FRUIT LEATHERS

PRACTICAL ACTION
Technology challenging poverty

technical brief

Introduction

Fruit leathers are made by drying a very thin layer of fruit puree to produce a product with a texture similar to soft leather. Fruit leathers are eaten as a snack and are often targeted at health food markets, using marketing images such as "pure", "sun dried" and "rich in vitamins". Such claims are not unreasonable given that low temperature drying is a gentle process that results in less loss of nutrients than, for example, canning in which up to 65% of minor nutrients can be destroyed. Losses of vitamin A and C are, however high, if the fruit is dried in direct sunlight. Fruit leathers can be made from one type of fruit or blends of different fruits. They may be sweetened, by adding sugar or flavoured with chopped nuts, coconut or spices.

The preservation of fruit leathers depends on their low moisture content, typically 15 to 25%, the natural acidity of the fruit used and high sugar contents. The products have a shelf life of up to 9 months provided they have been sufficiently dried and properly packaged.

Production of fruit leathers

This technical brief describes the production of fruit leathers at three scales; from a very small simple home based system, through cottage industry to small industrial production. The following basic steps are involved at all levels of production:

- selection and preparation of the fruit including intermediate preservation to allow production to continue out of season.
- preparation of the puree
- batch preparation
- drying
- packing and storage.

Selection, preparation and intermediate storage

A high quality product can only be made from good quality raw materials and production should not, as too often happens, be based on second grade fruit that is not suitable for the fresh market. Fruit that has been rejected for being too large, too small or because of surface blemishes is, however, usually acceptable.

Fully ripe soft fruits are very susceptible to bruising when handled and bruised areas will quickly begin to rot. It is thus better to purchase semi-ripe fruit (which is usually cheaper) and allow it to fully ripen in the processing area. This also has the advantage of allowing the daily selection of fruits of equal ripeness.

Incoming fruit should be selected and any unsuitable material removed from the processing area and properly disposed of; not simply put in an open bin outside. Selected fruits are then washed in chlorinated water (one teaspoon of bleach per gallon of water) and then peeled, de-stoned etc, depending on the type being used. Only stainless steel knives should be used as mild steel will corrode and stain the flesh. Some fruits require special attention. Banana has a very low level of acidity and is also subject to what is known as enzymatic browning which results in rapid discoloration after peeling and cutting. After peeling, bananas should be quickly immersed in a water containing a small quantity of a chemical, sodium metabisulphite, which controls such browning. The solution should have a concentration of 400 parts per million of sulphur dioxide. [*See box for more details on the use of sulphur dioxide*]

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Use of Sulphur dioxide (SO_2)

SO_2 has been widely used in fruit and vegetable products to control enzymatic colour changes such as the darkening of a freshly cut apple or potato. It also acts as a preservative, controlling the growth of moulds and yeasts. SO_2 is produced by either burning a small piece of sulphur or by dissolving sodium metabisulphite in water. The second method is more controllable.

The levels of SO_2 used are measured in parts per million or ppm. Concentrations of 400 to 1000ppm are used for dips to control colour changes and retard the growth of moulds and yeasts. A 400ppm bath, for example, is made by dissolving 6g of sodium metabisulphite in 10 litres of water.

NB SO_2 gas is harmful if breathed in, it should only be used in a well ventilated room

In recent years, the use of SO_2 has been increasingly controlled and it has been banned in many foods in the USA. Similar changes to food laws are is likely in Europe. In such situations browning can be controlled by the addition of citric acid but this is far less efficient than sulphur dioxide.

The most convenient production plan for very small producers is to use fruits that are in season at any given time. This does, however, have disadvantages that include:

- one particular flavour of fruit leather may be much more popular than others
- it will only be possible to produce small quantities of product in a short season

It is, however, possible to produce all year by preserving prepared fruit (or fruit puree) in sealed drums with added SO_2 at a level of 600ppm. Fruit may be stored for many months in this way. Intermediate preservation also allows fruits to be purchased at the peak of the harvest when prices are at their lowest. While most of the SO_2 absorbed during intermediate preservation will be lost during drying it is recommended that purees made from preserved fruits should be briefly boiled prior to drying to reduce the level of residual SO_2

Preparation of puree

At the simplest level fruit may be pulped to a puree by hand using a food mill, or Mouli Legume as shown in figure 1, in which the food is pushed through a mesh by a rotating paddle. If electric power is available a food liquidiser, followed by sieving will greatly increase production outputs. At larger scale, powered high-speed blender wands are recommended.

