

Individually Quick Frozen Cherries

Agricultural Processing

Brochure

South African farmers facing current economic realities are searching for new options to maintain or expand 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, taking into account the strengths and weaknesses of individual farms

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Introduction

Product group: Cherries

Cherries are the fruit of trees of the genus *Prunus*. Cherries are native to Europe, Asia, and North America, and more than 1 000 varieties are grown in the United States alone. Cherries are globular smooth-skinned fruits with a single pit or stone, and they range from 6 - 25 mm in diameter. Most cultivated cherries are bright red when ripe. Distinction should be made between sweet cherries and sour cherries.

Sweet cherries are commonly sold fresh or canned: Sweet cherry trees are grown in areas of mild weather. Most sweet-cherry trees must be cross-pollinated with other varieties in order to bear fruit abundantly. Sweet cherries can be divided into two distinctive groups based on fruit characteristics:

- Heart-type cherries: heart shaped with relatively soft flesh, early ripening
- Bigarreau type: firmer, crisp-fleshed fruit, mid- to late season ripening. Fruit flesh colour ranges from red to yellow and the skin colour ranges from dark red (nearly black) to light (yellow-white).

Sour cherries are commonly processed for pie fillings, jams and jellies. Sour cherry trees are generally hardier compared to sweet cherries and are self-fertile. Sour cherries are soft, juicy and have an oval shape, with flesh and juice colours ranging from dark red to almost colourless.

“Distinction should be made between **sweet cherries** and **sour cherries**.”

Product description - Individually quick-frozen cherries

Both sweet and sour cherries can be frozen using the IQF method. Fresh cherries are individually quick frozen (IQF) to produce a product that maintains its individual identity and gives the perception of "fresh fruit". This makes it ideal for inclusion into bakery products as well as fillings. Frozen cherries can also be incorporated into a mixture of other IQF berries or currants. The IQF method is used since it preserves the cell structure, texture, colour, flavour and aroma of the cherries best.

Process description:

Harvesting of cherries

Cherries are picked manually or mechanically when the cherries reach the soft ripe stage since flavour and aroma development are of prime importance to the end product. This requires a harvesting method that inflicts the minimum damage to the product. The cherries may be picked by hand and placed in flat trays for transport and/or further processing. However, with improved cultivars that ripen more uniformly and advanced technology of harvesters, mechanical harvesting has become a more viable option for large producers and processors.

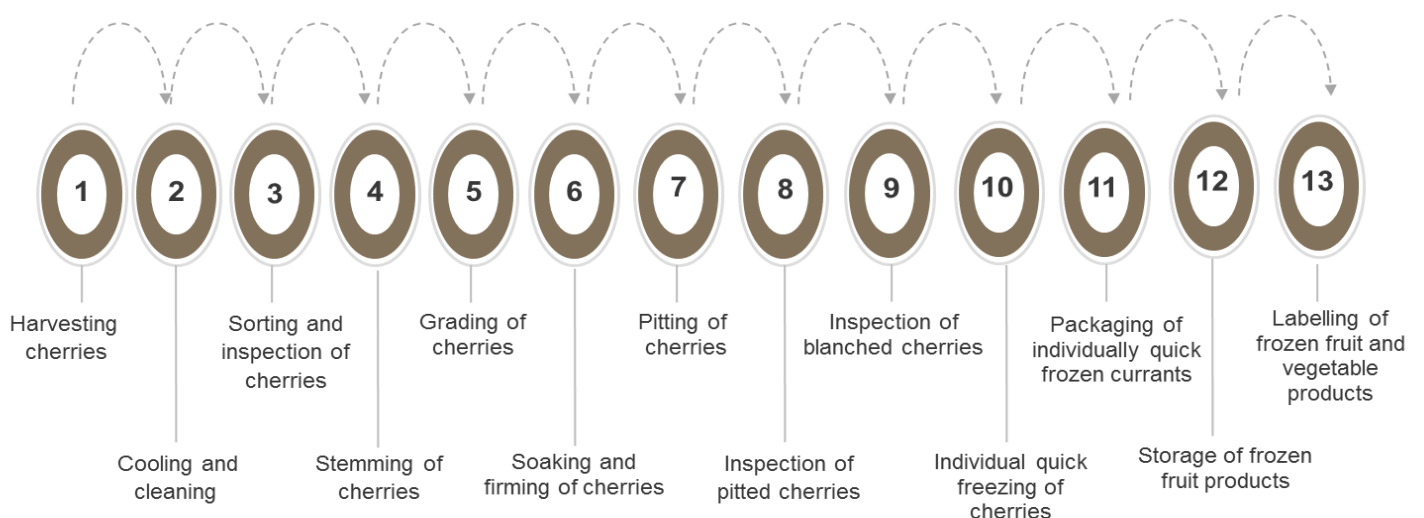
It is advisable to harvest cherries in the early morning to eliminate or at least reduce the need for additional cooling. The time between harvesting and processing should be kept to a minimum and the harvested product requires to be handled with great care at all stages prior to processing.

