FAQs

1. Explain the principle of salt preservation of fish.

The principle of salt preservation is that most food poisoning bacteria do not survive salt concentrations of 6 - 10% in the fish tissue. Salt is also not detrimental to health when used in quantities tolerable to the consumers. The products prepared by salting are known to have a longer shelf-life. However, a group of microbes called halophiles (salt loving) can spoil the salted fish. Drying can remove further moisture in salted fish and can preserve the fish much longer. Salting results in two simultaneous processes in fish: (i) Water moves from fish muscle into the solution outside and (ii) Salt moves from the solution outside into the flesh of the fish. Salting technique requires minimum equipments.

2. What type of salt is used for the preservation of fish?

Common salt (sodium chloride) is universally used for the curing of fish. Common salt available in India may be (a) Solar salt (or Sea salt) obtained by removal of water through evaporation and (b) Rock salt also called as mineral salt. Common salt normally contains water less than 6%, minimum of 98% sodium chloride by weight on moisture free basis, 0.5% matter insoluble in water by weight on moisture free basis.

3. What are the contaminants in common salt and how they affect quality of cured fish?

The contaminants in common salt are calcium sulphate (as CaSO4), magnesium chloride (as $MgCl_2$) and magnesium sulphate (as $MgSO_4$) all together less than 1.5%. .Calcium and magnesium salts present as impurities in common salt affect the salting process, water holding capacity of meat and in turn the quality of finished products.

4. Explain how dry salting is done for curing of fish.

In dry salting method dry salt crystals are applied to the flesh side of dressed fish and fish is stacked. As the salt penetrates the flesh, the extracted moisture is allowed to drain away. The method is suitable for lean fish and not for fatty fish such as sardine and anchovy due to oxidation of fat by the atmospheric oxygen giving rise to rancidity. Usually salt at 30 - 40% of weight of fish is used. This method suffers from the disadvantage of differential absorption of salts across the fish flesh.

5. Explain how wet salting is done for curing of fish.

Brining is a wet salting method. The dressed fishes are immersed into the saturated solutions of salt (~36% salt). Here the salt gets distributed uniformly. Usually brining is the preferred method as salted and dried fish have enhanced shelf life. Brining is more useful for fatty fish since the fish is soaked in a concentrated salt solution.

6. What are the general steps of salt preservation of fish?

The following are the general steps for salt preservation of fish.

(i) *Cleaning of fish*: Remove heads and viscera, wash and remove large bones especially in the case of large fish.

(ii) *Separation of meat:* Separate flesh from bones and skin either manually or mechanically,

(iii) *Addition of salt:* Mix sufficient fine salt with flesh to saturate all the water present in fish.

(iv) *Brine formation:* Hold mixture for a few minutes at ambient temperature, salt dissolves in water, the protein is denatured and loses its water holding capacity, and water is released from the solids forming saturated brine.

(v) *Brine removal:* Remove brine by pressing or centrifugation. Brine contains soluble components and blood pigments.

(vi) *Product formation:* The light colored press cake is formed in to cakes of desired shape. It has a neutral odor and flavor and contains approximately 42% water, 26 % salt and 32 % protein.

7. Explain principle of drying of fish for preservation.

Salting alone does not allow long term preservation of fish. Therefore most salted fish products are dried to bring down their water activity (aw) sufficiently low to have microbiological stability. Normally the water activity of 0.7 inhibits the growth of microorganisms. Ideally aw of the product should be 0.06. Adequately salted fish (not dried) with an aw of about 0.75 allows the growth of halophilic bacteria and moulds. The aw of fresh fish flesh is around 0.99. The prime objective of drying is to reduce the moisture content of a raw fish or salted fish to a level which corresponds to aw of 0.7.

8. How drying of fish is traditionally done?

Drying of fish can be accomplished in any system that uses heat source (sun, drier, smoking kilns etc) coupled with air flow. The most economical and effective heat source is the natural heat provided by sun and the wind. Most fishes contain moisture content ranging between 55 and 80% (depending on the type of fish). This moisture content needs to be reduced to 15 to 20% in order to prevent spoilage. The lesser the moisture content in the final product, the better would be the shelf life. The most common and traditional method of drying involves spreading the whole (in case of small of fish) or split (in case of large fish) fish on ground (especially beaches) or mats or raised racks (and covered with nylon mesh) under the sun. Sun drying basically does not allow control over the drying time and temperature and allows contamination from sand, insects, etc. The technique is totally climate dependent and hence needs dry weather with low humidity and clear skies for it to be effective.

9. What are the improved methods of drying of fish?

Major alternatives to sun drying include drying fish on racks, solar dryers and tray driers. Most of these alternatives overcome the problems / difficulties experienced in sun drying or beach drying. They minimize dirt / sand contamination and spoilage by insects. Raised platforms would be placed in windy open spaces, fishes to be dried (raw or salted) are spread on the plastic sheets or gunny bags put on these platforms and covered with small meshed net. This method is also climate dependent. The most improved alternative to sun drying involves use of simple solar energy based artificial dryers. Practical and working model of solar dryers for drying fish have been developed. The simple solar driers provide increased drying temperatures and reduced humidity thereby increase the drying rates. These dryers are energy consuming but produce dried fish of high quality.

