Punjab Horticultural Postharvest Technology Centre
Punjab Agricultural University, Ludhiana

PHPTC Newsletter

Issue No.- 19 **Oct-Dec, 2021**

Message from Secretary Horticulture

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Secretary Horticulture
Govt. of Punjab

Over the years, horticulture has emerged as one of the potential agricultural enterprise in accelerating the growth of economy. Its role in the country's nutritional security, poverty alleviation and employment generation programmes is becoming increasingly important. It offers not only a wide range of options to the farmers for crop diversification, but also provides ample scope for sustaining large number of agro industries which generate huge employment opportunities. In Punjab horticultural crops occupy an area of about 3.98 lakh hactares and produces about 81 lakh MT of fruits and vegetables. However, the losses during post-harvest operations are enormous and are matter of great concern. The major reasons for these losses are the lack of awareness about postharvest handling practices and non availability of adequate post-harvest infrastructure resulting in glut of particular fruit or vegetable. Therefore, growers are forced to make distress sale and substantial quantity of the produce goes waste.

Food processing provides an opportunity to utilize excess production efficiently. Not just from an agricultural growth perspective, but it is also important for reducing food wastage as it increases shelf life and enhances quality. The Punjab Government has identified it as a priority sector. A number of schemes have been launched by different Ministries of Government of India. Ministry of Agriculture has launched a "National Horticulture Mission", under which cold-chain development is the thrust area, Ministry of Food Processing Industries is operating a "Scheme on cold chain, value addition and preservation infrastructure". Department of Horticulture in Punjab state facilitates the farmers and entrepreneurs as a one stop access to understand government schemes and support. I am delighted to know that PHPTC provides training to farmers and entrepreneurs on postharvest handling and value addition of horticultural crops.

I trust this issue of Newsletter "Micro-processing of fruits and vegetables" will update the knowledge of farmers and entrepreneurs on basic processing techniques and will help to widen their processing scope and boost their income. I convey my best wishes for the success of this Newsletter and further hope that PHPTC would make efforts to develop cost effective processing technologies for the minimizing the postharvest losses of horticultural crops.

Micro-processing of fruits and vegetables

India is a huge producer of fruits and vegetables; however, perishable nature of fruit and vegetables dictates about its limited post- harvest shelf life. The country witnesses nearly 15-25% wastage in fruits and vegetables annually, due to lack of modern harvesting practices and inadequate cold chain infrastructure. Therefore, value addition of horticultural crops can help alleviate distress of postharvest losses and provide various financial benefits. The National Mission on Food Processing, a centrally sponsored scheme launched by MoFPI, is promoting the development of facilities for post-harvest operations in the country. Support from the government and increasing adoption of processed foods in the country will help the market for processed fruits and vegetables to grow strongly over the next five years. Changing lifestyle and rapid urbanization is playing a major role in the development of this industry. Moreover, growing presence of organized retail outlets in the country is making processed food products more readily available to consumers. Also, availability of large shelf space in these retail stores is helping companies to market a wider variety of products.

Need for micro-processing in horticulture sector

- To reduce postharvest losses
- To strengthen economic base of rural communities.
- To help generate additional income to farmers, self-help groups, women entrepreneurs and weaker section of society.
- To diversify utilization of a particular crop for better returns.
- To reduce import and surge export demands.
- To add convenience to food products for daily use especially for urban population.
- Fruits and vegetables offer variety of pigments and are thus right material for value

addition because they are more profitable, has high degree of process ability and richness in health promoting compounds and higher potential for export.

