

PROCESSING AND VALUE ADDITION IN ONION

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Abstract

Most of the harvested horticultural produce is lost during postharvest handling and storage as they are perishable. Postharvest vegetable losses occur due to mishandling and postharvest diseases that produce wither and decay. Under these situations, value addition is considered as a viable alternative solution. Processing of onion and the development of value-added products are commercially successful as they reduce the losses and retain the nutritional value of the produce. Storing onions for an extended period is a cumbersome process as they are amenable to sprouting and certain postharvest diseases. Hence value addition would generate great demand and more market opportunities by increasing consumer preferences. With available processing and preservation advancements, value addition would be the right choice to ensure the shelf life, nutrition status, and product quality that matches the market demands in the future.

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Introduction

Onion is an important vegetable crop grown all over the country. India ranks second in world onion production with the contribution of 16 % and 10 % of global area and production respectively. Worldwide, China (2.05 croret tonnes) leads in production, followed by India (1.33 croret tonnes) (Source: FAO, 2018). In India, Maharashtra, Madhya Pradesh, Karnataka, Rajasthan, Bihar, Gujarat, Andhra Pradesh, Haryana, West Bengal, and Uttar Pradesh are the leading onion producing states. The share of the above states is 90% to country's onion production. The top ranking state, Maharashtra is accounting for 8,854.09 thousand tonnes with a share of 38.09%; Madhya Pradesh ranks second in production, accounting for 3,701.01 thousand tonnes with a share of 15.92%, and third is Karnataka which accounts for 2,986.59 thousand tonnes with a share of 12.85% (<https://agriexchange.apeda.gov.in>). The currently production in India is 26.6 million tonnes from an area of 1.43 million hectares. (Source: Horticulture Division, Ministry of Agriculture). Bangladesh, Malaysia, United Arab Emirates, Sri Lanka, and Nepal are major importers of onion from India. There is a massive demand for onion in the world as all people consume it for its unique flavor, taste, and pungency. Onion not only provides flavor but they also a source of nutrients and phytochemicals which activate the metabolic process of the human body. It contains Vit-B, Vit-C, potassium, manganese, phosphorus, folate, sulfur compounds, and traces of iron and calcium. Nearly 7.51% of onions get damaged during postharvest handling and storage practices (Rama Krishna and Gajanan, 2021). Thus processing helps to overcome these problems. Onion-based food products have wide applications in processing and other industrial purposes. Ready-to-use or ready-to-cook forms are made from onion, besides, powder, dehydrated flakes, paste, oil, vinegar, sauce, pickles, wine are produced from onion bulbs.

Post harvest Management

After harvesting the bulbs, drying is carried out to remove the excess moisture and it benefits retaining colour of outer scales, minimizing the accumulated heat in the bulbs. The field heat is removed by either drying the bulbs for 4 days in open field after harvest or by curing the bulbs in shade for a week. The odd bulbs having thicker necks, bolting, splits, twins, damaged, and rotten bulbs are sorted out. Big-sized bulbs are highly preferred for the Delhi market, and medium-sized bulbs are preferred for Calcutta, Patna, and Lucknow markets. In Bhubaneswar and Guwahati, small-sized onions are preferred. Based on the length of the equatorial diameter of bulbs, a grading size code is given. Size code A onions have 10-20 mm, size code B onions have 21-40 mm, and size code C onions have 41-70 mm equatorial diameter (<http://apeda.gov.in>). Onion sizes preferred by different countries is 60-70 mm for Japan and Europe, 40-60 mm for the Middle East and Gulf countries, 25-30 mm for Sri Lanka, Bangladesh, Pakistan, Nepal, Malaysia, Singapore, Port Kelang, and African ports (Source: MSAMB, Pune). Sprouting and moisture loss of onion bulbs are reduced at a storage temperature of 23.9 °C to 29.4 °C for 5-6 months.

Onion Varieties for Processing

Red-colored onion varieties turn dark brown color on processing. Hence, white onion varieties are preferred chiefly for processing industries. Two hybrids were developed by the Indian Institute of Horticultural Research, Bengaluru, for processing ArkaKirthiman, ArkaLalima, where as ArkaKalyanis developed for making paste. These varieties possess various attributes such as pungency, vitamin C, total soluble solids, quercetin, and antioxidant properties that make them suitable for processing into various forms. Another variety, 'BhimaSafed' released by the Directorate of Onion and Garlic Research, Pune, possesses white coloured bulbs, 11-12% TSS and is suitable for table purposes and processing. In 2019, Punjab Agricultural University developed a processing-grade white onion variety named PWO-2, for commercial cultivation in the rabi season in north Indian states. This variety has shown desirable parameters for processing, like high TSS(14-16%), high dry matter content(25%), and a high yield of 165 quintals/ha. ArkaSwadista is a white colour onion variety suitable for bottle preservation. The most suitable varieties for dehydration are Punjab-48 with TSS range(14.6%), Pusa white flat, white imperial spinach, Rivrina late brown, Country queen, Pusa white round with TSS range 12-13%, and Udaipur 102. Less browning index and high rehydration ratio are two quality parameters for making dehydrated onion products. The Directorate of Onion and Garlic Research for fourteen years is mainly involved in evolving varieties suitable for processing with high TSS in the available germplasm collections.

