**Fish**

Fish is an important source of protein in the daily diet. However, fish has the disadvantage that it spoils quickly. If fish is not boiled, salted, dried, smoked or preserved in some other way, it will quickly spoil.

Fermented fish paste and sauces have a much more important place in the daily diet than salted or dried fish. Although fermented foods are a good source of protein, they can be consumed only in limited quantities, because of the high salt content of these products. Fermentation of fish is especially used in situations where drying of the fish is not possible, because the climate is too wet and where cooling and sterilization of the product is too expensive.

Preservation of fish by fermentation technology has been popular from time immemorial. Fermented fish paste and sauces are relished as condiment (flavoured salt) along with cooked rice in many of the South East Asian Countries.

During the fermentation of fish, protein is broken down in the presence of a high salt concentration. The fish protein is mainly broken down by enzymes which come from the fish itself. These enzymes are mainly present in the gut. In the traditional fermentation methods in which the intestines are removed from the fish, fermentation will often be slower as there are fewer enzymes present in the flesh.

**Types of fermented fish products**

1. Products in which the fish retain substantially their original form or preserved as large **chunks**.

2. Products in which fish are **reduced to a paste**

3. Products in which fish are **reduced to a liquid.**

Traditional fermented fish products are basically salt fermented products. Depending on the proportion of salt added, the products can also be classified into high salt (more than 20% of total weight), low salt (6 to 8%) and no salt products.

The dominant flavour giving components of fermented fish products are proteins and their hydrolytic cleavage products such as peptides, peptones, amino acids, higher fatty acids and their esters; glycerides and their derivatives, monosodium glutamate, nucleotides and inosine monophosphate.

**Traditional method for fermentation of fish**

Here the fermentation process is allowed to take place by chance and is based on experience alone. Further there is no control measures applied over fermentation. As in most traditional methods, influx of air is restricted and salt roughly about one-third of the weight of fish is added for the fermentation to occur spontaneously. The method in which the process is done varies according to region. So, experience alone determines the outcome of fermentation such as if the product has a different colour or smell so that it is different from normal, it should not be eaten.

Traditional fish products are classified into two groups:

1. Products which, in the presence of salt, are fermented by the enzymes present in the fish flesh or intestines;

2. Products which are fermented in the presence of boiled or roasted rice.

There are three kinds of fermented fish products:

1. the fish flesh is converted into fermented fish products;

2. the fish is converted into a paste;

3. the fish, whole or in pieces, retains as much as possible of its own structure

We know that fermented fish products are an important protein supplement. They contain a number of essential amino acids which can form an important addition to the daily diet. For example, fish sauce contains a lot of the amino acid, lysine which is essential amino acid to be supplied in the diet. This amino acid is found in small quantities in rice.

The quality of the resultant product depends on the fat content of the fish, the enzyme activity in the fish flesh, contaminations in the salt used and the temperature. Contaminated salt can be recognized by its slightly pink colour and can be purified by heating the salt on a metal sheet over a fire.

**Salt**

The main role of salt in fermentation of fish is to draw liquid out of the fish and to control fermentation. Addition of high salt content prevents the spoilage due to bacteria and as a result, the numbers of bacteria present drops as quickly as possible during fermentation. However, on the other hand, the high salt concentrations also slow down the fermentation speed.

**Production of fish sauce as fermented product**

First, the fish are washed and left intact. Then they are packed with large quantities of salt in earthenware or wood containers. Usually 1 kg of salt is used for 3 to 4 kg of fish. The containers are filled to the rim so that no air is present and sealed so as to create an anaerobic environment. The fish protein is broken down as a result of activity of the enzymes present in the fish. After several months, a clear, amber coloured liquid will have been formed, which is then separated from the residue by squeezing it out.

Sometimes, a fish sauce can also be made during the preparation of fish paste. Fermentation of fish sauce takes longer than that of fish paste; because all the flesh must be broken down to create a clear liquid.

**Fish paste and whole fish**

A considerable part of the protein consumption in a number of Asian countries emerges from the consumption of fish paste, which is of greater importance from a nutritional point of view than fish sauces.

There are two kinds of fish pastes used in South-East Asia:

1. fish-salt mixtures

2. products which are fermented in the presence of cooked or roasted rice on which yeasts and moulds are present.

The general method of preparation of fish pastes is the same as that described for fish sauces. Only the fermentation time is shorter as not all of the fish flesh needs to be broken down. Fish paste must be mixed regularly to keep the salt evenly distributed. As a supplement to fish sauces and fish pastes, entire fish are also fermented in South-East Asia. The intestines and gills are removed from mackerel after which the fish are washed in drinking water. The fish are mixed with salt (1 kg of salt to 3 kg of fish) and put into jars.

Dried fruit pulp or tamarind (a tropical fruit) is added to the salt and fish to lower the pH. The fish are kept covered with brine with the help of weighted mats and are fermented for 2 to 4 months. They are transferred to wooden barrels and care is taken to keep them covered with brine. The fermented fish can be kept for one year.

**Role of microorganisms in fermentation**

Microorganisms probably play no role in the breaking down of protein during fermentation. However, microorganisms which can tolerate salt do seem to contribute to the specific taste and smell of the fermented product.

In some fermentation techniques, a fermentable source of carbohydrates such as boiled rice is added to the fermented fish product. This combination stimulates the growth of lactic acid bacteria. Due to the formation of lactic acid, which is desirable in these products, the pH of the fish mixture is lowered making the product safer and easier to keep.