12 Other processed foods

Salting, drying (see chapter 11), smoking, curing and fermentation, either singly or in combination are traditional methods of preservation. While the shelf-life is prolonged by these methods the food itself is changed resulting in characteristic flavours, aromas and textures.

Temperature, water activity ($a_w$) and pH are important criteria in determining the types of microorganisms that can grow on food and these can be altered artificially to prevent or delay spoilage. The pH can be artifically lowered by the addition of acids or through fermentation, which produces lactic or acetic acids. Other deteriorative changes such as oxidative rancidity can be altered by the addition of antioxidants.

Preservation by chemical means

Classes of chemical preservative

Chemical preservatives are used to inhibit spoilage agents and to complement other food preservation techniques. Their effectiveness depends on the concentration of the chemical, the nature, number, age and history of the spoilage organisms, the processing temperature and time, and the chemical and physical characteristics of the food. There are several different classes of preservative and their use in food is controlled by law [1].

Inorganic chemicals

These include inorganic acids and their salts, alkalis and alkaline salts, halogen peroxides and gases. Some examples of the most commonly used are (i) sodium chloride in brines and curing solutions, (ii) hypochlorites, usually calcium or sodium, used in the treatment of drinking water, for processing, etc. and (iii) nitrites and nitrates used in the curing of meats, e.g. bacon.

Organic acids and their salts

These include acids such as lactic, acetic, propionic and citric acids and their salts. Also of importance is benzoic acid which can be added to a variety of
foams, but in particular fruit drinks: sodium benzoate exerts its effect by increasing the hydrogen ion concentration in foods, but the concentration of the undissociated acid is probably of greater importance. An alternative is sorbic acid which has a similar effect and is used for products such as wrapped hard cheeses, delicatessen products, margarine and fat spreads. Sorbic acid has also been used to extend the shelf life of cakes, jellies and pickles. Potassium sorbate is also used for meat products, fruit products, wine, pickles, etc.

**Antioxidants**

Oxidative rancidity occurs in fatty foods and causes objectionable odours and flavours and possibly deleterious nutritional effects. Antioxidants retard the oxidative deterioration of fats by capturing peroxy free radicals and inhibiting auto-oxidation. Tocopherols are examples of antioxidants which occur naturally in fat but some fats are deficient in such natural protection and need an added antioxidant. However, the addition of antioxidants is strictly limited by law [2] and they must be toxicologically acceptable. Sometimes two or more substances act together in such a way that the combined effect of the two is greater than the sum of the individual effects (synergism), e.g. citric acid acts synergistically with the phenolic compounds in oils due to its ability to inactivate metals such as iron.

**Antibiotics**

In general, the use of antibiotics in food processing is prohibited by legislation in practically every country. The risk of unintentional sensitivity, the reduction in incentive towards food hygiene and the possibility of the development of resistant organisms in the human body are the reasons for this prohibition. However, one antibiotic which is acceptable as a food preservative in a number of countries is nisin. Produced by a number of cheese starter organisms, e.g. *Streptococcus lactis*, nisin is also naturally present in certain cheeses. However, not all pathogenic organisms which are found in foods are sensitive to nisin (e.g. *Clostridium botulinum*) and therefore the indiscriminate use of nisin to reduce the times and temperatures of processing of certain canned foodstuffs may increase the risk of botulism. In the UK nisin is permitted in cheese, clotted cream and canned food [1]. The latter is defined as ‘food in a hermetically sealed container which has…been sufficiently heat processed to destroy all *Cl. botulinum* in that food or container and which must have pH of less than 4.5’. Cured pig meats require less thermal processing and therefore may not contain nisin, as the process would be below the minimum required.