



Although brine baths are more commonly used to salt fish, dry salt treatments can also be effective.



**George J. Flick, Jr., Ph.D.**

Food Science  
And Technology Department  
Virginia Tech/Virginia Sea Grant (0418)  
Blacksburg, Virginia 24061 USA  
flickg@vt.edu

## Uniform Distribution

One of the most difficult, but most important, steps in preparing smoked fish is obtaining uniform distribution of the desired concentration of salt or other preservatives in all parts of the product. Factors that contribute to variable salt concentrations in smoked fish include fish

size, species and fat content; method of salt application; and brine concentration, temperature and brining time. The state of the fish – fresh or frozen, skin on or off, state of rigor – also affects the effectiveness of treatments.

## Brine Treatment

Any salt used should be of food-grade quality, low in calcium and magnesium, and essentially free of iron and copper. The application of salt to fresh or thawed fish is carried out prior to hot or cold smoking by exposing the fish or a portion thereof to dry salt or, more commonly, a salt brine. Some processors use a combination of the two procedures. Although no hard and fast rules dictate the use of one procedure over the other, salt brines are more widely used because they are easier to handle and offer better control.

The typical brine used to soak fish for smoking varies from 8 to 12% salt, although higher concentrations can be used. Brines with 100% saturation leave unattractive powdered salt crystals on the surface of the finished product, whereas a 50%-saturated brine causes fish to swell, making it necessary for excess water to be evaporated during the drying process.

Brines must be kept at strength and changed at least once daily. Fish are usually immersed in tanks where the brine is combined with an equal amount of water. The process should be carried out at temperatures not exceeding 10° C. To secure uniform results, the water should be regularly stirred. Without proper stirring, the salty water, which is heavier than freshwater, will sink to the bottom of the tank, resulting in an uneven distribution of salt content in the final product.

## Dry Salting

With dry salting, the amount of salt, contact time and temperature should be carefully controlled to attain the desired product

## Smoked Fish

### Part II. Proper Salting, Drying Procedures Essential

#### Summary:

An important step in preparing smoked fish is obtaining uniform distribution of salt in the finished product. Dry salt curing is effective but requires experimentation and experience for best results. Salt brines are more widely used because they are easier to handle. Both methods require consistency and temperature control. Slow, even drying procedures provide good product color and form a “skin” on fish that holds in juices and readily accepts smoke.

Depending on the concentration, salt can slow the growth of spoilage microorganisms and some food pathogens in smoked food products. However, in modern products, salt has little effect on maintaining quality, and its main purpose is to impart flavor. It is important to remember that most smoked fish available today are perishable and require refrigeration.

In recent years, there has been a trend toward lowering the salt content in processed foods as a means of reducing dietary sodium. Smoked fish processors have been sensitive to this issue, because they are interested in adjusting to consumer tastes without sacrificing product safety or market share.

characteristics. The ratio of salt to fish by weight may vary from 1:8 for light salting to 1:3 for split fish or 1:1 for heavy salting.

Generally, two or three rows of fish are placed down the center of a drainage rack, which is covered with a layer of salt, and salt is sprinkled over each fish, particularly on the thicker portions. A pile is formed gradually, working out to the edges of the rack. At all times, the fish at the center of the pile are kept 7 to 10 cm higher than the edges. For first salting, piles should not be higher than 1 m, but in subsequent saltings, taller piles are possible.

There should be no pockets in the pile that cause irregular drainage. If pockets are present, the fish around the area become tainted and dark, resulting in an inferior product. The edges of the pile should be checked frequently, and fine salt should be sprinkled over the napes of the fish, which are affected by drainage from the pile.

Dry salting should be carried out at a temperature not exceeding 3° C. In the preparation of some Nova Scotia salmon by the dry salting procedure, brown sugar is also sprinkled in with the salt. Because of the many variations possible, proper curing can only be ascertained through experimentation and experience.

## Drying

After brining, fish are hung or laid on racks for drying, smoking and heat processing. If these processes cannot be conducted within two hours after removal from the brine, fish should be stored in a refrigerator at 3° C or below. Drying allows good color formation, forms a “skin” that holds in juices and gives the flesh the strength needed to keep fish from falling from hooks or other holding devices.

During hanging, dissolved proteins in the brine solution dry on the fish surface to produce the familiar smooth, glossy skin or

“pellicle” that is one of the commercial criteria for quality. Without proper brining and drying, a glossy pellicle will not form. A well-formed pellicle helps give the finished product an attractive appearance because smoke readily adheres to it. A poorly formed pellicle can allow the outer surface of the fish to emit coagulated body fluids, resulting in an unattractive appearance.

If too much humidity builds up during this step, or if processing takes too long and the meat and bone are exposed to heat before drying, the product will fall apart. To prevent this, protein must be set or denatured with low-temperature drying before applying higher temperatures. If the air is too hot and moves too quickly, the surface of the fish can be damaged and not dry properly.

Fish flesh, like that of other animals, is primarily composed of protein. When proteins are dried too fast, they harden, and the outer layers form a hard case. When this happens, water cannot escape from the core of the fish. Consequently, ovens must dry the fish slowly enough to prevent this process, but fast enough to avoid deterioration caused by bacterial and enzymatic activities. If the surface of the fish is overdried, it will later crumble, leading to inadequate smoke absorption and poor smoke color formation.

If fish are not properly dried and then smoked while too moist, the smoke is not evenly absorbed, resulting in a “streaky” product. Time is also an important factor in drying. The longer the drying process, the greater the protein degradation.

*Editor's Note: The last part of this three-part series will discuss smoking procedures, packaging and shelf life.*