

## POSTHARVEST PROCESSING OF SPICES IN RELATION TO EXPORT QUALITY

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The history of the cultivation and use of spices is perhaps the most romantic story of any vegetable product. India is the only country renowned for spices in such a versatile manner around the world. The land of Kerala is considered as the major production centre. By ruminating the glorious past, an attempt is made to appraise the general aspects of interest and the present problems troubling our spice production and export with special emphasis on Kerala. Classification, chemical nature, processing, solar drying, etc. of spices are reviewed. The scenario of present postharvest processing of spices is not encouraging in India. It leads to export rejection. Due to unscientific processing methods, large quantities of spices produced are also spoiled every year. So it is very urgent to implement developmental programmes, especially in the processing sector, to enhance the export quality of spices.

### HISTORICAL

Spices have played an important role in the history of civilization, exploration and commerce as these had a universal acceptance as condiments and flavours in human diet as well as in treatment of ailments. There are evidences of plant derived aromatic compounds especially spices being used by almost all ancient civilizations—the Indian, the Egyptian, the Babylonian, the Persian, the Jews, the Chinese, the Greek, and the Roman. A notable use of spices and herbs in very early times were in medicine in the making of holy oils and unguents, and as aphrodisiacs.

The history of Indian spices dates back to the beginning of the human civilization. There are references about Indian spices and their uses in the Vedas (6000 BC), by 'Manu', the lawgiver

in 4000 BC, by the Babylonians and Assyrians (around 3000 BC), and in the Old Testament (1000 BC) of the Bible. Traditionally, India was known as the legendary land of spices, and the West coast of India, known in history as Malabar Coast, was maintaining very active trade relation with The Western world, starting from the ancient Egypt, Greek and Roman times. India enjoys a wide range of agronomic and climatic conditions, which enable her to grow a number of spices. While India produces high valued saffron on temperate zone of Kashmir in the North, the black pepper, 'the king of spices' and cardamom, 'the queen of spices' and other plantation spices are grown in down South the Tropical zone in Kerala.

### DEFINITION OF SPICE

The term 'spice' is derived from Latin word 'species' that means fruits of earth. Christopher Morley said that spice is the plural of 'spouse', Malabar pepper being the king and queen. It

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can be defined as the dry part of a plant, such as roots, leaves and seeds, which impart to food a certain flavour and pungent stimuli. By clubbing spices and condiments into one group, the International Standards Organization (ISO) illustrated that the term spice or condiment applies to “such natural plant or vegetable products or mixtures thereof, in whole or ground form, as are used for imparting flavour, aroma and piquancy to and for seasoning food”. International Spice Group suggested more or less a similar observation i.e. ‘spices are any of the flavoured or aromatic substances of vegetable origin obtained from tropical or other plants commonly used as condiments or employed for other purposes on account of their fragrance, preservative or medicinal qualities.’

‘Spice is a culinary term, not a botanical category—it does not refer to a specific kind of plant or plant part’ says Farell. Some said that the word ‘spice’ has become almost synonymous with anything that creates a piquant effect. According to Australian Food Law, ‘the term spice refers to plants or part of plants (possibly dried) that are used to enhance the flavour or taste of human food’. Henry B. Heath pointed out that “the soft-stemmed plant materials used in seasoning food are classified as ‘herbs’ and all other aromatic plant products used for a similar purpose are called ‘spices’, although this broad definition admits of several exceptions.” Other explanations are also available in literatures as underlined its wide recognition.

### **CHEMICAL NATURE**

Spices are storehouses of many chemically active compounds that impart flavour, fragrance

and piquancy. Most spices owe their flavouring properties to volatile oils and in some cases, to fixed oils and small amount of resin, which are known as oleoresins. Phytochemicals in spices are secondary metabolites, which are originated for the protection from herbivorous insects, vertebrates, fungi, pathogen, and parasites. Most probably, no single compound is responsible for flavours; but a blend of different compounds such as alcohols, phenols, esters, terpenes, organic acids, resins, alkaloids, and sulphur containing compounds in various proportions produce the flavours. Besides these flavouring components every spice produce contains the usual components such as proteins, carbohydrates, fibre, minerals, tannins or polyphenols.

### **SPICES CULTIVATED AND THEIR CLASSIFICATION**

Total number of spices cultivated in the world is perhaps a disputed question. Based on data collected from Bureau of Indian Standards, 63 spices are grown in India. But Spices Board (Government of India) has listed only 52 spices. However, the International Organization for Standardization (ISO) has approved 70 spices and condiments.

Classification and presentation of spices in a particular sequence or plan becomes rather difficult because of their heterogeneity. Spices could perhaps be classified or grouped according to different systems of classification based on (i) botanical analogies or families, (ii) economic and commercial importance, (iii) climatic requirement (tropical, subtropical, temperate, etc.), (iv) number of seasons required to complete

the life cycle (annuals, biennials, perennials, etc.) and (v) morphology of the useful parts; but each system has its own merits and demerits. Since spices come from various woody shrubs and vines, trees, aromatic roots, flowers, seeds, rhizomes, and fruits of herbaceous plants, most convenient system of classification may possibly be based on the morphological characters (Table-1).

