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Post harvest handling and value addition in spices

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1. Introduction

Spices are high value export oriented crops and India is a major exporter of spices and spices products. During 2012-13 India has exported 1,77,625 tons of spices valued Rs.2,71,147 registering 13% increase in and 9% decrease in volume. In the quality front, the major consuming countries like Europe and USA are demanding more and more quality compliance by the producing countries. To meet this challenge we have to equip ourselves to produce, process and market high quality spices, with internationally accepted food safety standards. Hence precautions has to be taken from the harvesting, primary processing which includes, washing, threshing, blanching, drying, cleaning, grading and packaging in order to meet the standards. The improvements in post harvest processing, mechanisation and value addition in spices in major spice crops are presented in this paper.

2. Black pepper

Harvest in Black pepper starts when one or two berries turn yellow (Purseglove *et al.* 1981). The spikes are nipped of by hand and collected in bags. Three models of pepper harvester were fabricated and evaluated on the basis of efficiency in the cutting action and easiness in operation (Aneeshya *et al.* 2013). The most efficient and user friendly was the second model due to its light weight, easiness in operation and minimum loss. Recent advances in product diversification have necessitated harvesting of the berries at different stages of maturity (Natarajan 1981). The primary processing in black pepper involves threshing, blanching, drying (sun drying or mechanical drying), grading and packing.

a) Threshing, Blanching, Drying

Traditional manual processing has given way to mechanization in majority of the processing stages. Mechanical threshers are used now to improve the quality of the product and to increase the efficiency of operations. Threshers developed by various agencies are compared (Amaladhas & Korikanthimath 2003) and given in Table 2.

Table 2. Comparison of black pepper threshers developed by different agencies

Parameter	Model/ make of thresher									
	Gudalur thresher	KAU thresher	TNAU thresher (Improved model)	Malaysian thresher	Indonesian thresher		Vivega thresher		Mohta thresher	Cafex thresher
					Manual	Power	Manual	Power		
Capacity (kg h ⁻¹)	600	50	200	600	170 – 185	425 – 450	50	200	1200	600
Power source	2 hp motor	0.5 hp motor	1 hp motor	NK	Pedal operated	3 hp motor	Hand operated	3 hp motor	3 hp and 1 hp motor	3 hp motor
Threshing mechanism	Wooden cylinder with aluminium angles	Metal drum with rubber lining	Metal drum with rubber lined rasp bar	Metal drum lined with rubber blades	Metal drum	Metal drum	Metal drum with angles	Metal drum with angles	Metal drum	Metal drum
Max. efficiency (%)	99.5	98.0	99.6	99.8	94.13	92.21	91.5	96.0	Nearly 100	98.0
No. of passes	2 - 3	2 - 3	2	2	NK	NK	3	2	1 - 2	2
Damage (%)	< 0.3	< 0.5	Negligible	NK	3.78	6.13	4.0	> 4.0	Negligible	< 0.5

NK – Not known

Source: Amaladhas & Korikanthimath (2003)

The quality of the black pepper can be improved by blanching, a simple treatment of dipping the mature berries taken in perforated vessel in boiling water for a minute before drying. Sun drying is the conventional method followed in order to bring the moisture content below 10%. The average dry recovery varies between 33-37% depending on the varieties. Recently, various types of dryers such as solar and mechanical dryers have been developed by different agencies which are highly efficient for drying pepper. Solar tunnel drying in a cylindrical tunnel shaped drying chamber of size 2 m × 3 m to a height of 2m for drying 100 kg pepper was reported by Thirupathi & Visvanathan (2008). A natural convection reverse air flow mechanical drier developed by Regional Research Laboratory, Trivandrum are used by the farmers and small scale industries for drying of black pepper. Models of varying capacities operated either electrically or by burning agricultural wastes can also be used for drying. An electrically operated drier of 100 kg capacity has been developed by TNAU, Coimbatore (Sreenarayanan *et al.* 2003).



