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EAST AFRICAN STANDARD

Cured fish and fishery products — Processing and storage — Code of practice



EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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Introduction

Salting fish and drying in the sun is one of the oldest, easiest and cheapest methods of preservation techniques developed by human being. For several years, salting fish remained unchanged as the major preservation method. With the development of modern methods of food preservation, such as freezing and canning, and with the greater facilities for transportation of fresh fish in refrigerated vehicles, the salting and drying processes have lost their previous importance. Still these traditional techniques continue to enjoy popular appeal since they are low cost technologies easily adoptable in rural conditions. However, thousands of tons of salted fish are lost every year all around the world, and the major portion of these products are poor both in quality and nutritive value.

This Code is intended for those engaged in the fish curing industry. It contains technological and essential hygiene requirements for the preparation and storage of sun-dried, salted-and-dried fish and fishery products and is based on long established traditional commercial practices duly revised in the light of scientific research.

In the preparation of this East African Standard, the following sources were consulted extensively:

IS 14516:1998(R2003), *Cured Fish and Fishery Products — Processing and Storage — Code of Practice*

CAC/RCP 52:2003(Rev. 4:2008), *Code of practice for fish and fishery products*

IS 4303-1:1975, *Code of hygienic conditions for fish industry — Part 1: Pre-processing stage*

IS 4303-2:1975, *Code of hygienic conditions for fish industry — Part 2: Canning stage*

Codex Alimentarius website: http://www.codexalimentarius.net/mrls/vetdrugs/jsp/vetd_q-e.jsp

USDA Foreign Agricultural Service website: <http://www.mrlatabase.com>

USDA Agricultural Marketing Service website: <http://www.ams.usda.gov/AMSV1.0/Standards>

European Union: http://ec.europa.eu/enterprise/sectors/pharmaceuticals/veterinary-use/maximum-residue-limits/index_en.htm

Assistance derived from these sources is hereby acknowledged.

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Draft for comments only — Not to be cited as East African Standard

Cured fish and fishery products — Processing and storage — Code of practice

1 Scope

This code provides the technological guidelines and essential requirements of hygiene for processing, handling and storage of cured fish and fishery products.

NOTE This code applies to sun-dried, salted and dried fish and fishery products.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CAC/GL 21, *Principles for the establishment and application of microbiological criteria for foods*

CAC/RCP 1, *Recommended international code of practice — General principles of food hygiene*

CAC/GL 30, *Principles and guidelines for the conduct of microbiological risk assessment*

CAC/GL 31, *Guidelines for the sensory evaluation of fish and shellfish in laboratories*

CAC/GL 48, *Model certificate for fish and fishery products*

CAC/RCP 52, *Code of practice for fish and fishery products*

CAC/GL 53, *Guidelines on the judgement of equivalence of sanitary measures associated with food inspection and certification systems*

EAS 38, *Labelling of prepackaged foods — Specification*

3 Definitions

For the purpose of this standard the following definitions shall apply.

3.1

brine

a solution of edible common salt (Sodium chloride) in potable water

3.2

clean water

water which meets the same microbiological standards as potable water and is free from objectionable substances

3.3

cleaning

the process of removal of objectionable matter from fish surface

3.4

chilling

process of cooling fish to a temperature approaching that of melting ice

3.5

chlorinated water

potable water containing appropriate amounts of available chlorine

3.6

contamination

direct or indirect transmission of objectionable matter or microorganisms to the fish or salt

3.7

disinfection

reduction, without adversely affecting the fish, by means of hygienically satisfactory chemical agents and/or physical methods, of the number of microorganisms, to a level that will not lead to harmful contamination of fish

3.8

dry-salting or kench curing

process of mixing fish with dry food grade common salt (sodium chloride) in such a manner that the resulting brine drains away

3.9

equipment

all processing machines, tables, sinks, utensils, tanks, racks, etc, used in a fishery products plant

3.10

fatty fish

fish that when alive contains more than 2 percent fat or oil in the flesh

3.11

fillet

a slice of fish of irregular size and shape removed from the carcass by cuts made parallel to the back bone

3.12

fish

any of the cold-blooded aquatic vertebrate animals such as *Pisces*, *Elasmobranchs* and *Cyclostomes*. The term also includes, unless specifically excluded, molluscs and crustaceans. Aquatic mammals, amphibians and reptiles are not included.