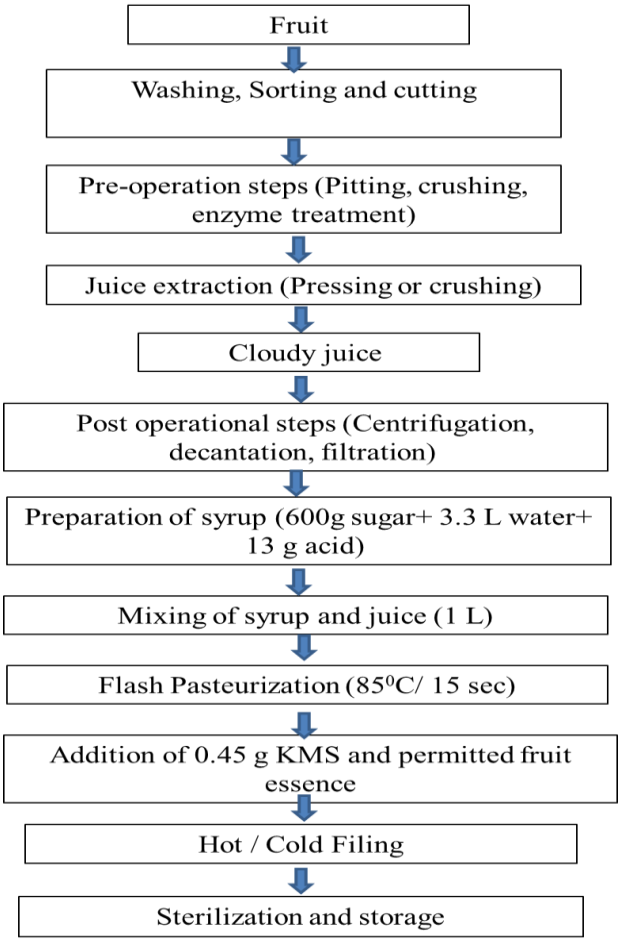
Table 1: Potential crops of Punjab for processing into various value-added products

Sr. No.	Crop	Potential processed products
1.	Guava	Nectar, squash, candy, fruit bar, jam
2.	Kinnow	Squash, juice
3.	Mango	Nectar, squash, candy, fruit bar, jam
4.	Amla	Candy, preserve, powder, juice
5.	Tomato	Ketchup, puree, juice, sun dried tomatoes
6.	Peas	Frozen, pea protein
7.	Potato	Chips, flour, flakes, frozen, canned
8.	Pear	Chutney, candy, bar, canning
9.	Jamun	Nectar, RTS, jam

Potential micro-processed food products

Fruit juices: Fruit juices are among the prime choice of consumers. It refers to a pure juice obtained from mechanical squeezing and macerating mature and ripe fruits with no additional additives added. They are often marketed as energy booster due to their high carbohydrate content along with vitamins and minerals that helps in maintaining ion balance within the body. Among the fruit juice category, ready to serve (RTS) and fruit nectars share a major portion. These sweetened beverages must possess minimum 10 to 20% fruit pulp and TSS of around 15-20^0 B.

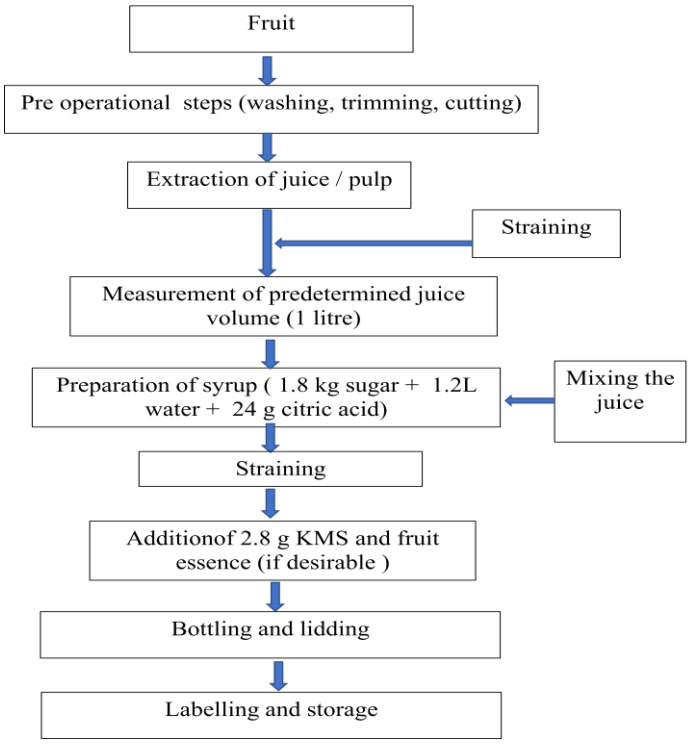
Sugar-sweetened beverages hold a great market share thereby creating numerous opportunities for small-scale processing units. Fruits grown in the Punjab region such as kinnow, guava, mango, grapes, gooseberry (amla), pear and tomato are the predominant crops in high demand for fruit beverages. Fruit juice extraction is one of the simplest and important steps in processing that governs the overall quality of the finished product. A generalized process chart for the preparation of fruit beverages has been described in Figure 1. While inculcation of certain crop related pre and post operational steps have to be chosen according to the fruit employed.