Fig. 1. TNAU Thresher



Fig. 2. Mechanical black pepper dryer

b) Cleaning and Grading

Cleaning and grading are basic operations that enhance the value of the produce and help to get higher returns. The dried pepper is cleaned to get rid of the extraneous matter such as dirt, stalks, leaves etc. Magnetic separator is used to remove metallic contamination such as iron fillings and stray nails. Vibratory conveyors with inclined decks in combination with air classification are used for efficient de-stoning of spices. Broken pepper and light pepper grades are separated pneumatically. Pinheads which come along with garbled pepper are separated by sieving. Cleaning on a small scale is done by winnowing and hand

picking which removes most of the impurities. Grading of black pepper is done by using sieves and sifting black pepper into different grades based on size. TNAU has developed a hand operated cleaner cum grader suitable for cleaning and grading operations (Thirupathi and Visvanathan, 2008). At an operating speed of 25 rpm, the unit had a maximum effectiveness of 66.4% and capacity of 430 kg/h.

c) Packaging and Storage

Whole pepper is generally packed and transported in gunny bags and polyethylene lined double burlap bags. The bags are arranged one over the other on wooden pallets after laying polypropylene sheets.

3. Cardamom

Cardamom, known as the 'queen of spices', is one of the highly prized spices of the world. As the flowering continues over a long period several pickings are needed. Harvesting should be taken up only at a time when the capsules reached the maturity stage. Immediately after harvesting on each day, capsules are washed to get rid of dirt and treated with 2 % washing soda (Sodium Carbonate) for 10 minutes to retain green colour and reduce mould growth in RCC tanks. The treated capsules are spread in a single layer on portable drying trays for draining of wate and later for drying.

a) Curing

Cardamom curing or drying is the process in which the moisture content of green cardamom is reduced to 8-12%. There are mainly two types of drying viz. sun drying and artificial drying. In sun drying it is difficult obtain good green colour and requires 5-6 days or more depending up on the availability of sun light. Artificial drying can be done either by electrical or conventional flue pipe drier.

b) Garbling

The dried cardamom is then subjected to garbling. Traditionally this is achieved by rubbing the cardamom capsules against coir mat or wire mesh and winnowed to remove any foreign matter. An oscillatory type semi mechanical garbling unit developed by Tamil Nadu Agricultural University, Coimbatore has a capacity of 2-3 kg per batch whereas the rotary type garbler will take about 2-3 minutes to garble one batch of about 5 kg. Its capacity is 100kg/h and the efficiency was 98% (Sreenarayanan *et al.* 2003).

4. Ginger

India and China are the world's largest producers and exporters of ginger. In India, domestic market prefers fresh green ginger for culinary use while two other types of dried ginger i.e. bleached and unbleached are also produced for export purpose. The fresh ginger immediately after harvest is subjected to washing, which is performed to remove dirt, residues of farm chemicals and other foreign materials.

a) Peeling and drying

After washing the ginger rhizomes are subjected to peeling operation. Indigenously, peeling of ginger is done by scrapping with sharpened bamboo stick. The scrapped or peeled rhizomes are again washed well and dried in sun for a week or more and then rubbed again to give a polish. A mechanical brush type ginger peeling machine has been developed by Rajasthan Agricultural University. The peeling efficiency of the machine was 85% and the capacity was 200 kg/h (Agarwal *et al.* 1987). Another mechanical ginger peeler was developed with its peeling drum made of diamond cut mesh (Jayashree & Visvanathan 2013) which has a peeling efficiency of 59%. The sun dried ginger is brown in colour, more or less irregular wrinkled surface

and when broken, shows a dark brownish colour. However, it is reported that the quality of dry ginger cured in the brightsun is better than the quality of ginger cured in a closed oven with artificial heat.

b) Polishing

Polishing of dried ginger is done to remove the wrinkles developed during drying process. In the indigenous method the dried ginger is rubbed against a hard surface. However, hand or power operated polishers similar to turmeric polishers are also employed for the purpose of polishing dried ginger. In the case of hand operated polishers an output of 5-6 quintals per day of 8 hours is obtained with the help of two persons. The dried ginger rhizomes are manually graded. The machines of various capacities to pulverize dried ginger from 25 kg per batch to continuous powdering of 2-3 t/ day for large scale production are available.

