythene are suitable
- For consumer retail packs of dry fish, polyester - polythene laminated pouches are advisable
- Adequate labelling should be done in the packaging



Packing area

- The packing area shall have adequate ventilation, natural or artificial lighting (110-220 Lux) and is protected from the entry of flies, pests, dust etc.
- Provisions for controlling excess humidity inside the packing area shall be provided

Storage area

- The storage area shall be so constructed to preclude contamination and to avoid excess humidity
- Suitable devices for measuring humidity shall be installed and the level of humidity of storage area shall be monitored at regular intervals

Quality Requirements

Salted fish/dried salted fish

As per the Food Safety and Standards (food products standards and food additives) Regulations, 2011, Dried/ salted and dried fishery products means the product prepared from fresh or wholesome fish after drying with or without addition of salt.

The products shall conform to the following microbiological and chemical requirements

SL No	Characteristics	Requirements
1	Water activity (a_w) at 25°C	Less than 0.78
2	Salt Content (% Sodium Chloride)*	Not less than 12 %
3	Histamine** content, max.	200 mg/Kg
4	Acid Insoluble Ash on dry basis N	Not more than 1%

*Requirement of salt content is only applicable to dry salted fishery products.

** Requirement of Histamine content is only applicable for dried/dry-salted fishery products prepared from histamine poisoning fishes.

Additionally biochemical parameters like TVB-n, TMA, PV, FFA and TBA can also be checked to ensure the quality of the product.

Microbiological Requirements

Microbiological requirements for fish and fishery products – as per Food Safety and Standards (Food products Standards and Food Additives) regulations, 2011

Hygiene Indicator Organisms	Aerobic Plate count				Coagulase positive Staphylococci				Yeast & mold count				Stage where criterion applies	Action in case of unsatisfactory results
	Sampling Plan		Limits (cfu/g)		Sampling Plan		Limits (cfu/g)		Sampling Plan		Limits (cfu/g)			
	n	c	m	M	n	c	m	M	n	c	m	M		
	5	0	1 x 10 ⁵	-	-	-	-	5	2	100	500		End of Manufacturing process	Improvement in hygiene; Selection of raw material; Adequate drying (water activity ≤ 0.78)

Safety Indicator Organisms	<i>Escherichia coli</i>				<i>Salmonella</i>				<i>Vibrio cholerae</i> (O1 and O139)				<i>Listeria monocytogenes</i>			
	Sampling Plan		Limits (MPN/g)		Sampling Plan		Limits		Sampling Plan		Limits		Sampling Plan		Limits	
	n	c	m	M	n	c	m	M	n	c	m	M	n	c	m	M
	5	0	20		5	0	Absent /25g		-	-	-					

n = No. of units comprising a sample; c = Max. allowable no. of units having counts above m; m = Limit that may be exceeded no. of units; M = Limit that no sample may exceed

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3. Code of Practice for Fish and Fishery Products. CAC/RCP 52-2003
4. Standard for salted fish and dried salted fish of the gadidae family of fishes codex standard 167 - 1989
5. Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011
6. F.No. 1-10(1)/Standards/SP9Fish and Fisheries Products)/FSSAI-2013, dated 11th January, 2016;