3.13

fish handling

any operation in the preparation, processing, packaging and other related work

3.14

food additive/preservative

any substances not normally used as a typical ingredient of the food, the intentional addition of which alters advantageously the characteristics of the food

3.15

fresh fish

freshly caught fish which has received no preservative treatment or which has been preserved only by chilling

3.16

lean fish

fish that when alive contains 2 percent or less of fat or oil in the flesh

3.17

pickling or pickle curing

process whereby fish is mixed with food grade common salt (sodium chloride) and is stored in the resultant brine which is formed by dissolution of salt in the fish tissue water

3.18

plant

building(s) or area(s) in which fish is handled and processed

3.19**potable water**

fresh water fit for human consumption

3.20**salt**

sodium chloride of an appropriate quality suitable for the purpose

3.21**salted fish**

fish which have been salted by brining, dry-salting, pickle curing or a combination of these treatments

3.22**scaling**

process of removing scales from the fish body using suitable instruments without cutting the flesh or disfiguring the body

3.23**scoring**

opening the thick parts of muscle by cuts to allow better salt penetration

3.24**splitting**

process of cutting open the belly all the way along the back bone to the tail

3.25**suitable corrosion resistant material**

Impervious material free from pits, crevices and scales, is non-toxic and unaffected by sea-water, ice, fish slime or any other corrosive substances with which it is likely to come in contact. Its surface must be smooth and it must be capable of withstanding exposure 10 repeated cleaning, including the use of detergents and disinfectants.

3.26**thawing**

process by which heat is introduced into the frozen product to raise its temperature above freezing point

4 Raw material requirements

4.1 No fish or ingredients which have deteriorated or decomposed, or are contaminated to an extent which renders them unfit for human consumption, shall be used for the processing of fish by drying or salting. Fish in a diseased or damaged condition shall be discarded.

4.2 Raw material shall be rejected if it contains harmful, decomposed or extraneous substances which will not be removed to acceptable levels by the normal procedures of sorting or preparation.

5 Curing yard facilities and operating requirements**5.1 Plant construction and layout****5.1.1 General considerations**

5.1.1.1 Fish curing yards should be so designed that all handling and processing operations can be carried out efficiently, and all materials and products can pass from one stage of processing to the next in an orderly manner with minimum delay (see Figure 1).

5.1.1.2 In order to prevent cross-contamination between different processing activities and to safeguard the wholesomeness and quality of cured fish, the following operation shall be conducted in well defined areas of adequate size:

- a) Receiving and storage of raw materials;
- b) Processing (dressing, cleaning, salting, drying);
- c) Treating with preservatives;
- d) Sorting and packaging;
- e) Storage of final product; and
- f) Disposal of processing wastes.

5.1.1.3 The fish handling and storage areas shall be strictly kept separate and away from the following:

- a) Dumping of waste materials;
- b) Storage of packaging materials;
- c) Storage of cleaning and disinfecting compounds;
- d) Living quarters of personnel; and
- e) Toilets.

5.1.2 Construction

5.1.2.1 The plant and surrounding area shall be maintained in such a way that they are reasonably free from objectionable odours, flies, dust or other contaminants. The processing hall shall be of sufficient size with adequate moving space. It shall be designed and built to protect against the entrance and harbouring of insects, birds or rodents and permit easy and adequate cleaning.

The location of the curing yard, its design, layout and construction should be planned with proper emphasis on the hygiene aspects.

5.1.2.2 Floors shall be hard surfaced, non-absorbent and adequately drained. Floors shall be constructed of durable, water-proof, non-toxic, non-absorbent material and shall be easy to clean and disinfect. They shall be non-slippery, without crevices and shall slope evenly and sufficiently for liquids to drain off to trapped outlets fitted with removable grills of suitable mesh size.

5.1.2.3 Drains shall be adequate, fitted with traps and with removable gratings to facilitate maximum flow of effluents without any overflowing. Drainage lines should have a minimum internal diameter of 10 cm.

5.1.2.4 Internal walls shall be smooth, waterproof, readily cleanable and without any crevices or projections. Pipes or cables shall be concealed within the wall surface or neatly boxed without giving chances for insect harbourage.

5.1.2.5 Windows shall be of adequate size, fitted with removable fly-proof nets made of corrosion-free material. Window sills shall be at least 1 m above the floor.

5.1.2.6 Separate doors, fitted with door closers, shall be provided for movement of fish or products and for staff access.