Generalized flow sheet for preparation of fruit nectar

Fruit squash : Squash is a type of fruit beverage containing at least 25% fruit juice or pulp and TSS of 40 ^{0} B. Squash is diluted before serving in the ratio 1:3 or 1:4. According to FSSAI specifications, class II preservatives such as sulphur dioxide and sodium benzoate in fruit squash shall not exceed 350 ppm and 600 ppm, respectively.

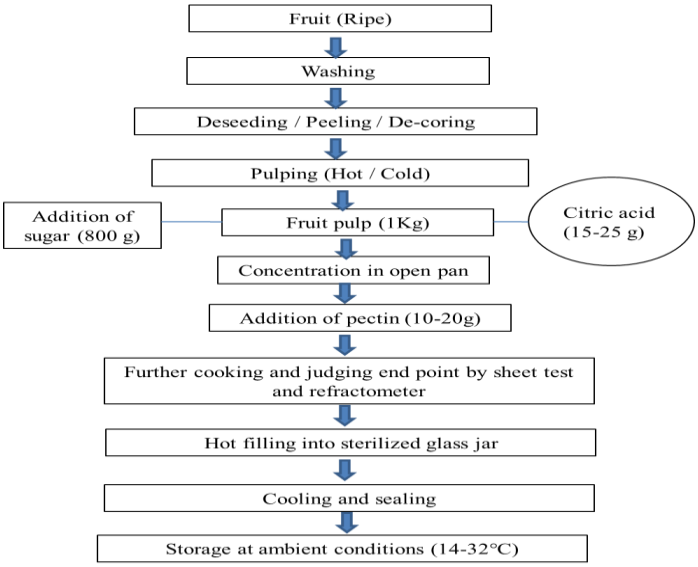
Artificial colour and flavours are often added for increased consumer preferences and should be specified on the label. Sugar, water and citric acid are among the major ingredients employed for the preparation of squash. Generalized process for squash preparation has been described in Fig2.



Generalized flow sheet for squash preparation

Fruit jams: Fruit jam is a product obtained by cooking fruit pulp with sufficient sugar and acid to a rationally thick consistency to hold the fruit tissues in position. Jam contains 68 percent total solids and 0.5-0.6% acidity. Jam must possess minimum 45% of fruit pulp singly or in combination. A wide variety of fruits could be employed for jam manufacturing. Widespread applicability of fruit jam is due to its replenishing taste and extended shelf life. High concentration of sugars is mainly responsible for reducing the water activity of fruit jams, thus providing preservative effect.

