

Brochure content:

- Introduction
- Process description
- Legislation involving fruit products
- Other processing options
- Energy Advisory Services
- References



Strawberry Jam

Agricultural Processing Brochure

South African farmers facing current economic realities are searching for new options to maintain and expand their businesses. One of the many opportunities to grow markets, turnover and profits is to add value to farm produce. Options need to be selected carefully based on sound information and knowledge of the opportunities presenting themselves.

Introduction:

Product group: Strawberries

The strawberry is a very popular member of the berry family - not only as a fresh fruit but also because of its versatility in processing. Processing options include canning, freezing, drying and pulping.

Product description: Strawberry jam

Strawberry jam is produced from fresh or frozen strawberries harvested at full maturity. Jam is a product that consists of whole fruit; pieces of fruit, fruit pulp or fruit puree of one or more types of fruit with fruit juice or concentrated fruit juice as an optional ingredient, and may contain permitted food additives and sweeteners.

Jam shall be:

- smooth or contain reasonable tender whole fruit or pieces of fruit,
- prepared from one or more than one type of fruit,
- have a colour and flavour typical of the product concerned and
- free from defects, insect infestation, foreign or bad tastes or flavours, discoloured particles and peel or skin, any signs of crystallisation, burnt shreds, grit, foreign matter, and pips or seeds or pieces of pips or seeds,

except jam made from fruit which is normally consumed with pips or seeds,

- in a container with a minimum vacuum of 17 kPa and must comply with the requirements as set out in R1844 of 15 November 1996 and R 2627 - Jam, conserves, marmalade and jelly of 12 December 1986.

Jam shall contain at least 35 parts whole fruit, pieces of fruit, fruit pulp or fruit puree, excluding sweeteners and have a soluble solids content of at least 60%.

Extra Fruit Jam shall contain at least 45 parts whole fruit, pieces of fruit, fruit pulp or fruit puree, excluding sweeteners and have a soluble solids content of at least 60%.

Reduced Sugar Jam shall contain at least 35 parts whole fruit, pieces of fruit, fruit pulp or fruit puree, excluding sweeteners and have a soluble solids content of at least 30% but not more than 55%.

Fruit Spread shall contain at least 45 parts whole fruit, pieces of fruit, fruit pulp or fruit puree, excluding sweeteners and have a soluble solids content of not more than 30%.



"Strawberry jam is produced from fresh or frozen strawberries".

Process description:

Harvesting of berries

The strawberries are picked manually at the soft-ripe stage when the required ripeness is achieved, and then placed in flat trays for transport to the processing site. Strawberries may be picked without the stems and caps to minimise trimming requirements. Picked strawberries must be cooled as soon as possible after harvesting and processed within 2 - 4 hours to ensure the best quality product.

The product must be transported and handled carefully to ensure minimal damage to the product. Bruises may result in soft spots, off flavour development and sites/places for insect infestation or enzymatic reactions.

Cooling and cleaning of strawberries

The strawberries must be cooled to between 2 - 4 °C as soon as possible after harvesting and kept between these temperatures. Hydrocooling is the most effective method to achieve rapid cooling. Water has the advantage of acting as a cooling, cleaning and transportation medium.

The trays of strawberries are dumped gently into a tank containing cold, potable water (0 - 5 °C). The water acts as a cushion against any possible mechanical damage, while cooling and cleaning the strawberries. The strawberries are transported by the water via a trough or closed pipe from the tank to a vibrating, sloping riddle or screen on which it is sprayed with potable water to complete the cooling and cleaning process. From here the clean strawberries are delivered to the sorting tables/belts via perforated racks/conveyors that also allow draining of cleaning water. The cleaning water may be recirculated after filtration and treatment.

Although forced air-cooling can be used instead of hydrocooling, it requires additional cleaning (aspiration and screening) steps to remove foreign matter. The trays of berries are placed in a chamber where chilled air is drawn into the cold room through the trays. The temperature of the fruit must decrease to between 2-4 °C within 1 hour of harvesting.

