2 Fish raw material

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2.1 Introduction

Preserved fish is presented to the consumer in many forms, but no matter which form the consumer purchases, the quality of the end-product will reflect the quality of the raw material used in its preparation. Like any other food product it is impossible to produce a premium-quality canned fish product using second-rate raw materials. The handling and storage of the fish as a raw material, together with preliminary processing operations prior to packing, are major factors influencing the final product quality.

This chapter attempts to outline some of the problems and procedures together with quality assurance methods which are used in canneries to control the quality of the raw material being packed.

2.2 Transportation

The term ‘canned fish’ includes both fish and shellfish. By far the greater percentage of fish which is canned is caught by fishing vessels which hunt for their catch in waters where the desired species are known to congregate in large numbers at certain times of the year. Many such catches are seasonal, and consequently when species are caught in excess of the capacity of the canneries they must be preserved by other methods for use at a later date. The handling of the fish from the point of capture to reception at the cannery, when carried out correctly, will result in the cannery producing a product of excellent quality. However, poor handling of the catch may result in rejection of the fish at the cannery door.

2.2.1 Spoilage factors

Fresh fish and shellfish are very susceptible to spoilage and as a consequence may be expected to undergo some degree of deterioration between catching and delivery to the cannery reception area. The deterioration is caused mainly by enzymic reactions in the fish tissues due to autolysis which begins as soon as the fish dies, and also due to increases in the number of bacteria present in or on the surface of the fish if they are
allowed to multiply. Physical damage due to mishandling the catch, both during netting operations and also after depositing on the deck or on dry land, may also affect quality due to bruising and/or temperature abuse. In the case of fatty fish, the availability of oxygen over prolonged periods will result in the development of rancidity to a point where the fish becomes unacceptable for further processing.

Fatty fish contain high levels of unsaturated fatty acids which are susceptible to attack by atmospheric oxygen leading to rancidity. Hence, fatty fish, such as sardines, always have a shorter storage life than lean fish.

Rancid flavours can range from that of a mild cod liver oil to an acrid burning taste which is objectionable. Rancidity development in frozen fatty fish is difficult to control. The rate of lipid oxidation is influenced by several factors which have been described in detail by Hardy et al. (1979) and Labuza (1970).

Higher rates of oxidation occur with increased

- concentration of unsaturated fatty acids present,
- access of oxygen to the fish flesh,
- temperature of storage, and
- exposure to light.

The reactions leading to rancidity development are also catalysed by the presence of haematin compounds and transition metals.

In addition, the water activity of the fish flesh influences rancidity development. The salt and moisture content of the fish flesh can also have an effect. For example, according to Borgstrom (1965), it is generally recognised that the practice of freezing in common salt brine contributes to rancid flavours on frozen storage of fatty fish. Atkin et al. (1982) also state that the salt absorbed during brine freezing can accelerate deterioration in cold storage. Where fatty fish are to be frozen this should take place as soon after catching as possible. Research on Indian sardines frozen quickly and stored at $-23{^\circ}C$ found that they remained in an acceptable condition for 20 weeks. However, similar fish held in ice for 3 days prior to freezing were found to be unacceptable after only 2 weeks frozen storage (Shenoy and Pillai, 1974).

The relationship between temperature and spoilage rate due to enzymes and microorganisms is well known and much work has been done relating the spoilage of fish caught in cold waters to the storage temperature and time. Work on tropical species is less available but in both cases it is known that by reducing the temperature of the stored fish the spoilage rates may be greatly reduced.

The process of rigor mortis is also enzymic in origin, and results from the enzymes involved in maintaining the muscle in a state of relaxation ceasing to work. The muscle contracts and the fish becomes stiff. If the fish is whole the skeleton will prevent any shortening which will occur if the fillet has