



# Obtain the best blend with fruit juice concentrates

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A wide variety of fruit juices can be found in the South African market, ranging from pure juices, nectars, drinks, flavoured drinks and milk/juice blends. These products are manufactured either from direct blending of fruit juices, or the reconstitution of fruit juice concentrates.



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This article will focus on the fruit juices manufactured from concentrates. Fruit juice concentrates are bought from various companies that ensure that the legal requirements are met and that all the necessary addition of ingredients, eg colouring, citric acid, aromas, stabilisers, preservatives and other ingredients are added.

## Raw material reception and handling

Fruit juice concentrate manufacturers do an extensive chemical, organoleptic (taste) and microbiological analysis and document the results in a Certificate of Analysis (COA). The fruit juice packer needs to verify the results and

do his own analysis. Such routine checks for concentrate are described in *Table 1*.

Microbial growth is slow in concentrate due to its high sugar content, ie high osmotic pressure and no microbial growth in concentrates of 66° Brix at temperatures below 0°C can take place. However, a liquid layer of low sugar concentration may form on top of the concentrate inside the drum due to condensation of water vapour on the cold product.

## TABLE 1: Quality control of incoming concentrate

Testing of concentrate

- Brix by refractometer
- Total microbial count
- No signs of swelling
- Volume confirmation
- Acid content
- No tampering of lids
- Absence of foreign objects

Testing of final product (prepared in the laboratory according to own formula)

- Brix dilution
- Acid content
- Colour
- Defects

- Taste
- Appearance
- Flavour

Packing material such as bottles, caps, cartons and labels need to be inspected to ensure compliance.

### Water treatment

Water is the largest ingredient in reconstituted juice, corresponding to 80-85% of the final juice. The quality of reconstitution water significantly influences the final product. Water from municipal supplies or bore holes normally needs further on-site treatment to make it suitable for reconstitution of good quality juices.

Chlorine is the most widely used sterilant for water. Nevertheless, it should not be added to water containing humic organic matter because trihalomethanes (THMs) are formed. The chlorination step must be followed by the removal of residual chlorine.

Chlorination is normally not needed for municipal water. However, residual chlorine left in the water should be removed as it will otherwise react with flavour and result in reconstituted juice with a flat taste.

**Water must be routinely analysed for the following:**

- Micro-organisms
- Chemical composition
- Taste

### Blending

The term “blending” means the actual reconstitution step whereby concentrate is blended with water to make a ready-to-drink juice. The quantities of concentrate and water to be blended can be calculated approximately from the Brix value of the concentrate and that of the final product. See *Table 2*.

### TABLE 2: Quantity of concentrate needed to make 1 litre of juice

#### Basis:

*Final juice:* 11,2°B

*Concentrate:* 65°B, corrected

### Calculation:

Juice of 11,2°B has a specific gravity of approximately 1,045 kg/litre. In other words, 1 litre juice at 20°C weighs about 1 045 g

1 litre final juice of 11,2°B contains  
 $1\ 045 \times 11,2/100 = 117\text{ g}$  soluble solids

### Result:

To prepare 1 litre of juice you therefore need

**Concentrate:**  $117/650 \times 1\ 000 = 180\text{ g}$

**Water:**  $1\ 045 - 180 = 865\text{ g}$

### Filling

After the correct ready-to-drink Brix has been reached the product need to be packed into containers as soon as possible. It is important to cool the packed products immediately after packaging.

### Record keeping

For traceability it is important that effective records are kept to document the batch number of the concentrate, the final Brix reading, colour, taste, fill height, volumes, etc.

### Maintaining the cold chain

Careful attention needs to be given to hygiene to produce juice of high microbial quality. Despite all precautions it is impossible to exclude micro-organisms from the process. Preservatives added to the juice product only slows down the growth of the micro-organisms and unless cooled to lower than 4°C, it will spoil. Therefore the cold chain needs to be maintained from receiving of the concentrate to blending, filling and storage.

### Effective cleaning

Effective cleaning of plant equipment used for juice packing is essential. In the design of processing equipment careful consideration must be paid to its cleanliness.

There are two principal approaches to cleaning at the juice packing plant. In determining cleaning procedures, four cleaning parameters are considered – temperature, time, chemical and mechanical. The interaction between these parameters determines the cleaning result.

- **Temperature:** Choosing the correct temperature

for the cleaning agent used and type of fouling is a major factor in achieving effective CIP

- **Time:** The longer a cleaning liquid is allowed to circulate, the better the result
- **Chemical:** This means choosing the right type of detergent at optimal concentration. Too weak solutions will not work properly, while too strong solutions increase cost and may be corrosive to equipment
- **Mechanical:** Increased flow rates give higher turbulence and better mechanical removal of deposits.

It is strongly recommended that a reputable company be contacted to advise the type of chemical needed and the application thereof.

### Quality control of final product

For reconstituted juice, the most important quality control parameter is the concentration, or Brix level, of the juice. The sampling frequency for control of Brix level varies, but should be two times per hour. For batch blending, samples for Brix control are taken from each batch before juice is withdrawn from the tank.

Sampling and full laboratory analysis of juice properties on juice produced from each batch of concentrate is recommended.

### Microbiological control

Yeast is by far the most common spoilage organism in juice. Yeast contamination is usually accompanied by extensive gas formation, especially when the oxygen supply is limited. Hence, spoilage by yeasts tends to result in blown packages.

Some strains of acid-tolerant *Lactobacillus* grow faster under low oxygen pressure and usually result in a high level of defects.

Sampling to detect yeast spoilage is recommended throughout a production run.

### Microbiological control of the end product can be carried out as follows:

- Sampling of packs corresponding to 1-2% of production, eg one tray from every pallet
- Incubate sample trays in a room separate from the ordinary storage at about 25°C
- Inspect visually every day, or every two days, looking for blown packs. **M&JR**



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