

FRUIT JUICE PROCESSING



All the processes for fruit juice products require that the juice or pulp is first extracted from the fruit. The following are the manufacturing stages:

Juice extraction

In the case of citrus, this is easily done with a hand presser or a revolving citrus 'rose', Figure 1. Other fruits such as mango, guava, soursop, etc require pulping - that is, after peeling and stone removal, the flesh of the fruit is pushed through a perforated metal plate. For this process, there is a range of equipment available from the small 'Mouli Legume' and several versions of hand-powered pulper/sieves, all of which force the fruit pulp down through interchangeable metal strainers, Figures 2 and 3.

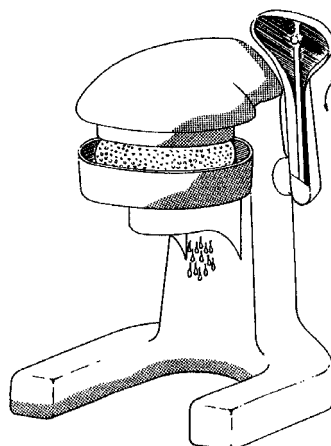


Figure 1: Hand presser

At slightly higher production levels, it is necessary to use a power source, and the multi-purpose Kenwood Chef food mixer, is strongly recommended. This has a pulping attachment rather similar to the Mouli Legume and in addition can be used for liquidising etc.

For large-scale production, an industrial pulper-sieving machine is necessary. This also acts by forcing the fruit pulp through a fine cylindrical mesh. These cost, however, upwards of £2,500.

Preparation

When the juice or pulp has been collected, it is necessary to prepare the batch according to the chosen recipe. This is very much a matter of choice and judgement, and must be done carefully to suit local tastes. Juices are sold either pure or sweetened. Fruit squashes would normally contain about 25% fruit material mixed with a sugar syrup to give a final sugar concentration of about 40%. These are diluted with water prior to use and as the bottle is opened, partly used and then stored, the addition of a preservative is necessary (for example 800ppm sodium benzoate). Cordials are simply crystal clear squashes.

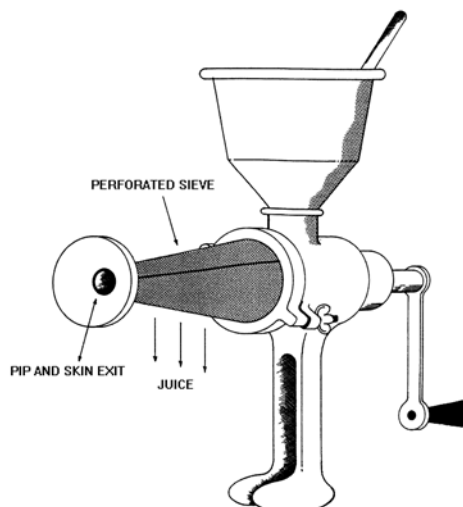


Figure 2: Hand powered pulper

Another range of products that has proved popular is fruit nectars which are consumed on a 'one shot' basis. Essentially, these consist of a 30% mix of fruit pulp and sugar syrup so as to give a final sugar level of about 12-14%. All fruits contain sugar, usually around 8-10%, with variations not only from fruit to fruit but also in the same fruit grown in different parts of the

world. The addition of sugar to give the recommended levels must take into account the sugar already in the juice. However, the amount of sugar added in practice is finally decided by what the purchasers actually want.

In all cases, sugar syrups should be filtered through muslin cloth prior to mixing to remove particles of dirt which are always present.

Pasteurisation

All the products mentioned above need to be pasteurised at 80-95°C for 1-10 minutes prior to filling hot*. At the simplest level, this may be carried out in a stainless steel, enamelled or aluminium saucepan over a gas flame, but this can result in localised overheating at the base of the pan, with consequent flavour changes.

To avoid the use of large expensive, stainless steel pans, a large aluminium pan can be used to boil sugar syrup. A given amount of the syrup is then mixed with fruit juice in a small stainless steel pan and this increases the temperature to 60-70°C. The juice/syrup mixture is then quickly heated to pasteurising temperature.