**TABLE-1. Classification of Spices Based on Morphological Characters**

Sl. No.	Morphology of the useful part	Examples of the Spice
1.	Berry	Black pepper, All spice, Juniper
2.	Seeds	Aniseed, Caraway, Celery, Coriander, Fenugreek
2.	Fruit	Cardamom, Capsicum
4.	Aril	Mace
5.	Kernal	Nutmeg
6.	Rhizome	Ginger, Turmeric
7.	Leaf	Basil, Bay leaf, Tejpath, Curry leaf
8.	Bark	Cinnamon, Cassia
9.	Bulb	Garlic, Onion
10.	Rind	Garcinia, Kokam
11.	Stigma	Saffron
12.	Pod	Vanilla
13.	Flower bud	Clove
14.	Oleogum resin	Asafoetida
15.	Root	Caper
16.	Fruit pulp	Tamarind

For simplicity and convenience of reference, spices have been classified, depending upon their commercial importance. This method has become the most popular system of classification (Table-2).

**TABLE-2. Classification Based on Commercial Importance**

No.	Category	Examples of the Spice
1.	Major spices	Black pepper, Cardamom, Chillies, Ginger and Turmeric
2.	Minor spices	
	(a) Bulb spices	Garlic, Onion
	(b) Seed spices	Aniseed, Caraway, Fenugreek, Celery
	(c) Aromatic tree spices	Clove, Nutmeg
	(d) Acidulant tree spices	Tamarind, Garcinia, Kokam
	(e) Leafy or herb spices	Basil, Curry leaf, Lovage, Tejpath, Rosemary
	(f) Miscellaneous or other minor spices	Saffron, Juniper, Savory, Asafoetida, Vanilla

### QUALITY EVALUATION OF SPICES

Quality of spices is assessed by its intrinsic as well as extrinsic characters. The former consists of chemical quality, *i.e.* the retention of chemical principles like volatile oil, alkaloids and oleoresins while the latter emphasizes physical quality. This include appearance, texture, shape, presence or absence of unwanted things, colour, etc. In addition, certain health requirements are also implemented as export quality standard *viz.* pesticide residue aflatoxin, heavy metals, sulphur dioxide, solvent residues and microbiological quality. However, physico-chemical quality remains the ultimate attribute, while considering export requirement of spices as these properties delineate its grade in the market. These qualities vary unpredictably. The physico-chemical characteristics vary widely depending on the variety, agro-climatic conditions existing in the area of production, harvest and post-harvest operations.

Every spice importing country has developed quality requirement specifications, or adopted quality specifications of international agencies. Cleanliness specifications for spices of American Spice Trade Association (ASTA) are a universally adopted manual for the assessment of physical quality of spices. USFDA (United States Food and Drugs Administration) has also provided requirement of quality for spices. Methods for the analyses of these parameters are also standardized. Besides specification, Indian agencies such as Agmark and BIS (Bureau of Indian Standards) have developed quality regulations. ESA (European Spice Association), BSI (British Standard Institution), ISO (International Organization for Standardization), AFNOR (Association Francaise De Normalisation), EOA (Essential Oil Association) etc. are the other reputed agencies providing spice quality regulations.

### POST HARVEST SCENARIO OF SPICES

Geographically, the State of Kerala is highly suitable for the cultivation of spices. Important spices cultivated are black pepper, cardamom, ginger, turmeric, clove, garcinia, nutmeg and mace. 95 per cent of the total production is contributed by pepper, cardamom, ginger and turmeric. Pepper and cardamom are cultivated in the high ranges, and ginger and turmeric in plains as well. The major production centers are Idukki and Wayanad districts. Despite the congenial environment for cultivation and production of spices, Kerala has not been able to succeed in the export market due to low quality produce. The quality of spices depends to a large extent upon the postharvest operations.

The postharvest technology of spices comprises of a whole gamut of operations such

as pretreatment, chemical treatment, curing and similar operations, drying, cleaning, sorting, grading and packaging. These steps vary with the spice and the region of cultivation. These processes should ensure proper conservation of the basic qualities of spices for which they are valued, viz. aroma, flavour, pungency or bite, colour, appearance, etc.

Considering each and every step under postharvest technology of spices, drying remains the most important operation. At the time of harvesting, spices like all other agricultural commodities invariably contain high moisture that must be brought down into the desired level at which attack of micro-organisms would be minimum. At the same time retention of quality attributes should also be at the maximum. However the percentage moisture content of spices varies considerably at the time of harvest. J. S. Pruthi opines that spices contain high moisture (55-85%) at the time of harvest, which must be reduced into 8-12%. Exceptionally, some spices like garcinia contains more than 90% moisture content at harvest. The period between initial moisture level and final moisture level, however, is more crucial while adopting postharvest technologies.

