Individually Quick Frozen Strawberries

Agricultural Processing Brochure

South African farmers facing current economic realities are searching for new options of maintaining and expanding their businesses. One of the many opportunities to grow markets, turnover and profits is by adding value to farm produce. Options need to be selected carefully based on sound information and knowledge of the opportunities presenting themselves on a regular basis, seen in the light of the strengths and weaknesses of individual farms

Please note the **Disclaimer** on page 6

Introduction

Brochure content

"Fresh strawberries are individually quick frozen (IQF) to give the perception of fresh fruit."

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: IQF strawberries

Individually quick-frozen (IQF) strawberries are rapidly frozen whole fruit that maintain their individual identity. This frozen product is perfect for use in muffins and other bakery products. The criteria for the selection of strawberry cultivars for IQF are as follows:

- uniformity of shape and size
- firm texture
- deep colour
- rich flavour.

The quality of the end product is evaluated according to the percentage drip after thawing, retention of shape, colour and taste.

Harvesting of strawberries

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

Process description:

Cooling and cleaning of strawberries

The strawberries are cooled and kept between 2 - 4 °C as soon as possible after harvesting. Hydro-cooling 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. The clean strawberries are then delivered to the sorting tables/belts via perforated racks/conveyors that also allow draining of the cleaning water. The cleaning water may be recirculated after filtration and treatment.

Forced air-cooling can be used instead of hydro-cooling although 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 is decreased to between 2-4 °C within 1 hour of harvesting

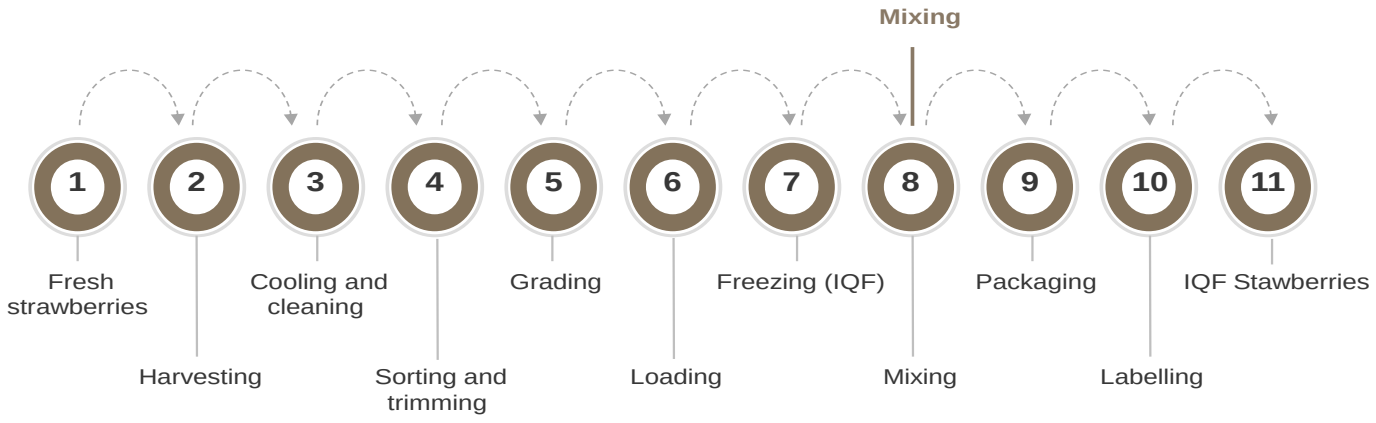
Intermediate storage of strawberries (optional)

The chilled fruit is held at 0 -2 °C and 85 - 95% humidity if a short intermediate storage period (maximum of 10 days at 0 °C for dry fruit) is required prior to further processing. The washed fruit are drained and dried very well prior to storage to prevent softening and leaching of colour pigments.

Sorting and trimming of strawberries

Sorting and trimming 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 unripe berries are removed along with any mouldy or soft fruit. The sorters take great care not to handle the strawberries unnecessarily, as this could bruise the berries.

Process overview



Grading of strawberries (optional))

Multi-process plants grade the strawberries according to size for end use. Size grading is done on diverging stainless steel rods or a stainless steel sheet with circular openings of two or more different diameters. Strawberries are usually divided into three size grades - small, medium and large. Medium strawberries are ideal for freezing whole by individual quick freezing (IQF) methods while large strawberries may require slicing before crushing them for puree. Small and trimmed berries are passed on directly to the crusher.

Loading of strawberries before freezing (optional)

Washed strawberries tend to stick together in large chunks when frozen. This can be eliminated by loading the berries onto special trays that space out the berries while they are being frozen. At the same time, better drainage from the berries and improved circulation of the freezing medium is achieved.

