

Punjab Horticultural Postharvest Technology Centre
Punjab Agricultural University, Ludhiana

PHPTC Newsletter

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FRESH CUT FRUITS AND VEGETABLES TECHNOLOGY

Fresh-cut horticultural produce stand out as convenient novel foods that fit the many needs of a modern lifestyle. Recently, their consumption has continued to grow rapidly linked to the increased public awareness of their health benefits. The International Fresh-cut Produce Association (IFPA) defines fresh-cut products as “fruit or vegetables (FCFV) that have been trimmed and/or peeled and/or cut into 100% usable product, bagged or pre-packaged to offer consumers high nutrition, convenience and flavor while still maintaining its freshness”. In essence, salad vegetables such as lettuce, carrots, cucumbers, tomato and fruits such as apples, pears, guava, papaya and watermelons etc are cut, sliced, and packaged in see-through containers that are stored at chill temperatures such that they are ready to use (RTU) upon purchase. In particular, fresh-cut fruits attract consumers because they are fresh, nutritious, low priced, and ready-to-eat. These products, in fact, are characterized by a shorter shelf life than their whole counterparts, because of higher susceptibility to microbial spoilage, increased respiration rate and ethylene production. The process operations (i.e. cutting, splicing, etc.) form lesions in the tissue that determine enzymatic browning, texture decay, rapid microbial growth, weight losses and undesirable volatile production thus, reducing the shelf life of the produce. Various fruit, vegetable and mixed-tray salads are available in the foreign countries providing the consumers a nutritional bowl full of health.

Global Market Tendencies

Traditionally, Indian life style has a predilection for FCFV or those processed at home. On the contrary, surveys indicate a consistently low consumption of FCFV. Average household consumption of FCFV indicate 149 to 152 during this decade though far below the recommended intake. Annual consumption (kg/person/annum) of fruits was 9.6 (rural), 15.6 (urban) and 11.8 (India) while it was 74.3 (rural), 79.1 (urban), 76.1 (India) for vegetables. Other recent studies on average consumption of FCFV amongst urban residents reported as 265 gm/day and less than 3 servings by 72.6% respondents respectively. Now a days, FCFV are more preferred and consumed by people so as to replace unhealthy snack foods with healthier diet. This trend has led the fresh-cut industry to increase investment in research and technology development to resolve the issues regarding raw product supply, packaging technology, processing equipment, and refrigeration. After getting popularity in the fast and nutritional food sector, fresh-cut produce became available at a retail level also. This led the way for development in the industry that results in the recent additions of fresh-cut fruits and vegetables at quick-service restaurants and in retail stores. The production and commercialization of fresh-cut fruits has grown rapidly in recent years, but fresh-cut vegetables, salad in particular, dominate the production of minimally processed foods. According to recent studies, the emerging fresh-cut

fruit sector will probably overshadow salad sales in the future, because fresh-cut fruits are more attractive to consumers and in general are more likely to be consumed as snack products. In addition, fresh-cut fruits on average have higher margins than bagged salads from retail, which will result in ample space for display in the stores.

Fresh-cut fruits processing: potential impact on quality

It is well known that primary processing of fruit promotes a faster physiological deterioration, biochemical changes and microbial degradation of the products which may result in degradation of its color, texture and flavor, even with minimal processing operations are used. Prior to being packaged for consumption, minimally processed fruits are subjected to one or more mild unit operations, as given in Fig. 1, which include washing / sanitizing, peeling, cutting and/or slicing, dicing, shredding, etc. Each step during the production, packaging and storage, could potentially have an effect on nutrients and quality of the prepared produce. A special attention is necessary for mechanical operations as it defines the shelf life of fresh-cut fruit commodities, causing the rupture of many cells and the liberation of intracellular products (such as oxidizing enzymes); at the same time, the surface of produce is exposed to air and to possible contamination with bacteria, yeasts and moulds. It is important to underline that cutting increases the area of injured tissues favoring elevated respiration, promoting further rapid deterioration and microbial proliferation. The damage inflicted by mechanical operations on the cut fruit tissues is greatly influenced by the state of maturity of the fruit; previous studies on this matter show that the more advanced the ripeness stage, the more susceptible the fruit is to wounding during processing. The optimal stage of processing to minimize cutting damage also varies greatly, depending on the species, cultivar, harvest, and postharvest conditions. Fruit such as apples, kiwifruits and cactus pears also require peeling. Several peeling methods are available; however, on industrial scale, peeling is normally accomplished mechanically, chemically or in high-pressure steam peelers. This operation should be as gentle as possible; the ideal method is hand peeling using a sharp knife. Coarse and fine abrasion peeling increased the rate of microbial growth over that of hand peeling. So, if mechanical peeling is used, it should ideally resemble knife peeling. Other methods disturb the cell walls of the produce, enhancing the deterioration, and should be avoided. Within the processing line, the washing operations are the most important steps affecting the quality and the shelf life of the fresh-cut products. A first washing step of whole fruits is generally conducted by rinsing in tap water to eliminate pesticide residues, plant debris and other possible contaminants. Secondly a washing step should be performed after peeling and/or cutting to remove microbes and tissue fluids. The microbiological and sensory quality of the washing water used must be good and its temperature