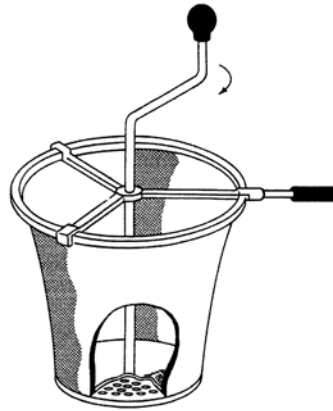


Figure 3: Hand power pulper

The next industrial jump in pasteurisation is, unfortunately, expensive in that it involves the purchase of a double-jacketed steam kettle in stainless steel and a small boiler. The total cost is likely to be in the region of £5-10,000.

ITDG had some success with the development of a low-cost continuous pasteuriser that would, at about £300, fall in between the saucepan and the steam kettle. Further information is given in *Appropriate Technology Journal* 12,7. 1985.

Filling & bottling

In all cases, the products should be hot-filled. A stainless steel bucket, drilled to accept a small outlet tap, has proved to be a very successful filler. Output can be doubled quite simply by fitting a second tap on the other side of the bucket. This system has been used to produce 500-600 bottles of fruit juice per day in the West Indies.

After filling hot, the bottles are capped and laid on their sides to cool prior to labelling.

*Care is needed when producing pineapple juice due to a heat resistant enzyme in the juice. The enzyme damages skin after prolonged contact and workers should therefore wear gloves to protect their hands. The juice must be heated to a higher temperature for a longer time to destroy the enzyme (eg boiling for 20 minutes).

Quality control

As in all food processing enterprises it is necessary to ensure that the fruit products are correctly formulated and priced to meet the customer's requirements, and that production costs are minimised to ensure that a profit is made. The quality of each day's production should be monitored and controlled to ensure that every bottle of juice has the correct keeping and drinking qualities. In particular the following points should be observed:

- Only fresh, fully ripe fruit should be used; mouldy or insect damaged fruit should be

- thrown away. All unwanted parts (dirt, skins, stones etc) should be removed.
- All equipment, surfaces and floors should be thoroughly cleaned after each day's production.
 - Water quality is critical, if in doubt use boiled water or add one tablespoon of bleach to each gallon of water to sterilise it. If water is cloudy, a water filter should be used.
 - Pay particular attention to the quality of re-usable bottles, check for cracks, chips etc and wash thoroughly before using. Always use new caps or lids.
 - The concentration of preservative should be carefully controlled for correct preservation of squashes and cordials, and may be subject to local laws. Check first and use accurate scales to measure the preservative.
 - The temperature and time of heating are critical for achieving both the correct shelf life of the drink and retaining a good colour and flavour. A thermometer and clock are therefore needed.
 - The correct weight should be filled into the bottles each time.

These factors are important because a customer will stop buying the products if the quality varies with each purchase.

Equipment suppliers

Note: This is a selective list of suppliers and does not imply endorsement by Practical Action.

Juice extractors

Kenwood chef major and continuous juice separator

Kenwood Limited
New Lane
Havant
Hampshire
PO9 2NH
United Kingdom
Tel: +44 (0) 23 9247 6000
Fax: +44 (0) 23 9239 2400
Website: <http://www.kenwood.co.uk/>

Victorio strainer

Lehman Hardware and Appliances Inc.
P.O. Box 41
Kidron
Ohio 44636
USA
Tel orders: +1 877 438 5346
Tel enquiries: +1 888 438 5346
E-mail: info@lehmans.com
Website: <http://www.lehmans.com>

Boiling pans

Boiling pans should be made of aluminium, enamelled metal or stainless steel. For larger quantities it is necessary to buy equipment which does not cause burning or sticking of the product to the bottom of the pan.

Stainless steel steam jacketed kettles, that is, a double walled pan are suitable and can be obtained with capacities from 5-500 litres from:

Raylons Metal Works
Kondivita Lane
J. B. Nagar Post Office
Post Box No. 17426
Andheri (E) Andheri - Kurla Road,
Mumbai - 400 059
India
Tel: +91 22 6323288 / 6325932

Gardners Corporation
6 Doctors Lane
Near Gole Market
PO Box 299
New Delhi - 110001
India
Tel: +91 11 334 4287 / 336 3640
Fax: +91 11 371 7179
Steam jacketed kettle for beverages & fruit
Capacity: 227 litres

Sri Rajalakshmi Commercial Kitchen Equipment No.57, (old No. 30/1)
 Silver Jubilee Park Road
 Bangalore - 560 002
 India
 Tel: +91 (0)812 2222 1054/223 9738
 Fax: +91 (0)812 2222 2047
 Steam cooking vessels for fish, fruit, meat & vegetables

Similar ones can be obtained in the UK but are more expensive.