Cooling and cleaning of cherries

The cherries must be cooled to between 0 - 5°C as soon as possible after harvesting, and kept at this temperature range until processing commences. 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 cherries are dumped gently into a tank containing cold, potable water (between 0 - 5°C). The water acts as a cushion against any possible mechanical damage, while cooling down and cleaning the cherries. The cherries are transported in water via a trough or closed pipe to a vibrating, sloping riddle or screen. Here the cherries are sprayed with potable water to complete the cooling and cleaning process.

Process overview



The clean cherries are then delivered to the sorting tables/belts via perforated racks/conveyors to allow for draining of cooling water. The cooling water may be recirculated after filtration and treatment.

Although forced air-cooling can be used instead of hydro-cooling, it requires additional cleaning (aspiration and screening) steps to remove foreign matter. The trays of cherries 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 cherries

This is done to select the best suitable raw materials for manufacturing the value-added end product. The clean cherries are spread out on sorting tables and inspected for defects. Any damaged, spoilt, immature or severely misshaped cherries are removed manually. Cherries that have not previously been stemmed are diverted to stemming rollers.

Stemming of cherries

Stemming can be performed manually where labour is available, provided the cherries are handled very carefully so as not to bruise the fruit in the process. Mechanical stemming is performed by passing the cherries through a rotary stemmer, which consists of parallel-inclined rollers revolving against each other that pull the stalks from the fruit without crushing the fruit.

Grading of cherries

The cherries are graded according to size, colour, ripeness or firmness. Grading can be done manually or with a grading device/machine. Grading ensures a more uniform, quality end product.

Soaking and firming of cherries

The cherries are soaked in potable ice water to produce a firmer cherry and to ease pitting. The correct soaking time is determined according to the ripeness, colour and firmness of each batch. Excessive soaking results in leaching of the cherry colour, acidity and other soluble solids.

Pitting of cherries

Pitting is the removal of the pit/stone from a fruit with as little damage as possible to the structure of the fruit. The cherries are pitted (destoned) using a mechanical pitter with a punching action or a pin-like probe that passes through the centre of each cherry.

Inspection of pitted cherries

The cherries are inspected to detect and remove any cherries that were unsuccessfully pitted or severely damaged in the process.

Blanching of cherries prior to IQF (optional)

Blanching is a short heating process whereby food products are heated to a certain temperature that is high enough to inactivate the enzymes responsible for undesirable changes in colour and flavour. Blanching prior



Sorting of cherries



Grading of cherries

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to freezing has the added advantage of producing a finished product with superior texture.

The cherries are blanched using a hot water or steam treatment of 100 - 102°C for 30 - 60 seconds. Rapid heating to reach the required temperature and rapid cooling after blanching is desirable to prevent overcooking.

A steam blancher consists of a wire belt, moving through a steam box or a sealed steam tunnel. It is heated by steam, followed by a deep layer holding zone and a cooling zone. A helical screw can also convey the heaped fruit pieces along a covered trough into which steam is injected through perforations in the wall and through the hollow screw shaft.

Steam blanching retains the colour and nutrients better due to the low levels of leaching compared to hot water blanching.

Inspection of blanched cherries

The blanched cherries are inspected to ensure that all cherries have been treated sufficiently and equally. Any damaged and discoloured cherries must be removed.