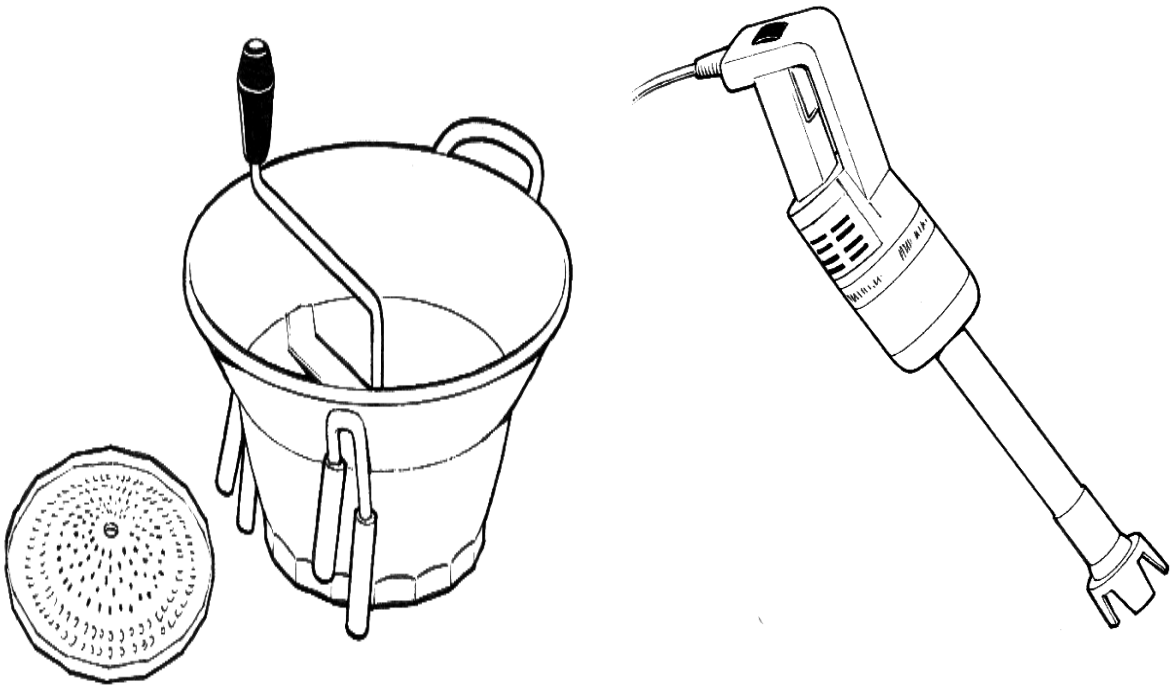

Figure 1: Hand food mill and wand type 50litre high-speed electric blender (not to same scale)

The puree should be heated to 90 ^{0}C to inactivate enzymes and reduce the level of micro-biological contamination. The use of a double boiling pan is recommended to avoid burning that can occur if direct heating is used.

The next step is to prepare the batch. In many cases the flavour of fruit leathers is improved if the acidity is increased by adding a small amount of lemon or lime juice. Many producers mix fruit with semi-ripe banana. This reduces the cost of the product and the high solids of the banana reduces the drying time. Other ingredients, such as sugar, nuts etc are added.

Finally the fruit puree is poured in a thin layer, approx. 3 to 6mm thick, onto plastic trays or wooden trays lined with grease proof paper or plastic sheet. Some producers cover the whole of the tray and cut the dry product into squares. Others pour the puree in circles about 20 cms in diameter and roll them when dry.

Drying

It is recommended that fruit leathers are not dried in direct sunlight as there will be considerable loss of colour and vitamins A and C. Indirect dryers, either solar or mechanical suitable for drying these products are described in Practical Action's Technical Brief - Small Scale Food Dryers.

After about a day or so, in a solar dryer, or 5 hrs, in an artificial dryer, it will be found possible to lift the leather sheet away from the tray. At this stage the product should be turned over and dried on the other side. Prior to packing fruit leathers are frequently lightly dusted with starch to reduce their stickiness.

Packaging

Fruit leather is normally sold in the form of a roll interleaved with greaseproof paper to avoid it sticking together. Strips, of the required weight, are laid on a piece of greaseproof paper and simply rolled with the paper. The final product should then be packed in polythene or polypropylene heat-sealed bags. The latter, if available, are to be preferred as they provide greater protection against moisture. The bags should then be placed into outer boxes to protect them from light. The product

should be clearly labelled stating, as a minimum, the name of the product, net weight, ingredients list and the name and address of the manufacturer. Where available, self-adhesive labels are recommended.

List of equipment required

Scales, balance to weigh in grams, plastic containers to wash fruit, stainless steel knives, spoons, chopping boards, double boiling pan, fruit pulper, large sealable food grade bins for intermediate storage of pulps, dryer, heat sealer

References and further reading

Fruit Processing, a selection of Practical Action Technical Briefs
Fruit Waste Utilisation, Practical Action Technical Brief
Juices and Drinks, a selection of Practical Action Technical Briefs
Snack Foods a selection of Practical Action Technical Briefs
Small-scale processing of ready to drink pineapple juice. Food Chain No 27
Principles and practices of small and medium-scale fruit juice processing. FAO Agricultural Services Bulletin 146, Food and Agriculture Organization of the United Nations (FAO), (2001).
Technical manual on small-scale processing of fruits and vegetables, Food and Agriculture Organization of the United Nations (FAO)
Setting up and Running a Small Fruit or Vegetable Processing Enterprise: Opportunities in Food Processing CTA
Starting a Small Food Processing Enterprise by Peter Fellows, Ernesto Franco & Walter Rios Practical Action Publishing/CTA 1996
Small Scale Food Processing 2nd Ed. P Fellows & S Azam Ali, Practical Action Publishing, 2003
Fruit and Vegetable Processing UNIFEM Practical Action Publishing, 1993

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