5. Turmeric

Maturity of the crop is indicated by complete drying of the aerial plants including the base of the stem. The leaves and stem are cut close to the ground. Two days earlier to digging out the rhizomes, irrigation is given. In case of ridge method of planting, plough is used to lift the rhizomes. Otherwise the rhizomes are dug out with manually. The harvested rhizomes have to be cured within 2-3 days after harvest for securing maximum output. In the turmeric growing regions of Tamil Nadu, mechanical harvesting of turmeric is being practiced. Tamil Nadu Agricultural University (TNAU), Coimbatore has developed a power tiller operated mechanical turmeric harvester with a capacity to harvest 0.6 ha per day (TNAU, 2009a). Tractor drawn turmeric harvester mounted on 35-45 hp tractor with a capacity to harvest 1.6 ha per day have been developed by TNAU (TNAU, 2009b). The tractor mounted harvester may be adjudged as the best mechanical harvester for saving of time and reduced the percentage of damaged rhizome apart from the removal of drudgery in harvesting of quality rhizome.



Fig 3. Tractor and power tiller driven turmeric harvester

a) Post harvest operations

The harvested turmeric rhizomes before entering into the market is converted into a stable commodity through a number of post harvest curing processes like boiling, drying, polishing and colouring. Curing of turmeric is taken up within 3 or 4 days after harvest. The fingers and mother rhizomes are separated and are cured separately, since bulbs take longer time to cook.

The recommended practice is to use clean water for boiling turmeric rhizomes in mild steel or galvanized iron pans and takes about 60-90 minutes. The cooked fingers are heaped on a cleaned drying floor and left undisturbed for 4-5 hours and later sun dried for 10-15 days by spreading in 5-7 cm thick layers on bamboo mat or on the drying floor. Tamil Nadu Agricultural University (TNAU), Coimbatore, has developed an improved turmeric boiler using steam boiling technique (Visvanathan *et al.* 2002). The

capacity of the boiler is about 200 - 300 kg per batch and 40 q per day of 8 hours. Fuel used is 70–75 kg of agricultural waste materials. Curing of turmeric for 60 min by steam cooking was considered optimum to produce quality dried turmeric with minimum losses. The use of large scale steamer for boiling large quantities of turmeric rhizomes at farm level was also available (Visvanathan 2008).

b) Polishing

Poor appearance of dried turmeric is improved by smoothening and polishing the outer surface by manual or mechanical rubbing. Manual polishing gives rough appearance and dull colour in the dried rhizome. A mechanical polisher for turmeric has been developed in the Agricultural University at Andhra Pradesh, India (Sukumaran & Satyanarayana 1999). The unit consists of 88 cm diameter mild steel drum with meshes and is operated by a 2 hp electrical motor. The drum speed was maintained at 30-32 rpm and the capacity of the polisher is about 600-700 kg/h. A pedal operated hexagonal drum having six polishing plates of size 30 × 60 cm has been developed at OUAT (Pal *et al.* 2008). The capacity of the polisher is 100 kg/h and 6% polishing is achieved.

c) Cleaning, grading, packing and storage

Turmeric of commerce is described in three ways- fingers, bulbs, and splits. Very little grading of the spice is done at the growers end. Cleaned and graded material is packed generally in new double burlap gunny bags and stored over wooden pallets in a cool, dry place protected from light.