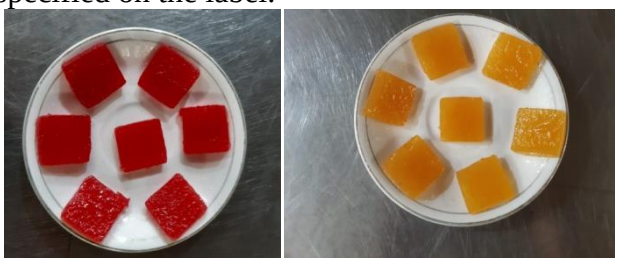
There are two important points to remember when making jams; there must be correct proportions of juice, sugar, acid and pectin in order to produce good gel. Secondly, fruit jams must consist of 40 % invert sugar to prevent crystallisation during prolonged storage. Generalized process for jam preparation is as follows:-

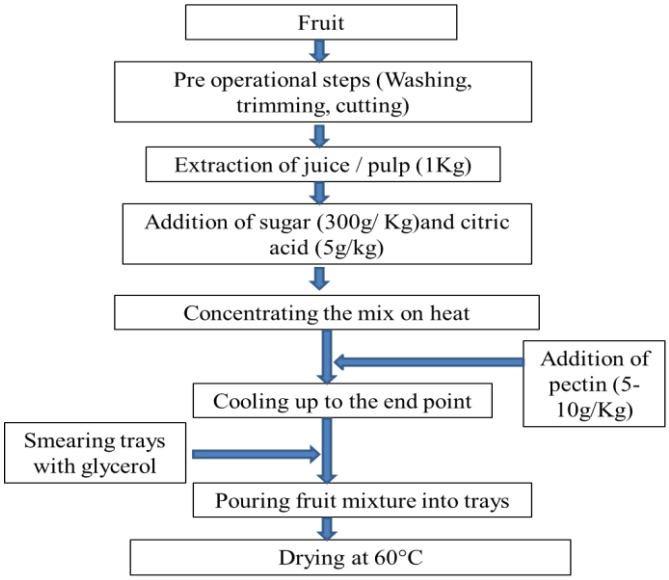


Generalized flow sheet for preparation of fruit jam

Fruit bar: Fruit bar /leather is a dehydrated fruit based confectionary product. It is a naturally flavourful and chewy textured product having a shelf life of more than 6 months. Fruit bar offer the great potential of value addition and profit-building through the processing of seasonal fruits of Punjab like kinnow, guava and mango. While the blending of these fruits could also be a great option nutritionally

and organoleptically. These are nutritionally wholesome products that are high in fibre and low in fat. Fruit leathers are usually cooked and sweetened using 25% table sugar and 45% fruit pulp. A fruit bar must possess a minimum TSS of 25^{0}C and 0.5% acidity. Fruit leathers are dried at 40 to 60 ^{0}C for up to 14- 20 hours. Final moisture content of fruit bar is usually achieved to 10- 15 % with the water activity (aw) of <0.65.Artificial colour and flavours are often added for increased consumer preferences and should be specified on the label.

