Modern Food Processing
A remedy for increasing shelf-life of fruits & vegetables
Date: 23-04-2010 | Edition: National | Page: 44 | Source: Bureau | Clip size (cm): W: 19 H: 26
Clip: 1 of 3

Dehydration technology

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Of the total fruits and vegetables (F&V) produced in India, approximately 35-40 per cent is wasted due to the water or moisture content in them. This wastage can be reduced dramatically by adopting dehydration technology, which helps in increasing the shelf-life as well as retaining the nutrient value of the products. **Geetha Jayaraman** discusses the various advantages of dehydration technique for processing of F&V.

Courtesy: www.edetoxify.com

Globally, India ranks first in the production of fruits and second in vegetables, accounting for approximately 10 and 15 per cent, respectively. India has a growing food processing sector that is playing a vital role in diversifying the agricultural sector and improving value-addition opportunities for agri-products. Inspite of being one of the leading producers in the world, India merely processes two to three per cent of its total F&V production. This contribution is low when compared with other countries like Brazil (30 per cent), US (70 per cent) and Malaysia (82 per cent).

Dr S Rajarathnam, head - Fruit and Vegetable Technology, Central Food and Technological Research Institute (CFTRI), says, "Fresh F&V produced in our country account for 51 and 72 million tonne (mt), respectively, based on the production figures of 2008 by the Food & Agriculture Organisation (FAO). Only about three per cent of this production is processed, of which one-third is processed by dehydration technique."

Besides, the demand for dehydrated F&V within India is limited to only processed food industry, as consumers mostly prefer fresh produce all the year round. Anil Jain, managing director, Jain Irrigation Systems Ltd, explains, "Indians prefer fresh produce over dehydrated products and are not particular about non-availability of some of the products after the season. The requirement of the processed food industry for dehydrated products is limited at present but is slowly and steadily growing. In the coming years, we hope it becomes substantial."

Dehydration process

Because the water or moisture content in fresh produce is the basic cause for spoilage, dehydration technology is considered one of the best options for preserving F&V. Removal of water content can increase the shelf life of F&V. Various methods have been developed for this purpose, and those

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Clip: 2 of 3

commonly used are hot air drying, vacuum drying, etc, thus making dehydration process the best viable solution for preserving F&V. Sonali Dutta, VP - Corporate Affairs, Bry-Air (Asia) Pvt Ltd, informs, "Vegetables are now preserved using modern techniques, unlike the conventional method of drying in the Sun. For example, some vegetables are frozen, while others are freeze-dried or dried & stored (using latest dehumidification techniques of drying at a particular temperature). These techniques preserve the taste, colour and aroma of the vegetables."

Agreeing with her, Govind Hardikar, managing director, Hardikar's Food Technologies Pvt Ltd, says, "Dehydration is an intermediate step in converting raw agricultural produce into retail products. Dehydration makes the availability of conventional food possible. As large food processing companies either have their own drying facilities or (more likely) hire firms specialised in dehydration technology, there is little opportunity to market bulk dehydrated farm products (except for grains) through conventional channels."

Dehydration of F&V is carried out in a closed chamber by mechanical procedures under controlled temperature and humidity conditions so that the product continues to remain attractive in appearance, nutritious & flavour and conforms to sanitary requirements. Dehydrated F&V are further processed and filled into tin cans, which are seamed and sterilised for the purpose of long-term preservation. This technology has been developed for dehydration of various fruits such as mango, banana, *amla*, *chikkoo* & figs and vegetables such as tomato, spinach, cauliflower & carrots.

Dehydrated flakes or slices are made or converted into powders. This is done at low temperatures so as to preserve the nutritional values of F&V. The use of vacuum dryers preserves the good aroma of F&V. This process needs no base material, and hence powders obtained are pure. Dr Rajarathnam avers, "Dehydration amounts to removal of moisture from fresh F&V (that counteracts the high spoilage in fresh form). This is done by different methods of drying, such as hot air dryers, vacuum shelf dryers and freeze dryers. Further, osmo-dehydration is an added advantage for drying fruits such as mango, papaya and pineapple, wherein the sliced fruit is subjected to osmosis in sugar solutions, followed by hot air drying, and the finished product retains good native colour, texture and flavour."

Various hot air systems have been developed by using electricity, liquified petroleum gas, woodfire boiler, etc. In some cases, eg, green leafy vegetables, blanching is done to maintain colour after dehydration. In fruits, osmosis is done before dehydration. The technology provides for a process that adds good nutritional values, as well as maintains taste & colour similar to that of the fresh ones.

Dr S Rajarathnam

head - Fruit and Vegetable Technology, Central Food and Technological Research Institute

Careful pre-treatments and use of proper equipment can yield a good product. In particular, dehydrated products are advantageous for export trade because of reduced bulk and absence of moisture from fresh fruits and vegetables, which cuts down freight charges and increases storage life.