low (below 5°C). By careful washing, the shelf life of minimally processed produce can be prolonged by several days. Fruit is generally subjected to extra handling with a routinely dipping in a sanitizing solution, containing chlorine or other antibacterial compounds. In the fresh-cut production, therefore mentioned step is the only one where a reduction in spoilage microorganisms and potential pathogens could be achieved.

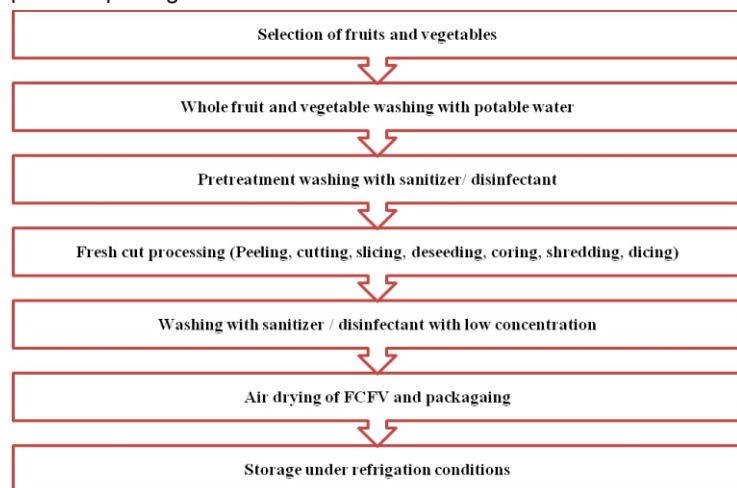


Fig. 1: Flow diagram for sequential steps in Fresh cut fruits and vegetables (FCFV) production technology

- 1. Selection of fruits and vegetables:** Healthy and ripened fruits without any bruises or spoilage should be selected. For vegetables, healthy, firm and spoilage free salad vegetables should be selected that can be eaten as raw.
- 2. Washing of whole fruit and vegetables:** Fruits and vegetables selected, needs initial cleaning with potable water to remove the dust, debris and other unnecessary particles from the surface of the commodity. This step contributes to the major reduction of microflora adhering to the produce. A gentle stream of water must be applied to the fruits and vegetables placed on the conveyor belt or can be done manually by washing each commodity thoroughly under potable tap water. After washing the fruits or vegetables should be kept at a dry place before next step.



- 3. Pretreatment washing with the sanitizers/ disinfectants:** Sanitizing treatments are recommended to minimize the potential for growth of microorganisms and contamination of fresh-cut produce. Various range of sanitizers/ disinfectants based upon active compound present are used in the pretreatment washing of the fruits and vegetables. Chlorine based (Sodium hypochlorite, Chlorine dioxide, HOCl), organic acids (acetic acid, benzoic acid, citric, malic, sorbic, succinic and tartaric acid), ozone, Hydrogen peroxide etc are commonly used disinfectants/ sanitizers. Efficacy of the method used to decrease microbial populations is usually dependent upon the type of treatment, type and physiology of the target microorganisms, characteristics of produce surfaces (cracks, crevices, and texture), exposure time and concentration of disinfectant/sanitizer, pH, and temperature. Concentration of

disinfectants plays a major role while designing an efficient washing protocol for the fresh cut produce. Chlorinated water is most common disinfectant used in the fresh cut industries as decontaminated agent. Around 50-100 ppm of chlorine concentration and contact time of less than 5 minutes has been found to be efficient in reducing population of the microorganisms over the surface of the fruits and vegetables. Organic acids are used widely to increase the shelf life of the fresh cut. Organic acids have the bactericidal activity that inactivates the pathogenic bacteria.