### DEHYDRATION PROCESS

The removal of moisture is attained either naturally or artificially by heat or pressure. Thermal mode of drying is more prevalent and most studied. Factors influencing the rate of evaporation are the ambient temperature, relative humidity, pressure and velocity of air, size and shape of the wet material, and direction of air movement. An important phenomenon to be considered during drying is 'critical moisture

content.' This will vary according to different spices. But it has colossal importance in drying, because if dried beyond critical moisture level the spice may become over dried. Almost all spices are hygroscopic in nature. Thus during drying, water evaporates at a rate which, in the falling rate phase, becomes smaller as the mean moisture content diminishes.

During drying, various other processes also take place, such as cooling effect, shrinkage effect, case hardening, loss of rehydration ability, browning, scorching or heat damage, loss of flavour and migration of soluble constituents.

**Traditional Sun Drying of Spices :** For the pupose of spice processing, farmers are still adopting sun drying method or traditional way of processing. Harvested spices are spread on mats, cement floors, roof tops or even on soil along the roadsides so as to expose to solar intensity until the completion of drying. In this method the spices are exposed to direct sun light and consequently the spice pieces heat up and internal temperatures rise without regulation. Drying is therefore uneven, and caramelized and crusted pieces result. The direct exposure to the sun also destroys colour, vitamins and flavour, and there is chance of contamination with dust, dirt, insect infestation, and contact with other pests. They may also be drenched by rain or dew and, may need further drying if mold growth is to be avoided during storage. In fact sun drying reduces microorganism growth in general, but its effectiveness varies with the kind and number of microorganisms originally present in the commodity. If the drying process is not rapid enough, respiration continues in the tissue cells, and this leads to the utilization of

sugar and the production of acids which account for the sour taste present in most traditionally dried products.

**Solar Drying of Spices :** Solar drying technique uses the energy from the sun to heat a stream of air, which in turn flows by natural or forced convection through a bed of the commodity to be dried. Scientists opined that in addition to the quality improvement, heat energy from collectors could also be stored, if needed, which permits drying to continue during the night or cloudy periods. Scholars studied about the appropriateness of using solar energy and other renewable energy sources for the drying of spices effectively. Various models of solar dryers are available for agricultural processing. However little work has been done in spice drying sector, especially in Kerala. Despite the development of several types of dryers during the last two decades in India, and consideration of theoretical aspects of drying and design of the dryers in depth by researchers, sustained efforts are lacking in the adoption or increase in the utilization of more efficient drying technology. However some related work have already been conducted hitherto. It is observed that the rate of drying is faster in solar dryer, and the quality of the product would also be superior in intrinsic and extrinsic factors.

Solar dryers in use can be broadly classified into two—the *direct* type and *indirect* type. Direct drying systems consist of a transparent cover, a kind of enclosure, which permits light and heat directly on to the produce. The product gets heated up due to direct absorption of heat or due to high temperature in the enclosure. As a result moisture from the product evaporates

and goes out by natural circulation of air current. The types of direct dryers in use are solar cabinet dryer, small holders copra dryer, low cost poly solar dryer, cabinet type solar dryer, solar air-drying system, low cost solar dryer CAZRI (Central Arid Zone Research Institute) solar dryer-direct etc.

Indirect drying system consists of solar collector, blower, drying chamber, supplementary heating system and energy storage systems. Here the drying chamber is completely protected from direct sunlight. Heat generated at the solar collector is forced to the drying chamber in the form of hot air current, with the help of blower, which works mechanically or electrically. During drying the evaporated moisture goes out fast because of high pressure due to the forced circulation of air. The types of indirect dryers in use are solar water heater dryer, solar air heater dryer, forced flow dryer, Indigenous solar-indirect type etc. It is recommended that indirect type dryers are better for spices, because retention of colour, texture and volatiles would be maximum in indirect drying. The solar tunnel dryers combine the features of direct and indirect dryers.

## CONCLUSION

The scenario of post-harvest processing of spice crops is not encouraging in our country. A reliable and unified method is lacking; prevailing methods are not promising. Ultimate outcome of these unscientific practices leads to (i) rejection from export market (ii) problem of reprocessing. Based on the studies regarding the identification of major production constraints of spices, Indian Institute of Spices Research (IISR), reported the lack of quality consciousness and poor handling of the commodity during postharvest period as one prime factor for quality deterioration. The present need is to formulate appropriate methods for the quality improvement of selected spices. A number of such steps are already developed, and at least some farmers have adopted them. However, large, quantities of spice produce are spoiled every year due to the mishandling and unhygienic methods adopted after the harvest, for processing and storage. The rejection of spice produce from the export market is also reported to be due to these unscientific approaches. Since it is imperative to take necessary action by concerned authorities.

### DO YOU KNOW?

- Q 6. Must the human heart be located only in the left chest cavity?
- Q 7. Which element is common amongst all living things?