Alvan Blanch Chelworth
 Malmesbury
 Wiltshire
 SN16 9SG
 United Kingdom
 Tel: +44 (0) 666 577333
 Fax: +44 (0) 666 577339
 E-mail: info@alvanblanch.co.uk
 Website: <http://www.alvanblanch.co.uk>

- Steam boilers provides a supply of steam for various processing operations for cereals, legumes, fruit and vegetables.
 Capacity: 96-960 kg/hour
- Fruit Pulper/Siever
 Used for the extraction of juice or pulp from fruit. Complete with feed chute, removable stainless steel perforated screen, rotary paddle with blades and collecting tray below. Food Groups: Fruit
 Power: Electric
- Juice Pasteurisers / Fruit
 Power: Electric

Israel Newton Limited
 Summerley Works
 All Alone Road
 Bradford,
 West Yorkshire BD10 8TT
 United Kingdom
 Tel: +44 (0)1274 612059
 Fax: +44 (0)1274 612059

APV Baker Limited
 Manor Drive
 Paston Parkway
 Peterborough
 Cambridgeshire
 PE4 7AP
 United Kingdom
 Tel: +44 (0)1733 283000
 Fax: +44 (0)1733 283005

H Erben Limited
 Lady Lane
 Hadleigh
 Suffolk
 IP7 6AS
 United Kingdom
 Tel: +44 (0)1473 823011
 Fax: +44 (0)1473 828252
 Website: <http://www.erben.co.uk>
 Packaging and bottling equipment

T Giusti & Son Limited
 Rixon Road, Finedon Road Industrial Estate
 Wellingborough,
 Northamptonshire NN8 4BA
 United Kingdom
 Tel: + 44 (0)1933 229933
 Fax: + 44 (0)1933 272363
 Website: www.giusti.co.uk
 Pressure cookers, emulsification systems, testing facilities & mixing vessels

Sussex & Berkshire Machinery Company PLC
 Blacknest
 Alton, Hants GU34 4PX
 United Kingdom
 Tel: + 44 (0)1420 22669
 Fax: + 44 (0)1420 22687
 E-mail: technical@sabplc.uk
 Website: <http://www.sabplc.co.uk/>
 Filling and packaging equipment. Pelletising, cartooning, blister packs, sachet filling, tube filling & labeling etc.

Refractometer
 Bellingham + Stanley Ltd.
 Longfield Road, North Farm Industrial Estate
 Tunbridge Wells, Kent TN2 3EY
 United Kingdom
 Tel: +44 1892 500400
 Fax: +44 1892 543115
 E-mail: sales@bs-ltd.com
 Website: <http://www.bs-ltd.com/>

technical brief

Checklist for equipment required

Peeler
Knives (stainless steel)
Cutting boards
Juice extractor
Thermometer
Analytical balance
Stainless steel saucepan
10kg scales
Measuring cylinder
Capping machine
Wooden spoons
Plastic funnels
Plastic buckets
Strainers
Cleaning equipment (brushes, scourers, cloths, hosepipes etc) 2 gas cylinders, 2- or 3- ring burners.

Building with large preparation table, smaller table for gas burners, shelves for products, sink, draining board, taps, cupboard for labels and dry ingredients.

Total capital for equipment and furnishings is likely to be £500-800 (\$US900-1440), working capital for fruit purchase, packaging and other materials is likely to be around £600 (\$US1080).

The cost of a building is not included, but it should have the following features:

- Sloping concrete floor and proper drainage for washing down each day.
- A potable water supply.
- Preferably electricity.
- Screened windows and doors to reduce insects.
- No horizontal ledges, window sills, or rafters where dust, bird droppings etc can collect.

References and further reading

Mixed fruit Juice Manufacture Practical Action Technical Brief
Lime juice Practical Action Technical Brief
Lime cordial Practical Action Technical Brief
Nas naran lime juice Practical Action Technical Brief
Passion fruit juice Practical Action Technical Brief
Liquid filling and packaging Practical Action Technical Brief
Small-scale of ready to drink pineapple juice Food Chain No 27
Fruit Juice Processing, *FAO Agricultural Services Bulletin* 13, Bielig. H
Food and Agriculture Organization of the United Nations (FAO)