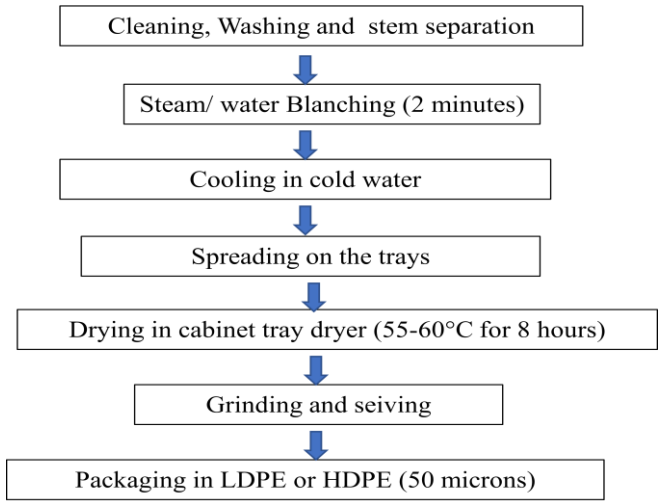




Generalised flow sheet for fruit bar preparation

Dehydrated fruits and vegetables : Dehydrated fruits and vegetables refer to a product from which the moisture have been removed under controlled temperature, airflow and relative humidity. Products can be dried as whole, sliced, diced and powder that must be free flowing in nature. Reduction in the water activity of any food substance via removal of its 70-80 percent water is one of the simplest food preservation methods. Dehydration is a century-old process, earlier it was carried out with the help of solar energy. Nowadays, this process has been mechanized with the help of dryers that helps in producing a uniform product. Pre-treatment i.e. blanching of the produce prior to dehydration is one of the essential pre- operational step to be followed. Blanching helps to curb down enzymatic processes and also removes the trapped oxygen of the produce. Vitamins and color loses can also be prevented through blanching. Drying operation must be carried out until the product is having moisture content less than 20 percent mass by mass.

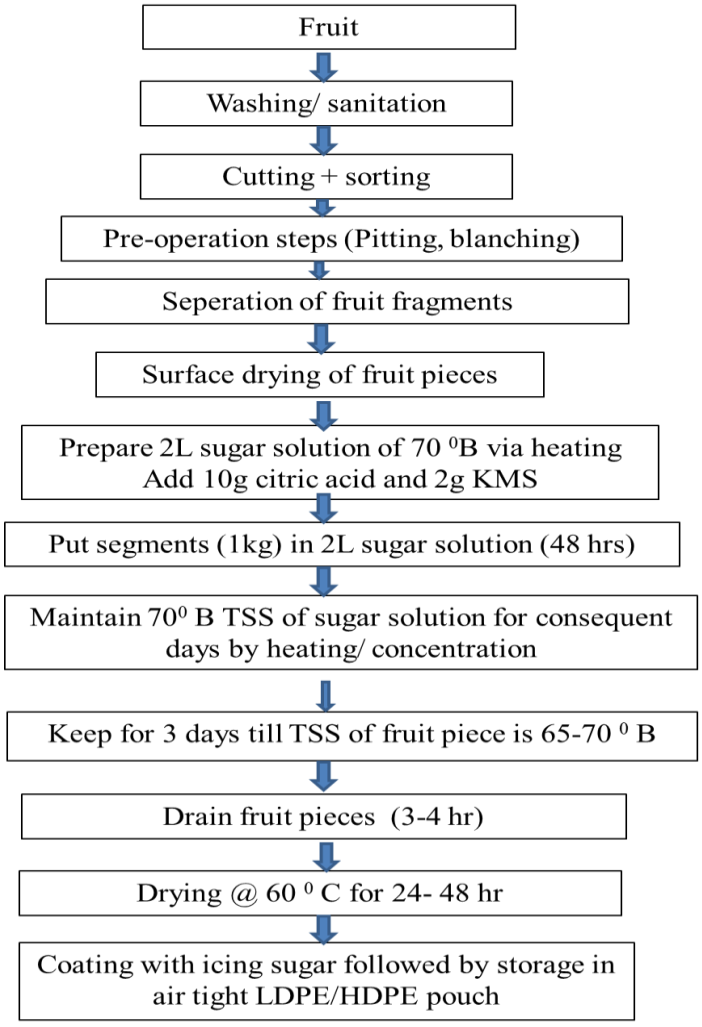
For the dehydrated vegetables the level of permitted preservatives such as sulphur dioxide should not exceed 2000 ppm and must exhibit negative peroxidase test. Therefore, blanching must be performed before drying operation.The processing steps involved in drying green leafy vegetables are summarized as below.