- 4. Peeling, Cutting, slicing of fruits and vegetables:** Major factor that affects the quality of the fresh cut produce includes methods of preparation such as types of tools used, size and surface area of the cut slices, type of water used for washing of products and handling conditions which includes packaging, speed of cooling, maintaining optimum temperature and humidity and proper sanitation conditions. Washed fruits and vegetables should be peeled and cut (over a sanitized cutting board with hands covered with disposable gloves) into medium slices having fine edges with minimum deformation. Slices should be kept on a sanitized place under hygienic conditions till further washing step.
- 5. Washing of FCFV:** Proper washing/ cleaning of fresh-cut produce immediately after cutting is one of the most important steps in fresh-cut production to reduce the pathogens and to pre-cool the cut produce. The effectiveness of the washing pretreatment depends upon the quality of the water, pH, temperature of the operation, concentration of the disinfectant and contact time with the commodity. The product should be washed and rinsed with potable water having low concentration of sanitizer. The large operational costs of water use have resulted in the industry-wide common practice of reusing or recirculating wash-water. It is well known that fresh-cut processors usually rely on wash-water sanitizers to reduce initial bacterial populations in their fresh-cut products as a strategy to maintain their quality and extend their shelf life. After washing with the sanitizing agent, the FCFV should be kept on a sanitized place during which it becomes little air dry suitable for further packaging.
- 6. Packaging and storage of FCFV:** FCFV after the sanitizing washing are packed in the food grade containers for simple packaging useful for immediate selling or for short period of time (4-5 days). For long term storage and transport of FCFV, Vacuum or modified atmosphere packaging technique is followed in which the gases content can be monitored and controlled to delay the ripening of the FCFV, enhancing the shelf life of the produce. Carbon-dioxide, oxygen and ethylene gases content is monitored



and controlled during vacuum packaging among which the carbon-dioxide content is kept high, oxygen content low that subsequently reduces the release of ethylene from the produce, thus preventing decay and spoilage of FCFV during storage. Packed FCFV (simple or vacuum) are kept under refrigeration conditions at 4-5 C for a period of time that can retain the freshness, physicochemical and nutritional value of the FCFV produce.

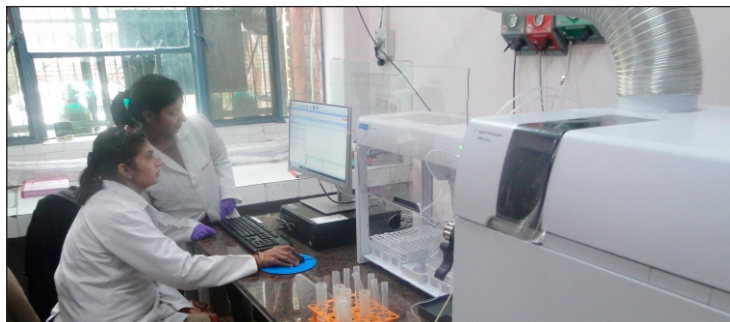
Economic benefits to the small scale farmers and Farmer's organizations

The FCFV technology can help the small scale farmers, farmer's organizations, self help groups and even housewives to opt for this easy and affordable technology to run a successful business providing high economic benefits besides giving the fresh, nutrition rich and healthy product to the consumers.

Future prospects: Fresh-cut fruits and vegetables; rare commodities with a rapidly growing sector in the food industry, with both retail and food service outlets. At the moment, the main factor that has promoted and maintained fresh-cut sales is the technology. However, permanent innovations are necessary to drive new growth in this sector. Use of innovative packaging technology that could improve product quality and shelf life, new fruit mixtures with more variety, incorporation of flavors, or the use of steamer bags for vegetables, are just a few considerations that could expand the markets of fresh cut products. Worldwide, there is a wide range of vegetables that could be used to broaden and increase the product offerings in the market. However, in many countries, it is necessary to improve preparation and preservation techniques with the purpose of keeping the product safe and of high quality long enough to make the distribution of fresh-cut commodities feasible and achievable.

PHPTC Activities

Elemental Testing Laboratory: PHPTC has upgraded its quality control laboratory with the installation of ICP-MS, Microwave digestion system and water purification system. Quality control Laboratory at PHPTC now offers services such as testing of heavy metals in water, fresh and processed food products along with other quality parameters. The detailed information of the services and respective charges can be obtained through the site- www.phptc.org or by email at phptc@pau.edu.



Calibration of moisture meters: PHPTC provides calibration services for moisture meters to different market committees of Punjab under Punjab Mandi Board.



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(Model No : PB-2020)



Universal Digital Moisture
Meter
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