Individual quick freezing of berries

Individual quick freezing (IQF) preserves the intrinsic characteristic of whole berries, causes less cellular damage and results in a firmer textured final product. The products can be frozen as loose pieces before packaging in carton boxes. Pre-packaging freezing is preferred because it is faster. Individual quick-freezing can be done with fluidised bed air-blast freezers or with cryogenic freezers.

- *Fluidised bed air-blast freezer*: The product is frozen with air at -30 to -40 °C that is passed at high velocity (2 - 5 m/sec) up through a 3 - 14 cm thick bed of berries contained in a trough (V) with a perforated base. Products are frozen within 3 - 15 minutes. The berries may be given a thin ice glaze to minimise freezer burn and clumping during freezing. This involves wetting the berries before passing through the pre-chilling zone of the freezer so as to freeze a thin ice layer around each berry. The glazed berries are then moved into the colder zone of the freezer to complete freezing.

- *Cryogenic freezers*: This involves freezing of food with liquefied or solidified gasses (refrigerants). Most common refrigerants are solid carbon dioxide and liquid nitrogen (boiling point of carbon dioxide is -79 °C and liquid nitrogen is -196 °C). The refrigerant is in close contact with the food and rapidly removes energy from the food to absorb its latent heat of vaporisation or sublimation, to provide high heat transfer coefficients and rapid freezing. The choice of a refrigerant depends on the price and availability of the carbon dioxide or nitrogen. Liquid carbon dioxide is sprayed onto food to form a layer of snow on the product that evaporates (sublimates) on contact. In liquid- nitrogen freezers, packed or unpacked products are put on a perforated belt moving through a tunnel, where it is cooled by gaseous nitrogen and then frozen by liquid-nitrogen sprays. The temperature is allowed to equilibrate at the required storage temperature before it is removed from the freezer. The possible production rate is from 45 - 1350 kg/h.

Loading strawberries

Frozen berries

"Fluidised bed air-blast freezer: The product is frozen with air at -30 to -40 °C."

"Cryogenic freezer: This process involves freezing of food with liquefied or solidified gasses (refrigerants)."

The use of a gaseous nitrogen freezer is advantageous because of its greater flexibility, relative low capital costs, smaller weight losses from dehydration of the product, rapid freezing, exclusion of oxygen during freezing, low power consumption and rapid start-up and no defrost time. The main disadvantage is the relatively high operating cost of replenishing the refrigerant

Mixing of frozen berries/currants (optional)

Different types of frozen berries and currants may be mixed together to produce interesting new product varieties. The combination of the various frozen berries used, depends on the end use of the product and the requirements set in *Regulations regarding control over the sale of frozen fruit and frozen vegetables in the Republic of South Africa.*

Packaging of individually quick frozen currants

Packaging is defined as the containment of a food product in a protective barrier that prepares goods for transport, distribution, storage, retailing and end-use. The frozen berries are immediately packed into suitable containers and hermetically sealed. A great variety of packaging containers may be chosen from; provided the packaging material and seal are moisture proof and can withstand the frozen storage conditions. Suitable retail containers include polyethylene and polypropylene bags and tubs.

Large quantities can be packed in drums or barrels, which can be either steel with a plastic lining or fiber drums. Cartons with a wax or plastic-lining (bag-in-box packaging) and an exterior protective overwrap can also be used. The packaged product should be stored at around -23 °C. Temperature fluctuations should be avoided since this reduces the storage life due to the rapid build-up of water on the internal surface of the package and subsequent clumping of the individual fruit.

Vacuum packaging would add to the preservation of the berry flavour and colour and thus extend the keeping quality of the product.

Labelling of frozen fruit and vegetable products

Frozen fruit and vegetable products must be correctly labelled according to the requirements set out in the Regulations regarding control over the sale of frozen fruit and frozen vegetables in the Republic of South Africa.

Storage of frozen fruit products

The recommended storage temperature for frozen products is -18 to -20 °C. The storage life of frozen products is extended at lower storage temperatures. Temperature fluctuations reduce the storage life due to a rapid build-up of water on the internal surface of the package and an accelerated growth of ice crystals in the product and colour degradation.

Legislation for 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.

Other processing options

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 a moisture content of between 2 - 8% have an intense flavour and works well in dry baking mixes. The dried strawberries have a cooked flavour and a brown colour.
- **Frozen strawberries** 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.

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.

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- Understanding their electrical systems and processes
- Investigating the latest technology and process developments, including electric infrared heating and drying systems
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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.**

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Five alternative funding product offerings are available to help reduce your investment costs for new agro-processing or agro-beneficiation business or expand/improve an existing agro-processing or agro-beneficiation business.

For more info visit: http://www.eskom.co.za/sites/idm/Business/Pages/Alternativefunding.aspx

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Issued by Eskom Integrated Demand Management
Date: September 2018

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