

[1] The aim is to maintain the quality and nutritional attributes while stopping spoilage as much as possible. The standard of excellence is freshly prepared, unprocessed juice. However this has got a very limited shelf life—days or hours under the best conditions. It is more susceptible to spoilage than the fruit itself—as it is not protected by skin or cell walls. The fluid is mixed with air and microorganisms from the environment. Because it is unheated, it is subject to rapid microbial, enzymatic, chemical and physical deterioration. Aflatoxin producing mould contamination on the surface of the fruit can end up in the juice, and these can be potent liver carcinogens. Unpasteurised fruit juice has been known to cause outbreaks of salmonella and emerging pathogens such as E. Coli.

Even though pathogenic microbes may be kept out, the natural microflora in fruit will be active.

[2] The most significant processes that will extend shelf life are sanitisation and low temperatures. Keeping the juice to as close to freezing point as possible (-1 to -3 deg C) can enable juice to last up to a month. Minimum temperatures need to be maintained during distribution and also in the consumers fridge at home.

[3] Pasteurisation (which destructs spoilage organisms) and hermetic (airtight) packaging will increase storage life. Thermal processing does away with the need to refrigerate and inactivates enzymes. However some fruits (mainly tropical) can't tolerate even gentle heat processing. The flavour becomes scorched and the colour deteriorates.

[4] If juice can be stored above fridge temperature (5degC) it will be subject to maillard browning (as a result of sugar reacting with amino acids).

[5] Freezing and storing in a low oxygen environment can maintain the fresh character. The decline in nutrients, ascorbic acid, enzymatic activity, colour, flavour and viscosity will be much slower (months).

[6] In fruit juice production, the hurdle principle is significant. That is, a number of barriers together can enhance product stability (see the diagram).

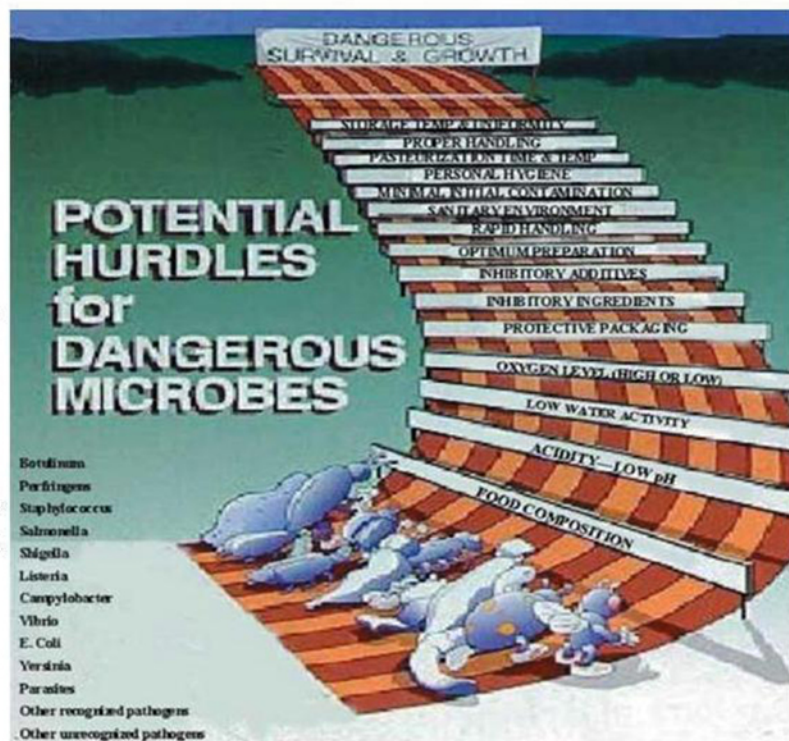
Juices can change in their physical quality - clear juice can turn cloudy or release a displeasing precipitate, chemically or freeze-thaw induced colloidal reactions can effect viscosity (thicken or thin) and influence the taste.

[7] Some juice is bottled using a plate heat exchanger that pasteurises the juice prior to filling. The hot juice sterilises the bottle and cap. This requires no preservatives and can have a shelf life of 18 months.

[8] Packaging also includes tetra briks. These are square or rectangular cartons that include cardboard and foil and possibly a cap. The aseptic boxes allow juice to be stored at ambient temperatures.

Pouch (retort) packs are also now being used (more for single serve size). These are a laminate of flexible plastic and metal foils. It is a sterile packaging that allows juice to be kept at ambient temperature.

[9] In NZ there is a voluntary code of practice to ensure more honest labelling. For example, some juice companies were claiming their product had up to 7mg per 100ml of Vitamin C, but in fact had none at all. Any product labelled juice must contain 100% juice ie it can not be diluted with water and it can not have more than 4% added sugar. Concentrate (that needs to have the water added back in) can be labelled as juice, but it must instruct that the same amount of water than was removed is added back in. Orange juice can be labelled as this as long as it does not have more than 10% of mandarin or tangelo juice.



[10] Kiwifruit juice is supplied in concentrate form to the hospitality, catering and further food processing industries as well as household consumers in NZ. This is done in order to reduce storage, packaging and handling costs. An integrated membrane process is thought to be a good method, advantages being that this process helps to maintain colour and flavour. It can be operated at room temperature, which preserves the freshness, aroma and nutritional value. The process does not cause damage or denature the flesh or cells. One company processes using enzymes and fining agents to produce a clear juice. It is then evaporated under vacuum to a syrupy concentrate. It has a brix level of about 65 and a turbidity of less than 5 NTU.

[11] The juice is susceptible to microorganism spoilage. One way it is supplied is in blast frozen form below -18 deg C. This allows it to be stored for more than 12 months and up to 3 years. The juice can darken over time, so it is recommended that it is used within a shorter time frame. The exclusion of oxygen during processing helps to reduce browning during storage. Also, storing at the low temperature (some will go below -20 deg c to minimise browning and loss of ascorbic acid). Once reconstituted so the kiwifruit particles are finely dispersed and suspended, it needs to be consumed within 3 days.

[12] The fruit is pulped so the cell structure is preserved and a preservative is not required. The juice is sometimes packaged in poly lined cartons that are taped closed. The poly lining helps to prevent the juice from seeping through. It is sometimes also packed in zip lock pouches that are heat sealed. The idea is that the pouch would be thawed, ripped open and used in one day, but it can be refrigerated for a few days once opened.



[13] Alternatively it can be packaged in recyclable PET bottles, which is what a NZ based company called NEKTA does.



For it to be suitable for consumers, NZ pasteurises and aseptically packages it to achieve a shelf life of 12 months. Pasteurisation destroys the bacteria and mould responsible for spoilage. It is packaged straight way before regrowth can occur. The nutrients are maintained during the preservation and packaging—so preservatives do not need to be added. It must be stored under refrigerated conditions that are below 4 deg C and it is recommended that it is consumed within 7 days once opened. This is because it is exposed to air. This is in line with any pasteurisation of juice that does not contain preservative.

Another NZ company (Elliots) pasteurises their kiwifruit slowly by a belt system. They bottle it cold and then slowly move it through a system that raises the temperature so microorganisms are killed. It is quickly cooled so that as many as the nutrients and vitamins as possible are preserved in the bottle.