5.1.2.7 Ceilings should be so designed and constructed as to prevent accumulation of dirt, dust and mould, and flaking. The roof-wall joint shall be tight to avoid entry of rodents, etc.

Ceilings shall be minimum 3 m in height. In buildings with thatched roof, a false ceiling without crevices or joints, and which can be easily cleaned, shall be provided.

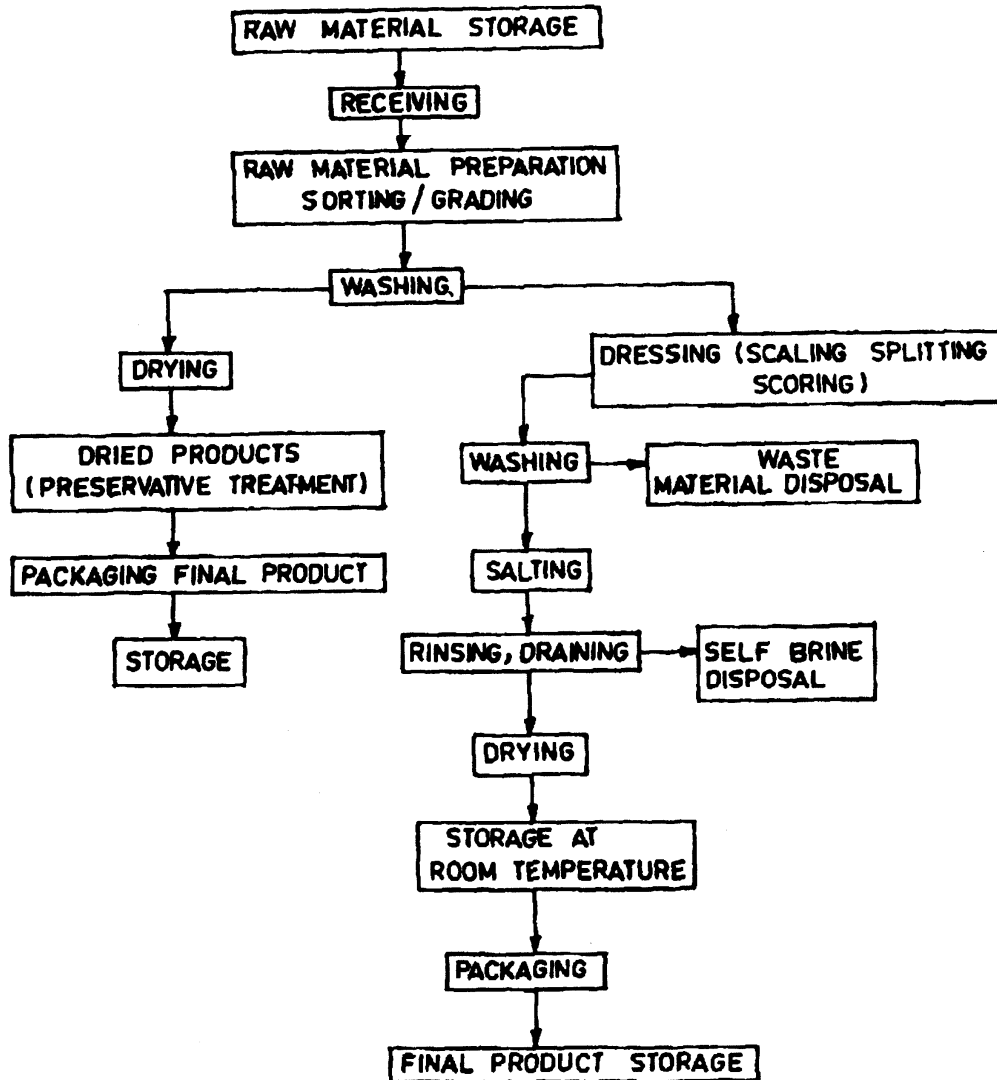


Figure 1 — Flow diagram for fish curing operation

5.1.2.8 Since good ventilation is important to prevent condensation and growth of moulds in overhead structures, the processing hall shall be well ventilated to prevent heat, dust, vapour, etc. The air flow shall be from the more hygienic areas to the less hygienic areas.

5.1.2.9 The working areas shall be sufficiently illuminated. Light bulbs shall not be fitted above work tables so as to avoid contamination with glass pieces in case of accidental breakage. It is desirable to have the light fixtures fitted close to the ceilings to prevent accumulation of dust on them.

5.1.2.10 Separate and adequate storage shall be provided for utensils, cutting knives, drying racks, etc, used for processing work.