Fig 4. Turmeric steam Boiler Developed by TNAU & Tractor driven turmeric polisher

6. Chillies

Chilli (*Capsicum annum*) is the most widely cultivated crop among the spices grown in India. Chillies are harvested when the pods are well ripened and partially wither at the plant itself. At this stage they would have superior pungency and colour. Improved drying involves drying of chillies on materials like tarpaulins, cement concrete floor, polythene sheets etc. In mechanical drying, the chillies are dried at a drying temperature of 50° C and at air velocity of 1.5 m/s. Solar cabinet driers developed by CIAE Bhopal with a capacity of 30-50 kg/batch (dry weight basis) can dry chillies in 3-5 days. Waste fired driers developed by PKV Akola is suitable for drying 200 kg of red fresh chillies per batch with in a period of 16 hours for moisture reduction from 73% to 16.6% (Kachru & Gupta 1993). The cleaning and grading are done manually. Pulverizing of chillies is done in hammer mills of various capacities. The whole or powdered chillies are stored in double layer poly propylene bags as it is easily subjected to aflatoxin contamination.

7. Nutmeg and Mace

Fruits of nutmeg are harvested when they split open on ripening. The split fruits are either plucked from the tree with a hook or collected soon after they drop onto the ground. Since this crop is harvested during rainy season in Kerala, sun drying is difficult resulting in improper drying of nutmeg and mace. Drying of medium to large quantities of nutmeg is done in drying rooms. The harvested nutmeg is spread on raised wire mesh floor and heated air is passed through pipes inside the drying room. Continuous drying of nutmeg is not recommended as the oil oozes out without proper drying. The local practice of drying nutmeg at Kalady, a prominent nutmeg growing area is to pass the hot air for one or two days (8 hours each) and then allow to dry at ambient conditions for one week. The heated air is again passed for a day or two and then dried for a week or 10 days. The nutmegs are dried until the seeds inside rattle on shaking. This takes about 15 days or more. The seed cover is removed by breaking the hard seed coat manually or mechanically. Some of the nutmegs are dried improperly by this process have lot of fungal infections and the problems of aflatoxins are also reported by the exporters. Nutmeg samples dried in solar tunnel drier showed a higher reduction in drying time. It took about 8 hours for drying from an initial moisture content of 42.6% to 7.2%, while the conventional drying practice took about 13 days (Joy *et al.* 2000). Nutmeg is usually packed in double layered jute or polythene bags. If other packing materials are used, care must be taken to avoid materials, which might lead to 'sweating' and mould development. Powdered nutmeg is prepared by grinding at ambient temperature.

Mace is detached from the nut carefully soon after harvest, washed, flattened by hand or between boards and then sun dried until they become brittle. Hot air ovens can be used for drying and the colour retention is much better than sun dried mace. Studies conducted at IISR, Calicut showed that blanching of mace in hot water at 75 °C for two minutes preserved the qualities of mace during drying (Amaladhas *et al.*, 2002). Dried mace is graded and packed.

8. Cinnamon

Cinnamon is obtained by drying the central part of the bark and is marketed as quills or powder. Harvesting for bark is made after the second or third year of planting and the subsequent harvest is made between 12 to 18 months after previous harvest. The finest quality of bark is obtained from shoots of uniform brown colour, thin bark 1.0-1.2m length and 1.25 cm diameter. The ideal time for cutting the stem is when the red flush of the young leaves turn to green. Coppicing of cinnamon for extraction of bark, harvesting of 5- 6 cm thick stem is recommended. Production of quills consists of peeling, rolling and piping. The process of producing quills has several by-products (Quillings, Feathering, chips) which are used in further processing.

9. Seed spices

Out of 20 seed spice crops cumin, coriander, fennel, fenugreek, dill and ajwain contribute more than 95 per cent towards area and production. Cumin and fennel are dominant seed spices of Gujarat while coriander and fenugreek are important in Rajasthan. India exports raw as well as value added items to nearly 70 countries in the world and meet around 45% of the global demand and earns 361.5 crores of foreign exchange.

For exporting the seed spices, quality is the most important criterion. The quality of seed spices is assessed by mean of its intrinsic (Moisture, volatile oil, oleoresins content, major chemical constituents) as well as extrinsic (size, appearance, colour) quality. The produce must be safe, free from any health hazards substances and contaminants. The contaminants can be classified into three categories.