Export value

F&V are dehydrated with a view to preserve surplus perishable foods. With increasing urbanisation, continuous efforts are made to provide a regular supply of acceptable and desirable food products. Thus, a significant increase in demand for dehydrated F&V has been noted, although much of the food produced all over the world is consumed in the fresh form.

Furthermore, the future demand for dehydrated fruits is thus contingent upon income, price and change in the consumption habits of the population, particularly the urban. Dehydrated vegetables are used as processed raw material in a wide range of food processing industries. There is immense scope for developing this industry by integrating production with marketing and processing. Also, the demand for dehydrated F&V is increasing in the overseas market.

"Fruit slices and vegetable powders have huge export market. Onion and garlic market for export is

Anil Jain

managing director, Jain Irrigation Systems Ltd

With all the challenges the outlook is still positive as even today small amounts of the produce are being processed. Farmers too are slowly becoming allied to the requirement of the industry, followed by changing food habits that are resulting in growth of local markets.

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Clip: 3 of 3

Sonali Dutta
VP - Corporate Affairs, Bry-Air (Asia) Pvt Ltd

Freeze-dried foods are more nutritious than their canned counterparts, as these retain more vitamins and nutritional content. They are good for everyday cooking and long-term food storage. These foods have 98 per cent of their moisture removed, but retain almost entire flavour and nutrients of fresh food.

already established. Many enquiries have started coming for fruit slices and vegetable powders. The only problem is the requirement of large quantities of products, for which huge investments are necessary. For investors, this is the best opportunity to venture in this new market," points out Hardikar.

Dehydration has great potential for overseas trade because of the reduction in mass and volume, which decreases the freight charges and, more importantly, enhances storage life, which makes the fruit and/or vegetable available in off seasons also. Agreeing with this, Dr Rajarathnam says, "Careful pre-treatments and use of proper equipment can yield a good product. In particular, dehydrated products are advantageous for export trade because of reduced bulk and absence of moisture from fresh F&V, which cuts down freight charges and increases storage life. Parts of Europe, the US and Gulf countries are the major importers. Bulk of the mushroom export trade is in the dehydrated form."

Table 1: Three-year export statement of APEDA; Qty in metric tonne (MT), Value in Rs lakh

Products	2006-07		2007-08		2008-09	
	Qty	Value	Qty	Value	Qty	Value
Fresh fruits & vegetables						
Fresh onions	1378373.2	116330.57	1008606.5	103577.89	1670186.3	182752.21
Other fresh vegetables	276824.6	43314.38	350235.47	48949.01	505285.47	68020.32
Dried nuts (walnuts)	5062.86	11803.79	6716.48	16207.8	5696.34	14123.63
Fresh mangoes	79060.88	14193.95	54350.8	12741.76	83703.18	17071.25
Fresh grapes	85897.79	30192.45	96963.57	31782.51	124627.97	40861.28
Other fresh fruits	177638.3	30997.39	207700.78	30452.6	256768.53	43086.84
Total	**2002858**	**246832.5**	**1724574**	**243711.6**	**2646268**	**365915.5**
Processed fruits and vegetables						
Dried and preserved vegetables	119270.43	42754.17	125726.28	42993.81	147861.21	49641.51
Mango pulp	156835.51	50582.79	166752.17	50968.51	173013.6	75298.9
Other processed fruits and vegetables	318067.57	95550.82	311756.29	96281.65	387126.42	137179
Pulses	255084.47	78999.4	170614.39	54900.85	136880.08	54232.5
Total	**849258**	**267887.2**	**774849.1**	**245144.8**	**844881.3**	**316351.9**

Bright future ahead

Next to osmo-dehydration and vacuum shelf-drying, dehydrated products of best quality are obtained by freeze-drying, which costs about 25 times more than the hot air-drying method. The freeze-dried products are of better texture, flavour and colour compared with the fresh ones, when rehydrated. Jain informs, "The most widely used technology is air drying; other technologies such as micro-wave drying & vacuum drying are also being attempted but they have had limited success."

The high cost of this procedure would restrain the easy Indian market; however, they can target definite foreign markets and accordingly boost earning of foreign exchange. "The challenges involved in preparing & marketing of dehydrated products, are availability of the processable variety of raw material at the right price & at right time, strong local consumption of fresh produce of any quality, high dependence on export markets, competition from other countries, non-tariff barriers like multiple quality standards, high energy costs and unreliable source(s) of energy," opines Jain.

Further, there is wide scope and potential for producing and marketing dehydrated F&V. "With all the challenges the outlook is still positive as even today small amounts of the produce are being processed. Farmers too are slowly becoming allied to the requirement of the Industry, followed by changing food habits that are resulting in growth of local markets," points out Jain.

Trends and studies on specific methods of drying for different commodities would evidently boost market for the products not only in the current year but in the coming several years. These will support the additional merit of India, which is one of the leading producers of F&V in the world.