5.1.3 Hygiene

5.1.3.1 Areas where raw materials are received, stored or handled shall be separated from the areas in which product preparation, processing and packaging are conducted. Receiving and storage areas shall be well ventilated, clean and shall provide protection to the fish from deterioration and contamination.

5.1.3.2 A separate refuse area or suitable facilities shall be provided outside the premises with easy access for vehicles loading and unloading. If processing waste, brine, etc, are to be collected and stored before disposal, adequate precautions shall be taken to keep it out of reach of rodents, flies, insects, etc. These areas shall be cleaned and disinfected regularly.

5.1.3.3 The processing of by-products shall be done in separate enclosed premises so that there is no possibility for contamination with the cured products.

5.1.3.4 Supply of potable running water under adequate pressure shall be available at various points during working hours. The water supply used for cleaning purposes shall be fitted with an in-line chlorination system.

5.1.3.5 Ice shall be made from potable water and shall be manufactured, handled and stored free of contamination. Suitable storage facilities shall be provided to protect the ice from excessive melting and to prevent contamination from dust, bits of wood or saw dust, straw, rust, microorganisms and other contaminants.

5.1.3.6 Salt and other ingredients used shall be of food grade and stored dry.

5.1.3.7 Storage facilities shall be available for the proper dry storage of packaging materials free from contamination.

5.1.3.8 Cleaning compounds, disinfectants, detergents, etc, shall be kept in separate rooms designed and marked specifically for the purpose. All such materials shall be prominently labelled.

5.2 Equipment, utensils and working surfaces

5.2.1 General considerations

5.2.1.1 All contact-surfaces and equipments that are likely to come into contact with fish shall be made of material which does not transmit toxic substances, odours or tastes to the product. Such surfaces shall be non-absorbent, resistant to corrosion and capable of withstanding repeated cleaning and disinfection. They shall be smooth and free from pits and crevices.

5.2.1.2 Boards and other surfaces on which fish are cut should be made of impervious materials which meet the physical requirements for cutting surfaces. Wooden surfaces soon become water logged and hard to clean and hence shall not be used.

5.2.1.3 Brining/salting vats shall be made of suitable corrosion-resistant material and so constructed as to permit easy cleaning and complete drainage.

The vats/tanks shall be of proper size with drain holes near the bottom to make cleaning and draining easy and effective. They shall be provided with lids of non-corrosive materials. Utensils with rollers/wheels, which can be rolled out of the premises for cleaning and drying in the sun are to be preferred.

5.2.1.4 Fish shall not be carried in open vehicles or trolleys. The vehicles should provide adequate refrigeration and shall have adequately insulated walls, roof and floor to protect fish from warming up during transportation and shall be of such material and construction as to permit easy and thorough cleaning.

5.2.2 Drying equipments

5.2.2.1 The fish drying racks shall be made of materials which can be cleaned and disinfected easily. The size of the racks should be adequate for easy operations. The height of racks from the floor shall be sufficient enough to keep the fish away from sand particles blown by wind.

The drying area shall have breezy surroundings with proper access for sunlight. When a number of racks are provided in an area, care should be taken not to overcrowd. The racks shall be covered with nylon nets to ward off birds, rodents, etc. The floor on which the racks are fixed, shall be of clean

surface, properly cemented without crevices or pits and so designed as to make cleaning easy and effective.

5.3 Hygienic operating requirements

5.3.1 Fish intended for curing shall always be treated in a hygienic manner. Precautions shall be taken at all times to protect the fish from contamination by objectionable substances. Preparatory operations and the packaging operations shall be so timed as to prevent deterioration or spoilage.

5.3.2 Strict hygienic procedures shall be observed during handling, processing, packaging and storage of products to prevent contamination and proliferation of *Clostridium botulinum*, *Salmonella*, *V. cholerae* or other pathogens that can cause food-borne intoxication.

In fish, lightly salted (with less than 5 percent common salt), the outgrowth of these organisms may not be preventable. In such cases the effective method of avoiding microbial contamination is the strict observance of hygienic and good manufacturing practice during handling and processing fish.

5.3.3 The building, equipment, utensils and other physical facilities of the plant should be kept in an orderly and hygienic condition.