- | | | |
|----|------------------------|---|
| 1. | Physical contaminants | Immature or shriveled seed, berries, insect infested product, presence of live or dead insect excreta of animals. |
| 2. | Chemical contaminants | Added colour material, preservatives, antioxidants, fumigants, aflatoxin, pesticides/insecticide residue. |
| 3. | Microbial contaminants | Presence of Salmonella, <i>E. coli</i> , yeast and mould. |

a) Stage of harvest

The crop of coriander matures in 90 to 135 days. The stage of maturity of the fruit at harvest is when central umbels are about to attain yellow colour. Cumin is harvested in about 100-110 days. Fennel takes 170-175 days to mature and harvesting is done before the fruits are fully ripe, umbel attains a slight greenish yellow colour. A good quality fennel for chewing purposes, commonly known as '*Lucknowi saunf*' is produced by harvesting the umbel 30 to 40 days after pollination. In fenugreek, the harvest time is judged when the colour of leaves and pods turn yellow. The right time of harvesting is usually done in the morning hours to avoid shedding losses.



Fig 5. Thresher for fennel and Cumin



Fig 6. Mobile processor for seed spices

b) Threshing of seed spices

Traditionally, threshing of seed spices is performed by treading the crop under the tyre of tractor or by stick beating and then the threshed stocks is cleaned by winnowing in natural air stream or in the artificial air streaming the processed products. The new modified threshers were tested in the adopted villages for threshing of cumin and fennel crop by CRSS, Jagudan and it was found that net return of 3.25 and 3.00 Rs per kg for cumin & fennel threshing respectively can be obtained as compared to traditional method.

c) Drying

Sun drying is usually adequate to dry to produce but there is a chance of contamination of the material by dust and dirt and volatile components will be lost. Mechanized drying could enhance the quality and post harvest losses. At CRSS, SDAU, Jagudan low cost poly solar drying method was the best for faster drying (32 hr) as compared to other drying methods. Shade drying is the best to maintain green colour of fennel. Higher net return (75.50 Rs/ kg) was obtained in low cost poly solar dryer as compared to shade drying method (64.84 Rs/ kg) and open sun drying (58.80 Rs/ kg).

d) Cleaning /Grading

Various machines are used for special functions. Spiral separator is used to separate round seeds and flat seeds. Magnet drum/pulley is used to separate iron particles. Magnet seed separator/ electrostatic seed separator is being used to separate identical weed seed from product. Electronic colour sorters are used to separate discoloured seed to enhance colour value of final product. Gravity separator/destoner is to separate undesirable material on the basis being used of gravity.

e) On farm processing through mobile seed processing unit

Value addition at farm level is urgent need of the time because major deterioration and post-harvest losses occurs at this stage. The Mobile Seed Processing Unit was demonstrated by Centre for research on Seed Spices, Jagudan in adopted villages under NAIP Component-II "Value chain in Major Seed Spices for Domestic & Export Promotion" project for on farm processing of Fennel & Cumin crop. Average higher price of Rs.725 and 491 per quintal, respectively for fennel and cumin was obtained as compared to unprocessed product. The farmers are realizing 10-15% higher prices of their processed produce as compared to traditionally unprocessed produce, such type of processing unit are also established in nearby the villages. A mobile agro processing unit developed at CIPHET on a four wheeled trailer could be used for processing of seed spices at farm level. The different machines suitable for processing of seed spices including cleaner grader, horizontal burn mill, vertical burr mill etc. could be installed and operated by a DG set. These types of mobile processing machine were also tested at Research Farm of NRCSS, Ajmer and at Farmers' fields and the results are encouraging. This machine is very much beneficial for small and marginal farmers as the produce can be processed at their door step.

f) Packaging and storage

To standardize proper packaging materials for coriander an experiment has been tried with following eleven packaging materials for bulk and retail packing at CRSS, Jagudan. For bulk package jute bag, jute bag with LDPE lining, HDPE bag, HDPE bag with LDPE lining, Paper bag each with 50 kg capacity, LDPE, HDPE, PP, PET+LDPE laminate, metalized PET +LDPE laminate. From the above packaging treatment, paper bag is found best followed by jute bag with LDPE lining in case of bulk packages (50 kg bags) while in the case of consumer packages (500 gm), metalised PET + LDPE laminate is found best followed by PET + LDPE laminate. The whole dried seeds are usually packed into jute or poly bags and stored in cool dry places at 25^{0c}-28^{0c} room temperature. Biodeterioration due to storage fungi and storage pests will occur if the moisture of the produce is more than 10%.