Sorting and inspection of strawberries

This is done to select the best suitable raw materials for manufacturing the value-added end product. The clean, cool strawberries are spread on flat tables or conveyor belts for sorting and trimming. All green stems and caps are removed while minor blemishes may be cut away. Culls and green berries are removed along with any mouldy or soft fruit. The sorters must take great care not to handle the strawberries unnecessarily, as this could bruise the berries.

Thawing of frozen berries for further processing

If frozen berries are used, they can be defrosted prior to further processing. The frozen berries are taken from the freezer and can either be left to reach room temperature naturally or defrosted in a heat exchanger (sometimes equipped with a chopper) or in microwave equipment. Berries that have been frozen are easier to process since partial destruction of the cell walls has already taken place

Mixing and boiling of ingredients for jam

The main addition to the fruit is sugar. Other optional ingredients include pectin and acids.

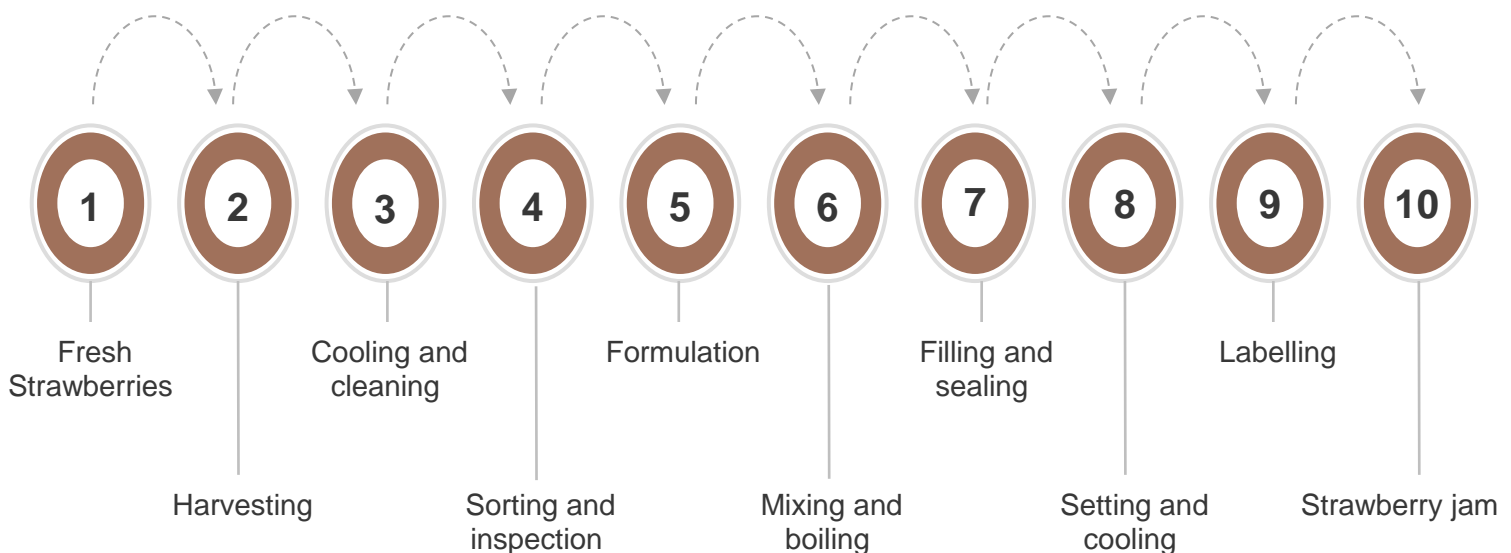
Atmospheric Boiling: Sugar is added to the fruit in steam jacketed batch heaters with a capacity ranging from 75 - 100 kg.

The heaters are covered by a hood to extract moisture laded vapour. The mixture is slowly heated; taking care to melt all the sugar before boiling point is reached. The addition of sugars to the fruit pulp increases the boiling point of the mixture and when more water evaporates during cooking, the higher the sugar concentration becomes, resulting in an even higher boiling point. With atmospheric boiling the end temperature is 105 °C. The boiling process also develops the characteristic flavour and texture of the product. Boiling continues until the required solids content or required temperature (boiling point) is reached. This is determined by a special thermometer or by taking a sample of the boiling mixture and allowing it to cool. If the sample shows signs of firm gelation, cooking is terminated.