5.3.4 The following cleaning schedule shall be followed before and after each shift of work:

- a) Wash the utensils in running potable water to remove solid fish particles, slime, etc.
- b) Spray a suitable non-corrosive detergent at a concentration of 0.5 percent followed by scrubbing with hand brush to remove slime. Flush with potable water.
- c) Immerse the utensils in water chlorinated to a residual level of 100 mg/kg for 15 minutes. For cleaning the floor, water chlorinated to a residual level of 500 mg/kg shall be used.
- d) Finally, wash with potable water (chlorinated to 10 mg/kg level).

The same cleaning schedule is applicable to equipments; fish carrier vans, etc.

5.3.5 Splitting and cutting board shall be frequently and thoroughly scrubbed and treated with disinfectant and flushed with running potable water.

5.3.6 The degree of microbial contamination found on fish and fish products is related to the microbial contamination of the working surfaces on which they are processed. All such surfaces shall, therefore, be cleaned, scrubbed and disinfected frequently.

5.3.7 Cutting knives, salting tanks, drying racks, and other food contact surfaces shall be protected from contamination.

5.3.8 Cleaned and disinfected portable equipments and utensils shall be stored above the floor in a clean, dry location. Knives, utensils, etc. shall be air-dried before being stored in a self-draining position on hooks or racks made of corrosion resistant material.

5.3.9 Special care shall be taken to clean salting tanks as frequently as necessary to prevent accumulation of fatty scum and deposition of sludge and of solid salt, fish residues and other foreign materials.

5.3.10 There are always impurities left in the tank after the salted fish has been removed for drying. These consist of crystals of salt, particles of dirt, fish scales, slime, fish oil, blood, etc. Such impurities shall be removed by flushing with water, scrubbing and emptying the tanks through the drain hole and then disinfecting.

5.3.11 Removal of solid, semi-solid or liquid wastes from fish unloading, holding or processing areas shall be on a continuous basis using water and/or appropriate equipment so that these areas are kept clean and the chances for product contamination are excluded.

5.3.11 Containers, conveyors, bins or storage bays used for removal, collection or storage of fish offal and other waste shall be frequently subjected to the cleaning schedule. Arrangements for removal and disposal of fish wastes shall be approved by the appropriate official agency having jurisdiction.

5.3.13 An effective and continuous programme for the control of animals, insects, birds, rodents, etc, within the premises shall be maintained. All rodenticides, fumigants, insecticides or other harmful substances used shall be those which are permissible under regulation and shall be stored in separate rooms, handled only by trained personnel.

5.3.14 All persons working in the plant shall maintain a high degree of personal cleanliness and should take all necessary precautions to prevent contamination of fish or fish products.

5.3.14.1 All employees shall wear clean light-coloured protective clothing, head covering and footwear which are washable or disposable. The use of water proof aprons, where appropriate, is recommended. Light colours are required to assess visually the cleanliness of the garment.

5.3.14.2 Gloves used shall be in a sound, clean and hygienic condition and shall be made of impermeable material. Hands shall be washed with soap from elbow down and disinfected with a suitable sanitizer before commencing work, after visiting the toilet, before resuming work and whenever otherwise necessary.

5.3.15 No person who is known or suspected to be suffering from or who is a carrier of a disease likely to be transmitted through food, or has an infected wound or open lesion, shall be engaged in processing work.

5.4 Processing practices

5.4.1 General considerations

Spoiled or damaged fish shall not be employed for curing. Salting and/or drying cannot correct faults that are due to the poor physiological conditions of the fish, improper handling or prolonged storage.

5.4.2 Handling of raw material

5.4.2.1 The time lag between catching of fish and its processing should be limited to 6 to 8 hours at ambient temperature. Fish which are suspected to contain harmful pollutants or other substances, which after dressing and cleaning are unlikely to get reduced to an acceptable level, shall not be used.

5.4.2.2 Fresh fish which cannot be processed immediately on arrival shall be chilled in clean containers and stored in specially provided areas within the plant, protected from heat, weather conditions and contaminants. Wherever possible, iced fish shall be stored in a chill room maintained at 1 °C to 5 °C.

Containers when filled with iced fish shall not be stacked in a manner which permits contamination from other containers. Intimate contact of ice and fish by proper layering is essential to obtain rapid cooling to around 0 °C. Flake ice is to be preferred for rapid cooling and to prevent damage to fish.

5.4.2.3 All fish shall be carefully inspected and sorted to discard contaminated or damaged fish.

5.4.2.4 Fish shall be thoroughly washed before processing and immediately after operations like scaling, gutting, etc.

Washing removes a large part of microorganisms from the surface of fish and from intestine. During dressing, eviscerating (gutting) or trimming operations, each fish shall be washed with a flow or spray of potable water applied in such a manner as to clean the fish thoroughly. Water used for washing, rinsing or conveying shall not be recirculated.

