

Vegetable products and processing: An overview

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The term 'vegetable' refers to all edible plant matter, including the flower, fruits, stems, leaves, roots and seeds of the plants. Vegetables are eaten either raw or cooked, and play an important role in human nutrition as they are mostly low in fat and carbohydrates, while being high in vitamins, minerals and dietary fibre. Some vegetables are classified as staple foods. However, most

are regarded as side dishes aimed at adding variety to meals with their unique flavours, while also adding nutrients necessary for good health. The aim of vegetable processing is not only to add a wider variety of applications to a specific crop, for example more product options, but to preserve vegetables in order to extend their availability and nutritional value throughout the year and in areas where they are not naturally cultivated.

Asparagus

- *Pickled asparagus* are preserved by the addition of salt and acid. Asparagus are usually pickled as whole spears, alone or with the addition of other minor ingredients. Spices can also be used. The spices are usually in concentrated extract form and may include ginger, pimento, black pepper, chillies, cloves and coriander. Pickled asparagus may be pasteurised to further extend the storage life.
- *Canned asparagus*: Whole asparagus spears are canned upright in tin cans filled with a brine solution to extend the availability of asparagus for use in salads and baked goods. Asparagus pieces or tips may also be canned. The canned product is classified according to the size (diameter) of the spears. Young, thin spears are softer and less fibrous.
- *Asparagus juice* may be used as an ingredient in mixed vegetable juices, since the juice possesses the well-known odour of asparagus.

Beetroot

- *Pickled beetroot* is cooked, skinned and sliced, and then packed and preserved in vinegar. The product is sealed in suitable containers and pasteurised to ensure a long and stable shelf life. Baby beetroots may be pickled whole.
- *Dehydrated beetroot pieces* are air-dried or puff-dried slices, diced pieces or strips that can be used in dry soups, spaghetti, pizza sauces and casserole dishes. It can be concentrated into beetroot powder used as a red colouring for salad dressings, sauces and tomato products.
- *Canned beetroot*: The roots used for canning should be a uniform, deep red colour, as beets with pale rings give a less attractive appearance to the product, although they have good edible qualities.



Carrots

- *Carrot juice* is the liquid extracted from carrot puree. It is served as a beverage and is often blended with other fruit or vegetable juices. Carrot juice has a bright orange colour, similar to fresh orange juice. It is rich in antioxidants such as beta carotene. It is usually canned, bottled or aseptically packaged to ensure a shelf life of six to nine months at 20°C.
- *Fresh-cut carrot sticks* are ready-to-use and require no further preparation prior to being used in salads or stir-fries. It can be packaged alone or in combination with other salad or vegetable ingredients. It is preserved by blanching, refrigerated storage, protective packaging and optional surface treatments such as edible coatings. The product has a limited shelf life and should be clearly marked and monitored to ensure that it is used before the expiry date. Fresh-cut peeled baby carrots is a ready-to-use product (minimally processed) that requires no further preparation prior to cooking. It is preserved by blanching, surface treatments, refrigerated storage and protective packaging.
- *Pickled carrots* generally fall into two categories, namely clear pickles and thick sauce pickles such as piccalilli. Pickled vegetables are preserved by the addition of acid, salt and sugar. A wide variety of sweet pickles are available, varying according to the vegetables used, the degree to which the vegetables are softened by cooking and the type of sauce used.

Onions

- *Onion oil* is extracted from minced onion by means of a distillation process using organic solvents such as hexane. The pungency or flavour strength of the oil is 500 times that of a similar dehydrated product, making onion oil a very useful flavouring agent.
- *Pickled onions*: Small onions are peeled and stored in brine (salt solution) to facilitate natural fermentation of the product. The fermented onions are then packed and preserved in vinegar liquor.
- *Diced frozen onions*: Chopped onions have become an important frozen product in recent years, with white varieties of onions preferred for freezing. Onions do not require blanching (which could destroy the enzyme responsible for the characteristic pungency of the vegetable) as they are relatively stable.

Sweet potatoes

- *Dehydrated sweet potato flakes:* Peeled, cooked and cut sweet potatoes are mashed and dehydrated on drum dryers to produce dry flakes. The flake can further be ground to produce sweet potato flour.
- *Sweet potato starch:* Fresh, peeled tubers are disintegrated and mixed with water to form a slurry. Starch is extracted from the slurry through a series of washing and precipitation steps.
- *Sweet potato sugar syrups* are made from sweet potato starch, which is converted into a whole range of different types of sugars by means of special enzymes.



Potatoes

- *Frozen French fries* are made from potato strips that are partially or completely fried prior to freezing. It requires only a short frying or oven baking prior to eating.
- *Frozen potato croquettes* is an extruded product made from mashed potato blended with optional ingredients and seasoning. The seasoned mash is extruded into any desirable shape, deep fat-fried and frozen.
- *Frozen hashbrowns* are made from grated potato blended with complementary ingredients. The mixture is shaped and fried prior to freezing and packaging.
- *Potato flour* is produced through dehydration of cooked mashed potato on drum dryers. The flour is used in the baking industry to enhance the shelf quality of baked products. It may also be re-hydrated to produce instant mashed potato by the addition of boiling water and/or milk.

Brassicas

- *Frozen broccoli:* Broccoli destined for freezing should be young, tender and bright green in colour. Over-mature heads have fibrous stalks and lowering buds, and are thus unsuitable for freezing. Young heads with tight florets and small beads are preferred.
- *Frozen Brussels sprouts:* Brussels sprouts used for processing should be dark green in colour, tight budded and of small, uniform size. This is obtained through careful cultivar selection and plant spacing. Processors generally prefer a bud size with a diameter of 18 to 25mm. A sweet, nutty flavour with only a slight bitterness is desired.
- *Sauerkraut* is a shredded cabbage product preserved by an acidifying fermentation process.
- *Frozen cauliflower:* Cauliflower pieces are frozen alone or in combination with broccoli and various other vegetables.

Butternut

- *Fresh-cut butternut pieces* have been physically altered from its original form, but remain fresh. It is trimmed, peeled, washed and cut to present a product that is 100% usable, with no wastage. The pieces are packaged for consumer convenience, but require refrigerated storage.
- *Frozen butternut:* Butternut is commercially frozen in diced form or in slices. Different freezing techniques can be used, including blast and plate freezing as well as individual quick-freezing. The packaging ranges from 300g retail packs to 13kg bulk packs.
- *Instant butternut flakes:* Butternut puree is dehydrated on drum dryers to produce a dry, flaked product with long shelf life that is easy to re-hydrate into a vegetable side dish, filling for pies or baby food.



Pumpkin

- *Frozen pumpkin pieces:* Pumpkin pieces can be frozen with success, provided the best suitable cultivar is used. The flesh must be an intense orange colour and firm with a high solids content. Watery pumpkin varieties must be avoided.
- *Frozen pumpkin puree:* Fully ripe pumpkins are cooked and then pureed to produce a product that can be eaten as such or used in various other products. The puree is preserved by freezing.
- *Roasted pumpkin seed* is a by-product of various other pumpkin products where the flesh is processed and the seeds discarded. The seeds are dried, cleaned and roasted. Flavouring is optional. The seeds are consumed as a nutritious snack along with nuts and dried fruit or used over salads or other foods.

Conclusion

Food processing takes place on various scales but the processes involved are the same. This article does not cover all the processing options available for these crops, nor does it go into any great detail of the processes involved. It merely offers a glimpse into the versatility of vegetable crops in general. ■

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