8 Dairy foods, multi-component products, dried foods and beverages

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8.1 Dairy products

MAP is used for a wide variety of products in the dairy sector, but it has mainly been applied to the packaging of cheese.

8.1.1 Cheeses

There are many different types of cheese, varying in composition and in shelf-life. Therefore, the packaging of each type of cheese needs to be considered separately. Another factor to consider is that some cheeses are carbon dioxide (CO₂) producers, while others are not. Furthermore, the age of the cheese may vary from three months to two years at the stage of packaging (MacDonald, 1985).

With cheese, the main factor limiting the shelf-life is mould growth, which can be controlled by reducing or excluding oxygen (O₂) from the headspace of the packs. This can, of course, be achieved through vacuum packaging. Vacuum packaging has been found to be useful in packaging cheese for the retail market, giving an extended shelf-life. However, a disadvantage of this packaging method is that the packs are not ‘user-friendly’, because they cannot be opened easily. They also give the product a low-quality plastic image. The use of MAP has overcome these problems by making the packs easier to open and by extending the shelf-life. Furthermore, MAP can be used to package soft and the more crumbly textured cheeses without damaging them, which is not possible with vacuum packaging.

In Europe and, in particular, the UK, the application of MAP within the cheese sector has increased considerably, at the expense of vacuum-packaged products. The sale of MAP products has been growing at an annual rate of 11.2% (Rice, 1995). The volume of MAP products is thought to have exceeded that of aseptic and retort pouch and hot-fill packaging combined (Berne, 1994). The cheese sector of the MAP market has been particularly active over the past few years, introducing a number of important developments in the form of new products and package types. The developments have been driven by consumer demands for convenient
products with extended shelf-life. The development of easy-open and resealable packs was an important breakthrough. The range of cheeses packaged under MAP has also expanded, bringing to the market many traditional and difficult-to-package soft cheeses with extended shelf-life. For the sake of convenience, the wide range of cheeses covered here has been broadly categorized under either hard or soft cheese categories.

8.1.2 Hard cheeses

Hard cheeses such as Cheddar are being packed in 100% CO₂ using horizontal form-fill-seal (FFS) pillow pack machines. However, there have been some recent developments in terms of gas mixtures used. Although, CO₂/N₂ (nitrogen) mixtures are commonly used for MAP of cheese, CO₂ was said to develop a spongy texture in cheese and N₂ to cause drying out. The optimum mixture to use for cheese has been claimed to be 75% CO₂/25% N₂ (Berne, 1994). The usefulness of other noble gases such as argon has also recently been discussed, with claims that these gases preserve both the sensory and microbial quality of food products (Spencer, 1995). The packaging materials used include polyvinylidene chloride (PVdC)-coated cellophane or polyester/polyethylene (PE) (Damske, 1990), 15 μm oriented polyester (OPP)/50 μm low-density polyethylene (LDPE) with 4% ethylene vinyl acetate (Addington, 1991) and clear polypropylene (PP) (Hampton, 1982). MAP of cheese in PP film has a shelf-life of up to four weeks, compared with only 14–15 days when packaged under normal conditions (Hampton, 1982).

The form-fill-seal packaging operation involves forming the packaging material around the product, gas flushing, cross-sealing and cutting to give individual packs. Depending on the size of the blocks and other factors, the packaging speeds possible are 42 to 180 packs per minute (Damske, 1990). The packs are flushed with CO₂ until air is displaced to give a residual O₂ content of less than 2% and sometimes 1%. Soon after gas flushing, the packs have the appearance of pillow packs, but over the subsequent few hours the film collapses around the product because of the absorption of CO₂ by the cheese (Figure 8.1). The package appearance, therefore, becomes similar to that of a vacuum-packed product. Calcium precipitation on the surface is a problem often found with cheeses. Although this problem can be prevented by the use of vacuum packaging, it cannot be overcome by the use of MAP (McDonald, 1985).

Sliced and grated cheeses are also packaged under modified atmospheres. For these products it is not possible to use 100% CO₂ as the absorption of the gas by the product causes the packaging to collapse, crushing the product and interfering with the ease of separation. Therefore, N₂ is used as part of the gas mixture to stop the total collapse of the film around the product. The gas mixture typically used for these value-