5.4.2.5 Thawing of frozen fish prior to processing shall be done at temperature not higher than what is necessary to carry out the operation reasonable quickly. Water used for thawing shall be potable running water of temperature not higher than 25 °C. All thawing operations shall be carried out under strict hygienic conditions.

5.4.3 Dressing fish for salting/drying

5.4.3.1 Small fishes intended for drying, such as white baits, anchovies, etc, need no splitting and gutting. They can be washed free of slime and extraneous matter prior to drying.

5.4.3.2 Fishes like jew fish, mackerel, etc, can be split open and gutted mechanically or by hand.

The fish could be prepared for salting according to the so-called "butterfly" cut. The knife is first introduced through the opercle. The bones other than head bones shall remain (in order to give rigidity during salting/drying operations). The fish shall be split open at the ventral side starting from the head portion. Wash thoroughly to remove all the viscera parts, blood, etc.

5.4.3.3 Preparation of fish for salting head on

The fish can be prepared with head on (which usually contains edible flesh) provided the head is first opened. The splitting could then be continued to the tail. If the head of the fish is very large, additional cuts or scoring shall be done in order to facilitate salt penetration.

5.4.3.4 Preparation of large fishes

Large fishes such as sharks, could be split open as described above or they could be cut to large pieces (usually longitudinally) and cut again into smaller pieces (1.5 cm - 2 cm thick, 10 cm width and 20 cm length). Sharks usually have certain ammonical odours (owing to the presence of body urea) which can be eliminated by placing the dressed fish or the fillets in a mild brine (10 percent) and crushed ice for 6-10 hours. This may be followed by salting. Before preparation, it is advisable to bleed sharks by cutting their caudal fin or by cutting through the gill opening. Bleeding improves quality and colour of flesh. The best way to salt fish is always by splitting it, even the small ones like sardines, etc. The splitting is usually made during gutting. As a rule, the maximum thickness of the piece/fillet/fish to be salted shall not exceed 1.5 cm - 2 cm.

5.4.3.5 Splitting shall be done by skilled workers, avoiding ragged edges, uneven separation of sides and losses in recovery. Fish shall be split by a cut parallel to the back bone straight down from the nape to the tail.

5.4.3.6 Immediately after splitting, fishes shall be washed with potable water. If intended for a specialty trade, the black membrane should be taken from the nape while the fish are being washed.

Fish shall be thoroughly washed before salting to remove all blood, slime, pieces of gut and other extraneous matter. Fish blood coagulates rapidly, and washing will facilitate more complete bleeding, which, in turn, will improve the appearance of the product. A continuous flow of clean cold water shall be used for washing to prevent the accumulation of contamination materials. After washing, fish shall be drip-dried to remove excess of water.

5.4.3.7 If frozen fish is used as raw material, thawing shall be done prior to salting in such a manner that temperature does not rise above 5 °C. However, in the case of soft textured fish, partial thawing before splitting might be desirable in preventing tearing of flesh.

The thawing operations shall be carried out in a hygienic and clean manner, care being taken to avoid contamination as far as possible. Access to animals, birds, etc, shall be strictly prevented.

5.4.4 Dry-salting

5.4.4.1 Salting time depends on the species of fish (amount of fat), size and thickness. Proper salting methodology shall above all, reflect the requirement of the final product, such as taste, salt content, texture, appearance and the products shelf life.

5.4.4.2 The maximum thickness of the piece/fillet/fish to be salted shall not exceed 1.5 cm to 2.0 cm. Small fish (such as anchovy, sardines) assimilate salt quicker than large fish. Very large fishes spoil if salted whole; and, therefore, large fish shall be salted in pieces and the intermediate (such as sea breams, croakers, etc) shall be opened and salted in halves or "butterfly" fillet.

5.5 Fish salting process according to fish type

5.5.1 The dry method (Kench Cure)

5.5.1.1 Alternate layers of fish and salt shall be stacked until the pile reaches about 1 m. The salt penetrates inside the fish tissue and dissolves in the tissue fluid and drains out as self brine.

