

Segment One

Fish Spoilage

Segment One – Fish Spoilage

INTRODUCTION

The process of curing, using a combination of brine, or dry salt, and smoke are carried out primarily to improve the

- flavour;
- texture;
- appearance of the fish product.

They have not always been the main reasons for treating fish by these methods.

Historically both salting and smoking were carried out to ensure that the fish was preserved from the most common forms of spoilage.

The product was salty and dry but it had a long shelf life. It therefore provided a store of food under conditions in which unprocessed fish would rapidly spoil.

The modern products which pass through the brining and smoking processes are alternative choices to fresh fish. They have been produced in response to public demand for the tastes, texture and appearance that brining and smoking can produce.

The shelf life of the majority of smoked fish products is only marginally greater than the shelf life of the fresh fish.

However, spoilage takes place and some preservative action does occur as a result of salting and smoking. We shall therefore look at spoilage and preservation in the first two segments of this module.

AIMS OF THE SEGMENT

The main aim of this segment is to help you to achieve Objective 1 given on page xiii.

When you have completed this segment you should be able to:

- State the prime reasons for brining and smoking fish;
- List the three methods by which fish spoilage occurs;
- Explain how the spoilage processes work;
- State the importance of correct handling and storage in the maintenance of fish quality.

FISH SPOILAGE

Spoilage is a result of 3 separate processes. These are:

- Chemical Decomposition;
- Bacterial Action;
- Oxidation.

You need to understand the basics of these so that you can appreciate how smoking can preserve fish.

We will start with chemical decomposition.

Chemical Decomposition

The chemicals present in living things are able to change due to them either splitting up or joining together. In both cases new chemicals are formed.

These changes are called **chemical reactions**. The rate at which the changes occur depends upon the temperature.

Water is one of the substances present in fish and plays an important part in the chemical reactions.

Enzymes are special substances which also play an important part. They help chemical reactions to work easily and some reactions will only work if enzymes are present.

As soon as any living organism dies, it begins to decay. This decay starts from the inside and is caused by the enzymes which break down the tissue of the dead organism.

The chemical reactions speed up as the temperature increases. However, if the temperature is raised to above 40°C then enzymes are destroyed and spoilage, due to their action, is halted.

Bacterial Action

Fish, like other living creatures, carry millions of bacteria of different types on their outer surfaces and in their guts. A healthy fish has a natural protection against any harmful effects from these bacteria.

When the fish dies some of the bacteria may enter the flesh. They will quickly multiply and cause the fish to spoil. In order to multiply they must have the right conditions. These are:



- Suitable temperatures (Bacteria grow much faster in the warmth);
- The presence of water;
- Suitable chemical substances present in the flesh as a source of food.

Whether the bacteria can enter the flesh easily after the fish dies will depend upon the condition of the fish and the way in which the fish is handled and stored.

If the outer surface has been damaged during handling then it will be easier for the bacteria to enter and spoil the flesh.

If the temperature is too high and chemical decomposition is occurring it will be accompanied by bacterial action.

One of the most likely causes of bacterial action occurs when the contents of the guts are spilled over the fish due to careless gutting.

The guts contain huge numbers of bacteria which can easily contaminate the flesh inside the belly cavity. If acids then break down the wall of the cavity they penetrate to all other parts of the flesh. This process is called **Autodigestion**.

Oxidation

The part played by oxygen in the processes involved in fish spoilage is often overlooked. Yet it is frequently the cause of complaints about fish quality.

Rancidity is the most widely recognised form of oxidation. It occurs when oxygen in the air attacks oil or fat. This results in a sour or stale smell or taste as a result of the oxidation of the fat.

Fish oil, like sunflower oil is 'polyunsaturated' but it unfortunately turns rancid quickly.

Fatty, pelagic fish like herring and mackerel store fat in their flesh and so they turn rancid quickly.

White-fleshed, demersal fish like cod, haddock and plaice store the fat in their livers and these should be removed in the gutting operation. Generally this means that rancidity is not such a big problem.

However, in frozen storage, when the temperature is too low for bacteria to grow or for enzymes to work effectively, oxidation still goes on. This is particularly the case for fatty fish.

Now for your first attempt at some SAQs:

❓ **SAQ1**

List the three properties of fish which are changed due to brining and smoking.

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❓ **SAQ7**

State the three processes which cause fish to spoil.

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❓ **SAQ12**

What part do enzymes play in the spoilage of fish?

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LIMITING SPOILAGE

There are three main substances which, if reduced, would limit the spoilage processes. They are:

- Water content;
- Enzymes;
- Fat content.

a) Thus if the **water content** of fish is reduced:

- The chemical decomposition would reduce;
- The bacteria present would be deprived of one of the substances needed for their survival.

- b) Reduction in the concentration of **enzymes** will reduce the chemical reactions taking place and so reduce chemical decomposition.
- c) If the **fat content** of the fish is reduced, there is less possibility of oxidation occurring. This means that there is less chance of the taste of the fish being spoilt due to rancidity of the fat.

Handling and Storage

Careful handling of the fish means that, at all stages, it is important to prevent damage to the fish.

Careless handling can result in:

- Bruised flesh. The darkening is caused by burst blood vessels.
- Broken skin allowing bacteria to enter the flesh;
- Burst guts allowing bacteria and enzymes to contaminate the flesh. This is more serious if the gut cavity wall is perforated.



Remember that damage to the fish can also occur due to overpacking and bad stacking of boxes.

The maintenance of good quality of the fish to be used in the smoking process is essential.

During all stages of the process the personal hygiene of the handler is very important.

This means that it is important not only to handle the fish carefully but also to store the fish in correct temperature conditions.



The rate of spoilage increases rapidly if the storage temperature is not held down. To keep fish in good condition it should be chilled down to as close to 0°C as possible. This can be achieved by covering the fish in ice.

On no account should fish, whether in ice or not, be stored in places where contamination can take place. For a more complete account of ways to maintain quality the reader is advised to study the module 'Maintenance of Fish Quality'.

To see if you have understood the very important topics in this segment you should now attempt the following two SAQs.

❓ SAQ17

How can the spoilage process due to bacterial action be reduced?

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❓ SAQ22

What are the important storage conditions required to maintain the quality of the fresh fish?

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SUMMARY

This segment has outlined three processes which cause fish to spoil.

These are:

- Chemical decomposition;
- Bacterial action;
- Oxidation.

The spoilage will decrease if certain important substances are reduced.

These are:

- Water content;
- Enzyme content;
- Fat content.

The maintenance of quality of the fish to be used in the smoking process is very important. It depends upon:

- Correct storage temperatures;
- Careful handling;
- Careful gutting.

You have now achieved objective 1 given on page xiii.

This is a good time to take a break before looking at segment two which deals with the way in which the smoking process can reduce the key substances mentioned above.