Pectin and acids are added after boiling is completed. The pectin must be completely dissolved prior to use. Pectins are used to ensure the correct texture of the final product as well as binding water.

The optimum pH for obtaining the perfect gel is between pH 3 - 3, 5.Aa 50% aqueous solution of the jam is used to measure the pH of the jam , since the jam does not give an accurate reading. If the fruit is not acidic enough, acids in the form of vinegar, lemon juice, lime juice, fumaric acid, citric acid, malic acid, tartaric acid or combinations thereof may be added towards the end of the cooking process.

Process overview



Corn (glucose) syrup may be used to replace a portion of the sugar. It has the advantage of preventing sugar crystallisation, improving texture and enhancing smoothness, while ensuring better colour retention during processing, and provides a pleasing level of sweetness. Corn syrup can be substituted for a portion of the sugar, where 0, 57 kg of corn syrup can replace 0, 45 kg sugar. Too much corn syrup can affect the quality of the set and lead to sugar crystal formation.

Batch Vacuum boiling vessels with capacities of 200 - 500 kg can also be used. The fruit and sugar or corn syrup is added to the vacuum boiler. A pre-heated mixture is pumped into the vessel and the pressure is reduced to ensure that moisture will evaporate at 50 - 60 °C until the required solids content is reached. The pressure is increased to allow the mixture to boil at approximately 90 °C, ensuring the optimum conditions for pectin formation. Pectin and acids are added after boiling has completed.

Filling and sealing of jam

Filling involves displacing the air in the container with a food product prior to sealing. The hot jam is filled into suitable, pre-sterilised bottles, taking care to leave a small headspace (space between the product and the seal). The containers are sealed hermetically while the content is still hot. This ensures a vacuum seal upon cooling of the container.

Take note: A hermetically sealed container is an unopened container that cannot be opened without breaking or damaging the container, seal, adhesive tape or any other attachment which may protect the contents against the entry of micro-organisms.

Cooling of jam

The product is cooled with water to approximately 30 °C. This is done by either immersing the bottles in cold water or by passing the bottles through misting

tunnels. In both cases, care must be taken not to give glass bottles a thermal shock by using too cold water, as this would result in cracking of the bottles.

The bottles are allowed to dry naturally or be blow-dried prior to labelling.

Labelling of fruit preserves

The containers are labelled and coded so that the product contains all the necessary information.

Labelling of fruit products

Labelling in South Africa is controlled by legislation. Anyone who wants to use the information provided in this document must familiarise him/herself with all the applicable laws that apply to the producing, processing, manufacturing and storage of the products referred to in this document.

Legislation involving fruit products

The dried strawberries have a cooked flavour and a brown colour.

Frozen strawberries that are frozen in the container are called straight pack frozen strawberries. This product is used to make fillings, toppings, syrups and soups. Yoghurt manufacturers can also use this as a fruit flavour.

Strawberry concentrate is basically puree that has been concentrated. The strawberries are pulped, depectinised, and concentrated to produce a product that can be used in confectionery products, beverages, sauces, flavourings and fillings and in fruit juices after dilution. The product is preserved by concentration and freezing.

Individually quick frozen strawberries (IQF) are whole fruit, which maintain their individual identity, and are just right for integration into muffins and other bakery products. The quality of the end product is evaluated according to the percentage drip after thawing, maintenance of shape, colour and taste.

Strawberry and other berry juices on small scale: Berry juice is the liquid derived from crushed berry fruits such as grapes, currants, strawberries, gooseberries etc. The juice is pure and contains no additives. It relies on pasteurisation and packaging for its preservation. The storage life is several weeks, depending of the storage conditions and pH of the product. The juice should be consumed immediately after opening.

Strawberry jelly is produced by concentrating and gellating unsweetened strawberry juice or strawberry syrup. Jelly consist of either the juice or aqueous extracts of one or more types of fruit or of the juice and aqueous extracts of one or more types of fruit which have been clarified by filtration or other means, and may contain permitted food additives and sweeteners.

Strawberry juice may be manufactured from fresh or frozen strawberries. A wide range of juice and related products can be manufactured. Both clarified and cloudy strawberry juice can be manufactured. Pure fruit juice contains no additives, but several other related ready-to-drink products can also be manufactured

Anyone who wants to use the information provided in this document must familiarise him/herself with all the applicable laws that apply to the producing, processing, manufacturing and storage of the products referred to in this document.

