13 Juices, soft drinks and alcoholic beverages

There are many different types of beverage: alcoholic and non-alcoholic, carbonated and uncarbonated, acid and non-acid. In most countries soft drinks, fruit juices and nectars are controlled by regulations [1, 2, 3]. Other general labelling and additive regulations also apply.

Packaging materials used for food liquids should maintain good hygiene and have sufficient mechanical strength to prevent leakage and contamination from the outside. They should also be inert and provide a barrier to light. Seals are important and low gas permeability is required. The container must also be capable of meeting the demands of the processing and filling lines [4].

Fruit juices and beverages

Fruit juice is defined as the ‘fermentable but unfermented juice pressed or squeezed from the fruit excluding the peel’. Fresh juice has a very short life after extraction from the whole fruit, due to enzyme or microbial action, unless it is rapidly processed and/or preserved. Orange juice, for example, is normally concentrated to four or more times its original strength, by multistage film evaporators, reverse osmosis or freeze concentration and the concentrate is kept at subzero temperatures. Frozen concentrated orange juice (FCOJ) is transported by bulk tanker and 250kg steel drums. Increasingly aseptic packaging of the concentrate is being used to reduce the costs of cold storage and transport. Much orange juice sold by retail is produced from concentrate. Non-citrus juice, apple, berry fruits, etc., are obtained by pressing and filtration.

Since all these juices provide an excellent medium for microbiological activity, processing and packaging require the production of a sterilized product for chilled short life or preserved long life. Aseptic or hot-fill techniques into cartons or plastic bottles for the former and glass bottles and cans for the latter are the usual techniques employed.

Aseptic ambient temperature stable juices are processed by pasteurizing the juice at 90°C, rapidly cooling and filling cold using the TetraBrik or Combibloc system. A shelf life of 6–12 months without chilling is obtainable in this way.

Where a chilled chain distribution of no more than 2 or 3 weeks is required,
full sterilization is not needed provided the microbiological load is initially small.

**Components and characteristics**

Many different kinds of product can be obtained from fruit juices [5], e.g. squashes, nectars, cordials, carbonated drinks, but in general there are five main components to be considered in relation to packaging; acidity, enzymes, vitamin C, colourings and flavourings.

**Acidity.** All fruits and their juices contain organic acids that can be detected by taste, and consequently fruit juice products usually maintain an acidic character. In most fruit there is one dominant acid, and other components of the mixture occur in secondary or trace amounts. Acidity is often used as an indication of maturity, since it decreases on ripening. Blending can be used to extend the production of acceptable fruit juices over the limitations of maturity and varietal characteristics; for instance, high-acidity early-season oranges can be blended with low-acidity late-season oranges to provide a product closer to the mid-season optimum. Varietal differences in fruit also affect the final product quality.

**Enzymes.** Enzymes exist in all fruit juices and are also used in their processing. The most important commercially are the pectolytic enzymes. These sometimes have to be destroyed and sometimes added. For instance, the cloudiness of some citrus products is related to the presence of pectin. The natural pectolytic enzymes of the fruit, unless destroyed, degrade the pectin resulting in clarification of the product. Materials for cloudy citrus products thus require pasteurization at temperatures high enough to inactivate the enzyme (usually 95°C for 30s, depending upon the pH). Commercial apple and blackcurrant processing, however, requires the addition of pectolytic enzymes to destroy the pectin.

**Vitamin C (ascorbic acid).** The best sources of vitamin C are fresh fruits and vegetables. The vitamin C content of fruits increases until just before ripening, and then decreases, due to the action of an enzyme, ascorbic acid oxidase. When fruits are cooked, much of the ascorbic acid transfers from the tissue into the liquid and may be oxidized, oxidation occurring more easily in iron, copper or badly tinned vessels. If the material is brought rapidly to the boil, the ascorbic acid oxidase is inactivated and subsequent loss due to oxidation is reduced. Losses in vitamin C also occur during storage. They are reduced by low temperature, and by preventing contact with air and exposure to light. Canning and aseptic packaging in cartons fulfils the last two of these conditions. Addition of sulphite has a preserving effect on vitamin C.