Generalised flow sheet for dehydrated fruits and vegetables

Fruit candy and preserve: Fruit candy is osmo-dehydrated product prepared from sound and ripe fruits by impregnating them in sweeteners. Osmotic dehydrated fruits have a shelf life of more than a year. Osmotic dehydration is a multicomponent diffusion process in which water oozes out and sugar migrates inside the fruit piece. Amla, carrot, karonda, apple, papaya are the potential crops that are of commercial importance for candy and preserve making. As per

FSSAI, fruit must possess 70 percent sugar to be called as osmo-dehydrated product. Major difference in fruit preserve and candy is that fruit preserve will be stored in fresh sugar solution whereas the fruit candy will be subjected to drying after completion of osmosis process. The procedure of osmotic dehydration has been shown by Fig 6.



Generalized flow sheet for preparation of fruit candy

Frozen fruits and vegetables: Freezing often refers to low-temperature preservation that maintains the product quality near to fresh one. Suitable fruits and vegetables for freezing are mango slices, pulp, pineapple slices, guava slices, orange segments, peas, carrot, cauliflower, beans, etc. There are various kinds of freezers available in the food industry. But the process employed for freezing of fruits is usually Individual quick freezing (IQF) as it reduces the processing time of the produce. For example, freezing of green peas can be completed in 10-15 minutes when subjected to IQF as compared to air blast freezer which takes 3-4 hr for freezing. Maintenance of the temperature throughout the process of transportation till the end use is the major concern in freezing operation. The process employed for freezing of fruits are as follows:

Grading →Washing → Size Reduction → Steam / Water Blanching (80-85 ^{0} C for 3-5 minutes) → Freezing (-18^{0}C) Packing and sealing (Automatic Sealer)

Fresh cut peeled garlic : Recent trend of fresh cut vegetables has been facilitated in the Indian market. These kind of products falls under the category of minimally processed products. Peeling of garlic bulbs could be done via flame peeling at a large scale but mostly manual feeling with sharp knives or mechanical peelers are employed at a small scale. Before packing, peeled garlic slices are rinsed with water and pat dried with a dry muslin cloth to wipe off excess moisture. Packing could be done in LDPE or HDPE. Vacuum packaging of the peeled garlic could also be preferred due to its longer shelf life as compared to conventional packaging.Shelf life of vacuum-packed garlic is around 1 month in refrigeration conditions and 15 days under ambient storage.

PHPTC Activities

Participation in Capacity Building Programme for Potato Farmers : A capacity building programme for potato farmers was organized jointly by APEDA and Punjab Agro on 11-11-2021 at Centre of Excellence for Potato, Dhogri (Jalandhar). Dr. B.V.C. Mahajan delivered a lecture on Postharvest Handling and Management for export of Potato.

Participation in Workshop at Citrus Estate Bhunga, Hoshiarpur : Executive Committee meeting of Citrus Estate Bhunga was held on 12-11-2021 to discuss establishment of postharvest infrastructure and cold chain at Citrus Estate, Bhunga. The meeting was chaired by Mrs. Shailender Kaur, IFS, Director Horticulture, Punjab and members of the Citrus Estate. Dr. B.V.C. Mahajan delivered a lecture on Role of Cold Chain in Horticulture Crops.

Participation in State Level Baghbani Mela at Kapurthala : State Level Baghbani Mela was organized by Department of Horticulture. Punjab on 10-12-2021 at Kapurthala. The mela was inaugurated by Sardar Gurjeet Singh Rana, Horticulture Minister, Punjab. Dr. B.V.C. Mahajan delivered a lecture on Postharvest Handling and Marketing of Fruits and Vegetables.

Participation in Training Programme at Narangwal Village, Ludhiana : Dr. Swati Kapoor provided one day hands on training to women at village Narangwal, Distt. Ludhiana on processing of mushroom under Entrepreneurship Development Programme in collaboration with Dept. of Extension Education, PAU, Ldh wherein the participants were detailed about processing techniques for mushroom pickle and dehydrated mushrooms.

Participation in Symposium on Food Safety: Dr. Ritu Tandon participated in Food safety symposium hosted by Agilent held from 26th to 30th July 2021 as a speaker for panel discussion on elemental analysis in food by ICP-MS.