10. Explain principle of smoking of fish.

Wood contains 40 - 60 % cellulose, 20 - 30 % hemicelluloses and 20 - 30 % lignin. Smoking is a partial dry distillation process, which happens with internal temperature range of 200 - 400 °C. The smoke generated has two major phases: vapor and particle. All the volatile compounds are in vapor phase. The particle phase contains carbon, tar and low volatile polycyclic hydrocarbons. The volatile fraction consists of phenols, alcohols, organic acids, carbonyls and lower hydrocarbons. The phenols and other natural chemical compounds present in the smoke are antibacterial. Smoking also has the drying effect. Thus smoking prevents bacterial growth and enzyme activity resulting in preservation of fish. Smoke components impart a typical color and flavor to the product.

11. How smoking of fish is done?

Primarily there are two methods of smoking. (i) In *Cold smoking* method, the temperature is not usually higher than 35°C and it does not have the cooking effect; and (ii) In *Hot smoking* method, the temperature is high (60 – 75 °C) and it provides cooking effect to the fish flesh. Hot smoking is often preferred as it requires less control and affords longer shelf life to the product as the fish is smoked until dry. The disadvantage of hot smoking is that it consumes more fuel as compared to cold smoking method. Traditionally, fish is hung on bamboo racks over with slow burning grasses or wood smoke. There are various types of kilns or ovens (equipment used for smoking) available which are cost effective. Though traditional kilns and ovens have low capital costs, they generally have an ineffective air flow system, which results in poor fuel economy and lack of control over temperature and smoke density.

12. What type of packaging materials are used for cured and smoked fish?

The most important concern regarding packaging of cured products is to prevent moisture pick up by the products and prevention of recontamination by insects / microorganisms. Traditional packaging materials used in case of cured products include cane baskets, leaves, and jute bags. In the recent times, the product is preferably packed in polyethylene film and cardboard box to ensure protection from light (which causes discoloration), air (which causes rancidity) and change in moisture content (to retain acceptable quality). Polyester polyethylene laminated pouches are highly suitable for hygienic packaging of cured fish products. Gunny bags lined inside with 400 gauge polyethylene or unit packs in 400 gauge polyethylene stored in dealwood box possess good stackability, attractive appearance and good acceptability, and are hygienic. Some aging of the product is required to develop a characteristic salt fish odor and flavor. Normally the storage life of well packed salted and cured fish product at 35ºC is about a year.

13. How curing and smoking affect quality of fish?

During salting there is extensive hydrolysis of lipids. Hydrolysis ceases when lipids contain about 50% free fatty acids. Methods of application of salt (dry salting or brining) influence lipid hydrolysis / degradation and oxidation. Hydrolysis of lipids gives undesirable soapy taste and oxidation of fats gives rancid flavor to the product. Slow protein breakdown also occurs during salting, drying and storage increasing in free amino acids content of flesh.

14. Explain how adverse effect of curing and smoking on fish quality is overcome?

The changes in proteins adversely affect the nutritional value of products by decreasing the digestibility, protein efficiency ratio (PER), net protein utilisation (NPU) and biological value (BV) of cured products. Normally after cooking, dried fish with or without prior salting gives a fibrous and tough mouth feel. Salting increases hardness and chewiness of fish muscle. Inclusion of small amount of additives such as tripolyphospate in a curing mixture results in to soft texture and greater juiciness of cured and dried fish products. Sodium benzoate prevents reddening due to halophiles and incidence of soft and mealy tissue. Sodium acid phosphate enhances the action of sodium benzoate. Potassium sorbate prevents mould growth.

Butylatedhydroxyanisole (BHA) retards yellow or brown discoloration and minimizes rancid odor. Smoking of fish imparts a typical color and flavor to the product.

15. Write a brief account on keeping quality of cured and / or dried fish.

Generally the products with water activity (aw) of more than 0.7 are liable to suffer from mould attack. Development of rancid odor and flavor may develop during storage due to oxidation of fats. Sometimes proteolysis in stored cured fish products causes bitter and unpleasant taste and change in color (browning / yellowing). The general guidelines for the good storage life of cured and dried fish products are:

a. The product hard dried to a moisture content of 15% with a salt content between 5 and 20% (on wet weight basis) has a long storage life at ambient temperature.
b. A product with 20% moisture and 10 – 20% salt will have a shelf life of about 4 months only.
c. With moisture content of 25 – 35 % and salt content of 5- 20 %, storage life may vary between a few days to 2 months.
d. A moisture content of 40% with salt content of 5 – 15% may assure a storage life of a few days to 3 weeks; when salt content is higher (20%), the product may be stable up to 4 months.