Value-Added Products

India's export of processed onion is increasing year by year. As India is a tropical country, onions produced have high pungency and flavor, which is more desirable for processed products. Some of the value-added products of onion are paste, dehydrated flakes, powder, rings, puree, vinegar, pickle, juice, and oil.

Onion Paste

It can be made from either boiled onions or dried onions. Onion pastes are used in curry preparations. Machinery used are Industrial washing machine, Onion peeling machine, Onion grinding machine, Electric heating jacketed kettle, Pasteurizer, and Packaging machine. Onion bulbs are harvested and stem portions are cut either manually or mechanically. Then, grading is done to remove the diseased, undersized, oversized, and injured bulbs. B and C-grade bulbs are used for processing. After grading, peeled to remove the inedible portions of the bulb. After peeling, these bulbs are washed to remove dust or leftover peels, and chlorine dioxide is used to disinfect the bulbs. Then pulping is done using a crushing machine to attain the pastes with uniform consistency. Heating should be done at 110°C to reduce the moisture content of the paste and 2-5% salt is added for taste and 0.1 – 0.2% of citric acid is added for preservation. Pasteurization is carried out at 82°C or slightly below for 30 sec to 30 minutes to inactivate the microorganisms which cause spoilage. Finally, the pastes are filled in containers and immediately sealed to retain the freshness of the paste. The containers for packaging may be pouches, plastic bottles, or metal cans. These packaging materials must be kept clean and sterilized. After that, proper labeling and packaging should be done, and they are allowed to cool by keeping them in a cool place or cold conditions to prevent flavor loss due

to increased temperature. They are stored in cool, dry places to maintain a shelf life of upto 18 months(<http://www.iifpt.edu.in>).

Dehydrated Onion Flakes and Powder

The USA, China, and India are major commercial producers of processed onion products. Generally the preferred drying ratio is 6:1, however, Indian varieties possess fairly high ratio of 10:1. A variety with high dry matter content has to be bred in India, so as to have the desired drying ratio. The present, varieties such as Pusa white flat, Pusa white round, Punjab-48, N 257-9-1, and Udaipur 102 have been identified for drying purpose. A dehydrated form of onion is used to produce flakes, powder, rings, and kibbles. Onion flakes are used for seasoning and in soups, pickles, salads, sauces, and other snack items. For dehydration purposes, onion varieties should possess characteristics like white color onion having globose shape varieties with TSS range from 15-20%, higher levels of pungency, insoluble solids and lower levels of reducing and non-reducing sugars with better storage quality are preferred. Varieties with high pungency produce high-quality flakes. Dehydration is carried out by drying the sliced onions at optimum temperature in a cabinet drier at a temperature of 55-60°C for 10-15 hours. Finally, the onion slices are placed in bins for drying to reduce the moisture content. Dehydrated onion flakes using freeze-drying, flow drying, or vacuum-shelf drying are pulverized to make powder and kept in cool, dry places to prevent them from absorbing moisture. Dehydrated onion flakes and onion powder are used in sauces, soups, salad sprinkles, seasoning, and culinary purposes. Dehydrated onions are used in other forms like minced onion, chopped, and rings. Onion rings are primarily used on sandwiches and bread crumbs.

Onion Rings

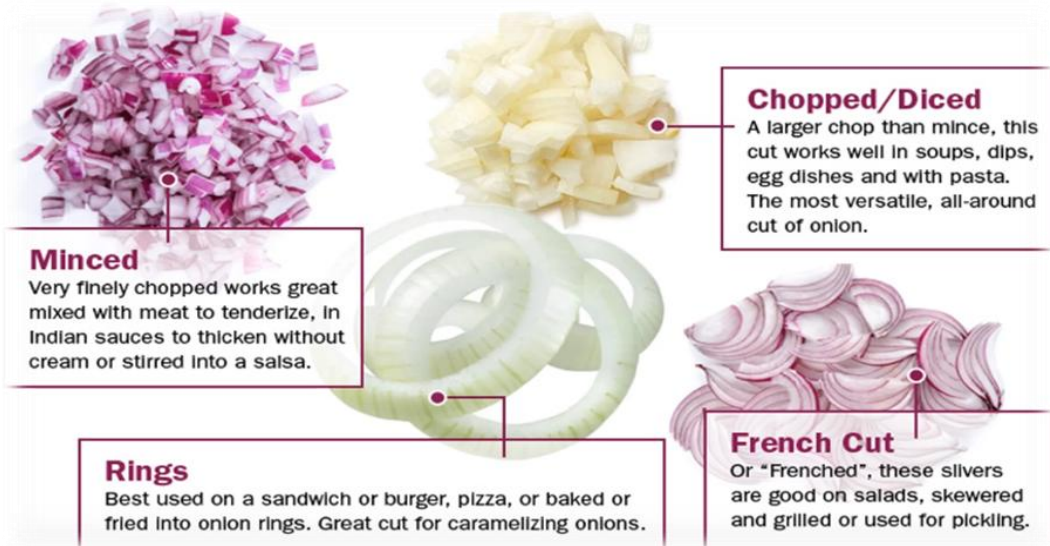
Onion rings are made from a dehydrated or frozen form of onion. French fried onion rings are made by deep-frying the rings in oil or fat before subjecting them to freezing, but raw breaded onion rings are not blanched before freezing.