10. Value added products from spices

a) Black pepper

A variety of products have been made from pepper like Green pepper based products, Black pepper and white pepper based products and Pepper by- products. The major green pepper based products are Canned green pepper, Green pepper in brine, Bulk-packaged green pepper in brine, Cured green pepper, Frozen green pepper, Freeze dried green pepper, Dehydrated green pepper, Green pepper pickle, Mixed green pepper pickle, Green pepper sauce and Green pepper-flavoured products. Black pepper and white pepper based products include Whole black pepper, Sterilized black pepper, Ground black pepper, Cryoground black pepper powder, Pepper oil and Oleoresin, white pepper and white pepper powder. Other miscellaneous products from pepper are Pepper-flavoured products, Pepper extract, curry powder spice blends, peppercorn, Pepper mayonnaise, pepper cookies and pepper tofu.



(2) Cardamom

Major products of cardamom are bleached cardamom, Decorticated seeds and seed powder, Cardamom volatile oil and Cardamom oleoresin. In addition to this, CFTRI, Mysore has developed the following products: Encapsulated cardamom, cardamom tea, cardamom coffee and cardamom soft drink mix.

(3) Ginger

Ginger powder, ginger oil, Ginger oleoresins, encapsulated ginger, Ginger preserves and salted ginger are the value added product from ginger.

(4) Turmeric

Major value added products are Ground turmeric, Turmeric oil, Turmeric Oleoresin and curcuminoids.

(5) Chilli

Oleoresin is the main product. Other products from chillies are Dehydrated chilli, Canned chilli, Brined/pickled chilli and Fermented chilli.

(6) Nutmeg and mace

Nutmeg oil and mace oil, Nutmeg oleoresin, Nutmeg butter are the main value added products. By utilizing nutmeg pericarp (rind), many value-added products have been developed viz., Nutmeg (rind) pickle, Nutmeg (rind) preserve from slices, Nutmeg (rind) preserve from shreds, Nutmeg (rind) candy, Nutmeg (rind) sweet chutney and Nutmeg (rind) powder.

(7) Cinnamon

In addition to cinnamon bark, various other products are obtained from the tree namely, bark oil, leaf oil, bark oleoresin etc.

(8) Seed spices

In seed spices value addition may be adopted in following way:

1. Ground spices.
2. Spices extractives
3. Curry powder
4. Consumer packed spices.
5. Organic spices.

The ground spices can be incorporated in food dishes more uniformly as compared to whole spices. In spite of these attributes they have limited shelf life and are subject to oxidation, flavour loss and degradation on long storage due to microbial contamination. For small scale production up to 100 kg/day manual grinders are adequate. For large scale production a small powered grinding mill needed and models are available that can grind 25 kg/hr. The high heat evolved at the time of grinding (42-95 °C) resulting in flavor loss. To overcome this, spices are milled at low temperature using liquid nitrogen cryogenic grinding. Coriander powder was prepared by cryogenic grinding at four temperatures – 30 °C -80 °C, -120° C and -180° C at CRSS, Jagudan. By cryogenic grinding at -180 °C had smallest particle size, more uniformity and high volatile

oil content (0.9%). Coriander powder obtained from cryogenically grinding method is found greener than that obtained from traditional grinding method. The major disadvantage of cryogenic grinding is high cost.



Fig 7. Cryogenic grinding facility for seed spices **Fig 8.** Processing facility for seed spice at Mehsana

(9) Spices extractives

Spices extractives can be categorized into three groups:

Essential oils

These are major flavouring constituents of spices, highly concentrated about 75-100 times than the fresh spice

Coriander: Major component of volatile oil is linalool (67.7%) followed by alphapinene (10.5%), ammaterpene (9.0%), geranyl acetate (4.0%), camphor (3.0%) and geraniol (1.9%). Minor components include beta-pinene, camphene, myrcene, limonene, p-cymene, borneol etc. Indian coriander oil differs from European oil in Possessing a lower linalool contents and comparatively higher linalyl acetate contents.