Please also refer to the disclaimer on the last page.

Other processing options for Strawberries

Listed below are other processing options not covered in this report, but available from Eskom.

Canned strawberries are prepared from fresh berries. The strawberries may either be packed in water or sugar syrup. The water packed product can be used as fruit fillings and toppings. The sugar syrup packed berries can be used as dessert fruit.

Dried strawberries have moisture content of between 2 - 8 %, have an intense flavour and work well in dry baking mixes.

Energy Advisory Services

Eskom's role is to aid the client with basic information in the decision making process.

Thereafter the Eskom Advisor will fulfil the role of energy advisor as part of the team that the farmer selects

Optimise your energy use

Eskom's Energy Advisors, in regions across South Africa, offer advice to business customers on how to optimise their energy use by:

- Understanding their energy needs
- Understanding their electrical systems and processes
- Investigating the latest technology and process developments, including electric infrared heating and drying systems
- Analysing how to reduce energy investment costs
- Optimising energy use patterns in order to grow businesses and industries

Call **08600 37566**, leave your name and number and request that an Energy Advisor in your region contacts you. Alternatively, e-mail an enquiry to advisoryservices@eskom.co.za

Alternative funding

The Agro Processing Support Scheme Grant (APSS) is available when you start a new agro-processing or agro-beneficiation business or expand/improve an existing agro-processing or beneficiation business.

For more info visit:

<http://www.eskom.co.za/sites/idm/Business/Documents/AltfundingAPSS.rev520180628.pdf>.

Literature and reference sources:

- Arthley, D. & Ashurts, P.R. (eds) 1996. Fruit Processing. London: Blackie Academic & Professional.
- Falconer, S. 2003. SA farmers capitalise on "berried" treasure. Farmer's Weekly, 28 March 2003.
- Fellows, P. 1988. Food Processing Technology: Principles and Practice. Chichester: Ellis Horwood, Ltd.
- South Africa - Agricultural Products Standards Act (No 119 of 1990) and regulations. Pretoria: Government Printers Energy
- Woodroof, J.G. & Luh, B.S. 1986. Commercial fruit processing. 2nd ed. Connecticut: AVI Publishing c
- Google free images: Product and other photos were sourced from Google images using a filter: Free to modify, share and use commercially

For more information on Eskom's solutions and services visit the website - www.eskom.co.za/idm



Disclaimer: The reader's attention is drawn to this notice which contains a limitation of risk or liability of Eskom, and constitutes an assumption of risk or liability by the reader or an indemnification of Eskom. The reader acknowledges that he/she has made him/herself aware of this disclaimer and is aware that the disclaimer limits the liability of Eskom.

The aim of this document is solely to provide the reader with some basic information on agro processing in order to understand the extent of the operations involved. The reader should familiarise him/herself with all applicable laws that apply to the product growing, storage, processing and manufacturing. This information concentrates on the sequence and steps involved in the processing of the selected product and explain the reason and necessity of each step. It is not a complete reference document on which calculation and design shall be based, nor was it ever intended to be.

While Eskom has made every attempt to ensure that the information contained in this brochure has been obtained from reliable sources, Eskom does not accept any responsibility or liability for the accuracy, content, completeness, legality, or reliability of the information contained in this brochure, and the readers or users are required to also make their own independent enquiry, before relying upon same. All information in this brochure is provided "as is" with no warranties, promises and/or representations of any kind, expressed or implied, as to the nature, standard, accuracy or otherwise of the information provided in this brochure nor to the suitability or otherwise of the information for a purpose. Computer generated images, walkthroughs and render images used in this brochure are the artist's impression and are an indicative of the actual designs. The imagery used in the brochure may not represent actuals.

Eskom shall not be liable to the reader for any loss or damage of whatever nature (direct, indirect, consequential, or other) incurred by the reader as a result of any action or omission related to the information provided in this brochure. The reader shall indemnify Eskom against any claim or action instituted by a third party as a consequence of the actions taken in relation to the contents of the brochure, emanating from any area of law.