Onion Salt

Onion powder is mixed with well-pulverized refined table salts, and 1-2% of anti-caking agents are added to prevent caking and water absorption.

Onion Puree

Red, white and small onion types are suited for puree preparation. After grading and peeling, pulped and heated at 110°C, and pulps are concentrated at a different level to get a puree having TSS range between 10-15° Brix. Double and triple-concentrated purees are obtained by using the vacuum evaporator. To get a puree, pulps are concentrated to 10° Brix, and also 1% NaCl and 0.1% citric acid are added. After concentrating, these purees are filled in containers at 70-80°C. Finally, they are stored in a cool place for further use. Purees can be stirred into stews, soups, and casseroles to add a good punch of flavor.



Onion Vinegar

Onion vinegar is made from onion juices with yeast culture of *Acetobacteraceti*. Onion vinegar was found to have high potassium content(943 mg) and low sodium(54 mg) content than conventional rice and malt vinegar and also high in calcium(363 mg) and magnesium(122 mg) content. It helps to boost the immune system by adding good probiotics and digestive enzymes to our human body. This vinegar is also effective against hypertension.

Onion Pickle

Onion varieties preferred for pickling are of two types, brown or dark red onion having 28-45 mm diameter and white or silver-skinned onions having 10-28 mm diameter. Onions chosen for pickling are peeled and blanched for 5 minutes. Then lactic acid is added to control the fermentation process, and bisulfite is added to control the enzymatic reaction and maintain the product's color. Blanched onions are filled in jars, and 2-5% salt is added. After 24-48 hours, water is drained off, vinegar and spices are added, and jars are sealed and stored in optimum condition for future use. Blemishes are a major concern in pickles, with white-colored blotches in the first layer caused by improper fermentation.

Onion Juice

According to Lawande, et al., (2012), onion juices are made by flash heating the crushed pulp at 140-160°C and then cooled at 40°C. Then they are evaporated to 72-75% solids for preservation. Onion flavonoids like quercetin, rutin, and myricetin are present in onion juices, and intake of those flavonoids results in reduced cholesterol levels and elevated antioxidant activity. They also inhibit lipid peroxidation and increase the oxidation period of low-density lipoprotein cholesterol (Luet al., 2015). Studies by Javadzadeh, et al. (2009) showed that injection of onion juice in rats had overcome the effect of selenite-induced cataract formation in rats.



Dehydrated onion flakes



Onion powder



Pickled onions

Onion Salt

This product is obtained by gathering 20 per cent onion powder and 78 per cent pulverized refined table salt. In order to prevent caking and water absorption, 1-2 per cent anti-caking agent is added.

Onion Oil

The distillation process produces oils extracted from the onions. Distillation yields oil having dark amber-colored liquid. Oil yield varies from 0.002 – 0.03%. About 4.4 kg of onion yields one gram of onion oil. Farrag (1980) described the medicinal properties of onion oil, which may overcome certain diseases like furuncles, liver cirrhosis, kidney inflammation, asthma, diabetes, and septicemia. They also exhibited inhibitory effects against mycotoxin and dermatophytic fungi. Many studies investigated that oil is highly effective against gram-positive bacteria by inhibiting their growth. The sulfur compounds in onion oil showed antibacterial, antioxygenic, and antidermatophytic activity (Zohret *et al.*, 1995).

Conclusion

Onion is an important vegetable crop with high foreign exchange earnings and is well known for its flavor and pungency. Primarily they are used as ingredients for Indian food. Hence value addition would lead to an improvement in the economic status of farmers. Value addition is the best solution to tackle market fluctuation and helps farmers profit more. As onions contain more proteins and energy, they are widely used for cooking worldwide. Onion value-added products have increased dietary components like flavonoids and antioxidants. Bioactive features in onion include allyl propyl disulfide, allicin, methyl alliin, quercetin, and protocatechuic acid. Flavanoid compounds in onion would help to overcome cardiovascular diseases (Lee *et al.*, 2011). Due to the non-availability of proper postharvest storage facilities, a significant portion of produced onions perishes and the market availability of fresh raw onion is also limited to only 8-9 months a year. Hence, processing and value addition would create high market demand as processed onions reduce the product volume, lower the transportation cost, extend the product's shelf life,

make the products available in the off-season, and satisfy consumer preferences and market demand.

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