Cumin: The main constituent is cuminaldehyde and three other aldehydes up to 70%. Dominant monoterpenes hydrocarbons (total about 50-55%) are b-pinene, g-terpinene and p-cymene, plus myrcene a- and b-phellandrene and limonene, with minor amounts of sesquiterpenes hydrocarbons (Baser et al 1992). Cumin oil is sometimes adulterated with synthetic cuminaldehyde, which is difficult to detect. The oil is a raw material for the production of thymol.

Fennel: Fennel seed oil, usually traded as fennel oil, is mainly obtained by steam distilling whole or crushed fruit with a yield of 1.5-6.5%, and more recently by supercritical carbon dioxide extraction. In general, oil content is greatest in European and lowest in Asian varieties. The main constituents are trans-anethole (60-65%, but up to 90%), fenchone (2-20%) estragol (methyl chavicol), limonene, camphene, a-pinene and other monoterpenes, fenchyl alcohol and anisaldehyde. Oil produced in Nigeria from fennel of Indian origin had 80% anethole content but no fenchone..

Fenugreek: Major constituents are the dihydroactinidiolide, 2-3- dihydrobenzofuran and 1-heanol totaling 7-9% with 20 other constituents at less than 3% and the remainder below 1%. The furanone derivative, sotolon, is reportedly mainly responsible for the characteristic fenugreek odour.



Oleoresins

Oleoresin represents the complete flavour and non-volatile resinous fraction present in the spices. The aroma and taste fractions are proportionally blended to constitute the 'true essence' of the natural spice. The oleoresin can be obtained in a single step by elimination of the steam distillation process.

Derivatives of essential oil and oleoresins

They include plated encapsulated forms of spice extractives, seasonings in dry carrier such as dextrose, salt or rusk powder. They impart the strength of good quality freshly ground spices and can be easily incorporated in the food.

(10) Curry Powders/blends and mixes

Curry powder is an indigenous seasoning made from various spices (coriander, cumin, fennel, fenugreek are common) constitute the raw materials used in quality curry powder. The ingredients of curry change according to different needs. The colour, form and taste of various curries are in accordance with the custom of various nations and regions. Consumers all over the world demand different curry powder. The export trade in curry powder at present is dominated by India. Curry powder is made from a blend of several spices, the number vary from a minimum of 5 to more than 20 depending on end uses.

(11) Consumer packed Spices

The exported spices are consumed in three main segments namely, industrial, institutional and retail. Different packaging media are used according to the consumer's preference. The packaging has gained considerable importance as it increases the shelf life of spices. The development of new and improved plastic films, aluminium foil, laminations, high speed film sealing machines etc. has created new opportunities for packaging the spices as instant spices, spices pastes, spices powder etc. By exporting consumer packed spices, higher unit value for the same quantity can be earned. The price of such retail spice packs is higher between 50-100 per cent as compared to prices of bulk spices.

(12) Organic spices

Exporters specializing in organic production have been successful in achieving the international standard prescribed for spices. The growing demand for organic crop products has led to the development of international trade for organic spices.

11. Conclusion

Post harvest operations like harvesting, procession, packing, extraction and development of value added products etc play a major role in maintaining quality of spices to the specifications of international trade. In addition to reducing the labour, mechanization helps in maintaining the quality and food safety standards. Improvements in hygiene, packing and storage facilities will not only help in keeping quality of spice flavours but also play a major role in reducing aflatoxin and salmonella contamination of our spices and spice products. The present deficiency in on farm primary and secondary processing of spices need to be bridged for quality up gradation and greater emphasis on product diversification to the newer requirements of domestic as well as global marketing. Thus post harvest processing and management of spices have great scope considering the present international trade scenario.

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