Chemical treatment of unblanched cherries (optional)

Cherries that are not blanched are treated with ascorbic acid to ensure that the cherries are firm after processing. The addition of ascorbic acid is specified in the applicable regulations.

Individual quick freezing of cherries

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

- Fluidised bed air-blast freezer: The cherries are frozen within 4 - 8 minutes with air at -20°C that is passed at high velocity (2 - 5 m/sec) up through a 3 - 14 cm thick bed of cherries contained in a trough (V) with a perforated base. The product being frozen shows turbulent movement (like a liquid - free-flowing). Products are frozen within 3 - 15 minutes. The cherries may be given a thin ice glaze to minimise freezer burn and clumping during freezing. This involves wetting the cherries before passing it through the pre-chilling zone of the freezer so as to freeze a thin ice layer around each cherry. The glazed cherries are then moved onto 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 -196°C). The refrigerant is in close contact with the food and rapidly removes energy from the food to absorb its

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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 and nitrogen. Liquid carbon dioxide is sprayed onto food to form a layer of snow on the product, which 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.

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 out 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

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.

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.

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.



Other processing options

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

- **Canned cocktail cherries** are coloured cherries that are canned in sugar syrup along with other fruit pieces and used for cocktails
- **Canned maraschino cherries** are sweet cherries preserved in almond-flavoured syrup. The cherries are used in cocktails and derive their name from the Italian (Dalmatian) sweet-sour liqueur originally prepared for bitter cherries.
- **Canned sour cherries:** Sour cherries are canned in water or sugar syrup and used for pie fillings.
- **Canned sweet cherries:** Sweet cherries are canned in water or sugar syrup and used as dessert fruit or in baked products.
- **Carbonated cherry juice:** The basic method of manufacture involves preparing the basic cherry juice to which sugar and other permitted ingredients are added to produce syrup which is then diluted with carbonated water.
- **Cherry jam** is produced from fresh or frozen cherries harvested at full maturity. Jam is a product which 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.
- **Cherry jelly** is produced by the concentration and gelling of unsweetened cherry juice or cherry syrup. Jelly consists of either the juice or aqueous extracts of one or more types of fruit which has been clarified by filtration or other means, and may contain permitted food additives and sweeteners.
- **Cherry juice** may be manufactured from fresh or frozen cherries. A wide range of juice and related products can be manufactured. The juice is usually clarified.
- **Dried cherries** have a chewy texture (similar to raisins) and strong cherry flavour. They are used in pastries, confectionery, ice cream, sweets, fruit salads, cheese and yoghurt.
- **Frozen cherries:** Cherries are frozen in the retail container. In-container freezing does not allow for rapid freezing as in the case of individually quick frozen (IQF) products. Slow frozen cherries do not maintain their shape and individual identity. The product has considerable drip loss upon thawing. This product is used to make pie fillings, toppings and syrups. Yoghurt manufacturers can also use it as fruit flavouring.
- **Glazed cherries** are sweet cherries infused with sugar syrup. They are used in baking, ice cream, desserts and decoration of baked goods.

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Literature and reference sources:

- Arthley, D. & Ashurts, P.R. (eds) 1996. Fruit Processing. London: Blackie Academic & Professional.
- Bianco, L.D. 1997. The 1997/8 lifestyle food index. Cape Town: Demeter Publications.
- Salunke, D K, Bolin, H R & Reddy, N R. 1991. Storage, Processing, and Nutritional Quality of Fruits and Vegetables, 2nd ed. Volume II: Processed Fruits and Vegetables. Boca Raton: CRC Press
- Somogyi, L P, Ramaswamy, H S & Hui, Y H. 1996. Processing fruits: Science and Technology: Vol 1 & 2. Lancaster: Technomic Publishing Co
- South Africa - Agricultural Products Standards Act (No 119 of 1990) and regulations. Pretoria: Government Printers
- South African - Foodstuffs, Cosmetics and Disinfectant Act (no 54 of 1972) and regulations. Johannesburg: Lex Patria
- Webster, A.D & Looney, N.E. 1996. Cherries: Crop physiology, production and uses. Wallingford: CAB International.
- Woodroof, J.G. & Luh, B.S. 1986. Commercial fruit processing. 2nd ed. Connecticut: AVI Publishing co.
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