5.5.1.2 Dry process is employed for fish which have a total lipid content not over 2 percent. Best appearance and stability are obtained in fish with total lipids less than 1 percent. Salt of proper crystal size and purity shall be taken in appropriate proportion of the fish mass. A thin layer of salt is first spread at the bottom of the-container. Each fish is smeared with salt, care being taken to cover the split surface and gills (if fish used is head on). The salted fish are stacked in the container with sprinkling of a small amount of salt in between the layers. The top layer shall be completely covered by salt. The salted fish is then covered with a lid to prevent contamination.

5.5.1.3 After 24-48 hours (depending upon the species of fish, thickness of flesh and fat content), the container is opened at the bottom (drain hole) and the self-brine formed is drained out. The salted fish is taken in plastic or bamboo mesh baskets and quick-washed in running water to remove any adhering salt crystals or other extraneous matter. The fish is then taken for drying.

5.5.2 Wet method

5.5.2.1 The wet process is recommended for fish with a high lipid content (over 2 percent). In fatty fish, the fat content can be reduced during wet salting by pressing the fish. The fish which accumulates fat in its liver can be dry salted since the fat is removed during dressing.

5.5.2.2 In the wet method the salting is done as described above. The self brine formed is not drained out, but is allowed to cover the fish. As and when need arises, the fish is taken out, rinsed in water and dried.

5.6 Quality and proportion of salt for salting fish

5.6.1 Salt

5.6.1.1 Salt used shall conform to EAS 35. The appropriate size of the crystals for dry salting shall be around 3 mm-5 mm (Regular Size) although it is advisable to use a mixture of 2/3 of this size and 1/3 of fine size. Smaller salt crystals will provide a self brine very quickly and the regular ones will maintain the strength of the brine during processing.

5.6.1.2 Salt used for salting shall be free of copper and iron contents as copper and iron accelerate rancidity in fatty fish.

5.6.1.3 Salt shall be free from halophilic microorganisms, the most common of them being the red halophilic bacteria. The contamination from halophiles can be eliminated by:

- a) Avoiding the use of visibly contaminated salt, which will be reddish in colour.
- b) Dissolving the suspected salt in clean water until it is saturated, put the brine in a solar dryer and let it crystallize. Eliminate the foam. Crystallization can also be performed by boiling the brine.

5.6.2 Proportion

5.6.1.1 In dry salting fish the proportion of salt shall be 3 kg/10 kg (30 percent) of dressed fish. For

many practical purposes a greater quantity of salt may be used, but it is not advisable to exceed beyond 35 to 40 percent as there is no additional advantage.

5.6.2.2 For wet salting, the ratio of brine to fish shall be 1:1 by mass when using a saturated brine. A certain amount of solid salt shall be present at the bottom of the salting cisterns. In effect this corresponds to 30 to 40 percent salt (on a dry basis) with regard to the mass of dressed fish.

5.6.3 Salting time

5.6.3.1 The time for salting may vary according to the following variables:

- a) Thickness of fish, fillets, etc;
- b) Brine concentration outside the fish;
- c) Fat layers; and
- d) Presence of scales.

Fat layers tend to reduce the rate of salt diffusion inside the fish. Presence of scales and thickness of skin usually present a high resistance to salt diffusion.

5.6.3.1 Small pelagic fishes shall be salted for 24 to 40 hours by wet salting/dry salting methods. Intermediate sized fish need salting for 40 to 48 hours whereas fishes like shark shall be salted for 48 hours.

5.6.3.3 The salted fish in the container may be subjected to pressing from the top layer for case of salt penetration.

Applying pressure (by putting some weights uniformly over the top layer) has the following advantages:

- a) The rate of salting is increased; thus there is reduction in the risk of spoilage during salting stage.
- b) Oil can be partially eliminated by pressing. It reduces the lipid content of the salted fish, thus lowering the chances for development of rancidity during storage.
- c) Application of pressure facilitates the removal of soluble undesirable compounds.
- d) Pressure reduces the total volume of the salted fish. The reduction of moisture leads to less time for drying. In the case of wet cured products, the volume reduction could help in lowering transportation costs; and also it will be easier to pack the salted pressed fish than the unpressed fish.
- e) Pressing also gives the opportunity to skim off the supernatant layer of fish oil, organic substances, foam, etc, and to maintain fresh brine over the pile.

5.7 Drying

5.7.1 Immediately after salting, fish shall be removed to the drying area in closed containers. Drying could be carried out in the sun in an open area or in a mechanical dryer under controlled conditions. The fish shall be suspended on rods, hooks or laid out on trays according to ease and efficiency of operations. Care should be taken to ensure that the suspended fish do not touch each other.

