Designing safety into products and processes

When designing a new food product it is important to ask if it is possible to manufacture it safely. Effective HACCP Systems will manage and control food safety issues on an ongoing basis but what they cannot do is make safe a fundamentally unsafe product.

It is essential that food safety is designed into a product at the development stage and this should be the responsibility of the Product Development and the HACCP teams working together. Possibly your HACCP Team will include a member of the Product Development Department who can introduce new product/process ideas at an early stage. There is no point in new product prototypes being shown to marketing departments or to customers if there are inherent safety risks which cannot be controlled. Not only will these be highlighted later, when the HACCP Study is carried out, leading to likely postponement of the product launch, but you may also be responsible for foodborne illness in the marketing or customer buying department.

Several factors must be considered when designing food safety into a product, and the HACCP Team and other relevant specialists must be involved at the outset. In this chapter we will consider the product formulation and process technologies, along with the importance of ensuring raw material safety. We will also discuss the establishment of a safe and achievable shelf-life, and finally, show an example of how this information may be organized into an individual product safety assessment.
5.1 Intrinsic factors

Intrinsic factors are the compositional elements of a food product and these can often have a controlling effect on the growth of microorganisms. The major intrinsic factors found in foodstuffs and considered here are pH and acidity, organic acids, preservatives, water activity and the ingredients themselves. The information given is an introduction only and, where necessary, HACCP Teams should refer to specific and more detailed reference books.

5.1.1 pH and acidity

Acidity is often one of the principal preserving factors in food products, preventing the growth of many food-poisoning or food-spoilage organisms at certain levels. In fact, fermenting and acidifying foodstuffs are food preservation techniques that have been used for thousands of years. Examples of foods that can be preserved safely by pH and acidity are yoghurt, which is fermented to low pH by the action of starter cultures, and pickled vegetables, which are acidified with acetic acid (vinegar) and normally also pasteurized to prevent spoilage.

Although measurement of acidity is still often used in manufacturing for flavour control, the more useful parameter of measurement from the food safety viewpoint is that of pH. This is because published information on the growth and survival characteristics of micro-organisms at different levels of acidity is normally based around the pH scale.

There is a characteristic pH range across which micro-organisms can grow and the limiting pH for growth varies widely between different species. Most micro-organisms grow best at around neutral pH 7, but may also grow at values ranging from pH 4 to pH 8. A small number of bacteria can grow at pH < 4 or pH > 8 but those able to grow at pH < 4 are not normally associated with food poisoning. However, the growth of these acid-tolerant organisms could have food safety implications if their growth in the foodstuff is involved in raising the pH to a level where other micro-organisms, including pathogens, can grow. This is also true for yeasts and moulds which can grow at pH values considerably lower than pH 4.

It should also be remembered that micro-organisms may survive at pH values outside their range for growth. This has significance for food safety when other factors cause the pH to change. For example, spores of Bacillus cereus might be present in a low-pH raw material where they are unable to grow. If this is then mixed with other raw materials to make a higher-pH product, the spores may be able to germinate and grow to dangerous levels.