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A Brief Summary of Work during the Summer of 1927 at the Fisheries Experimental Station at Halifax, N. S.

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A Brief Summary of Work during the Summer of 1927 at the Fisheries Experimental Station at Halifax, N.S.

By C.B. Weld

An attempt has been made to study the changes occurring in fish during freezing and subsequent cold storage, in an endeavour to determine how the present commercial product may best be improved.

This has included a careful microscopic examination of the fish treated in various ways, as well as a general microscopic examination and a final comparison of the products by the culinary method.

Working with cod, the following are some of the more important facts determined.

Changes taking place during the actual process of freezing.

(1) Unless the fish is frozen practically instantaneously, crystals of ice form within its substance.

The more rapidly the fish is frozen the smaller

are the ice crystals which form during freezing.

(2) The character of the frozen material may be roughly divided into four classes, depending on the rapidity of freezing.

(a) Where large crystals form between fibres, separated from one another by large aggregates of muscle cells.

(b) Where small, more numerous, crystals form, which however have broken through the sarcolemma, and to appear quite extracellular.

(c) Where still smaller crystals have formed --- about one to a fibre --- which are definitely within the fibre but which have broken the sarcolemma.

(d) Where many very small crystals have formed, several in each cell, which have not broken in sarcolemma.

(3) With cod, in tins one inch thick, a product described as (a) above will be obtained if frozen in the ordinary "sharp freezer": if frozen in brine at from 9° to 15° F will result in (b): if frozen in brine at about 1° F will result in (c): if frozen in brine at from -3 to -4°F will result in (d).

Changes taking place during the subsequent storage.

(1) The ice crystals which have formed during the freezing, grow in size during storage. This growth is rapid at a high temperature (e.g. 24°F) and slow at lower temperatures (e.g. 10 - 12°F).

The extent of the growth depends on the temperature of storage and is complete within a month or so at these temperatures.

(2) The changes occurring in the tissues -- a dehydration or concentration of the tissue substances -- is reversible (partly at least) when the fish has just been frozen by any method.

After they have been stored for a month or less, however, the changes have become irreversible. This means that the fluids which have been withdrawn from the tissues into the ice crystals are not reabsorbed by the tissues on defrosting.

This applies both to rapidly frozen and slowly frozen fish, the difference between them being:

The slowly frozen fish is like a coarse sponge the fibres of which are very tough and coarse and the spaces so large that the fluids run away as "drip" on defrosting.

The rapidly frozen fish on the other hand is also a sponge, but its grain is so fine and the spaces so small that the fluids are held in the spaces by capillary attraction, and the fibres are so small that they do not seem so tough,

Defrosting

The rate of defrosting is of no practical importance in determining the amount of recovery (reabsorption of fluids by the tissues) of the tissues to their original fresh condition from the frozen state.

Size of Mass of Fish

It is impossible, by commercial methods at present practicable, to freeze large masses of fish without causing a considerable degree of crystal growth in their central portions.

The rapid freezing (brine) methods show to best advantage when thin pieces of fish (e.g. fillets) are to be handled.

Freshness of Fish

The freshness of the fish frozen had but little bearing on the structural changes occurring during the process.

Culinary Results

There is little difference from a culinary and eating standpoint between fresh, brine frozen, and air frozen cod, if they have just been frozen. After they have been stored for a time however, the brine frozen shows a marked superiority.

Even the brine frozen fish is not as good after storage as when freshly frozen. This suggests the advisability of freezing the fish only as a means of increasing the marketing or distribution time, and not for indefinite storage periods. A lower storage temperature would prolong the period of usability of the fish.

Other Varieties of Fish

Varieties of fish other than cod have been examined though less thoroughly, and the changes occurring in them as a result of freezing are similar to those shown by cod. Minor differences in behavior may be explained by differences in the fat content, salinity, connective tissue content, and so on.

These variations in constitution of the flesh necessitate a more rapid freezing rate for one type of fish than for another, in order to obtain an equally satisfactory product.