5.7.2 Drying operations shall be carried out on elevated platforms made of non-corrosive, smooth surfaces or on single or multideck racks made of wood, plastic, steel, aluminium or neatly painted metals which shall not in any way affect the quality of the final product. The drying area and the racks shall be made clean before and after each operation.

5.7.3 The fish kept for drying shall be kept out of contact from insects, birds, rodents, or other animals by way of proper netting or other protective measures which shall not adversely affect the drying process.

5.7.4 At the close of the day, or as and when the weather conditions do not permit proper drying, the fish shall be carefully collected in clean vessels and transferred to a cold room and kept in hygienic condition out of contact with insects, rodents or animals till next day or till the weather conditions improve. The fish shall not be left overnight in the open area since infestation of insects or the growth of spoilage organisms will occur. The partly dried fish shall preferably be kept at chilled condition (2°C to 5 °C) as long as drying is not possible.

5.7.5 The drying shall be continued until the products reach the intermediate moisture level and attain marketable quality. Drying time may vary according to species, preparation of fish, salt content, fat level and the weather conditions. Generally a moisture content of 35 to 40 percent is sufficient for most of the species, but for fishes like sole, white baits, etc, a lower level of water content could be followed.

5.8 Requirements

5.8.1 When the drying process is over and after the product is allowed to attain moisture equilibration, the dried fish shall appear pleasing and wholesome, firm and soft with a fresh cured flavour. Detailed requirements of specific type of fish products are given in relevant Standards. However, for guidance, the requirements for some dried fish products are given in Annex A for guidance.

5.8.2 Food additives shall not be used indiscriminately. The types and concentration of the preservatives and other food additives used shall be as permissible EAS 103. For guidance methods for preservative treatment of cured fish are given in Annex B.

Annex A
(normative)

Requirements for dried fish products

	Product	Moisture, percent max	Sodium chloride ¹⁾	Acid insoluble ash, max
1.	Dried prawns/shrimps	20	5.0 max	1.0
2.	Dried white baits	18	2.5 max	1.5
3.	Dried Bombay duck	15	7.5 max	2.0
4.	Laminated Bombay duck	15	6 max	1.0
5.	Dry salted threadfin	40	25 max	1.5
6.	Dry salted jew fish	40	25 max	1.5
7.	Dry salted cat fish	35	25 max	1.5
8.	Dry salted leather jacket	35	25 – 30	1.5
9.	Dry salted horse mackerel	35	25 – 30	1.5
10.	Dry salted mackerel	30	25 – 30	1.5
11.	Dry salted seer fish	35	25 – 30	1.5
12.	Dry salted shark	35	25 – 30	1.5
13.	Dry salted shark fins	10	—	1.5
14.	Fish maws	8	—	1.5
15.	Dry salted tuna	35	20 – 25	1.5
16.	Dry salted dhoma	35	10 – 15	2

¹⁾ Values are on moisture free basis

Annex B
(normative)

Preservative treatment methods for cured fish

B.1 Direct dusting method

The cured samples are uniformly dusted with calcium propionate powder (0.3 g for 100 g cured fish). The powder taken in a coarse mesh cloth bag is gently and uniformly dusted over the entire surface of the product. Mechanical sprayers could be used for bulk treatment.

This method is found to be the most effective against fungus, 'red', discoloration or off smell. The product retains an attractive bright cream colour.

B.2 Dip treatment in calcium propionate brine

The cured samples, just after the salting stage, are kept immersed for 2 minutes to 3 minutes in saturated brine containing 3 percent calcium propionate (fish:dip solution is 1:1). The fish is drained and dried as usual. The method is second in efficiency to the above method. In this method the colour and appearance of the product are not as good as in procedure 1, but there is no fungus, 'red', etc. throughout the storage period.

B.3 Calcium propionate mixture treatment

This is as effective as the other methods but the appearance is not very good because of the presence of excessive salt particles on the surface of fish.

The cured samples are sprinkled with a mixture containing 3 percent calcium propionate in refined salt and intimately mixed. The proportion of the mixture to cured fish is 1:10.

These methods extend the shelf life of dry cured products from the normal 4 to 8 weeks to 52 weeks. In the case of wet cured products the normal shelf life of 2 weeks could be extended to 16 weeks. The method can be further improved to control rancidity by incorporating up to 0.5 percent BHA.

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