Dear Readers
Greetings and best wishes!

We are pleased to release the 4th edition of Spices Handbook on the occasion of “International Spices conference-2017”. The hand book will also be circulated at the Gulfood 2017.

The focus of the 4th edition of the handbook is on quality and food safety. Other themes covered are evolution of spices from whole spice to processed, impact of spices on health, development in the post-harvest techniques and price outlook.

Spices take an important place in common man’s every life mainly because of its flavor, taste and medicinal values. In recent years, changing food habits and changing lifestyle have fuelled the need for processed products across the globe. Spices usage grew with the increased use of processed products. India is the largest producer of spices in the world. With continued emphasis on quality and food safety, Indian spices industry has a great future in the coming years. Export of Indian spices and spice products is increasing at a rate of 10% in terms of volume and 17% in terms of value. Growth in Indian spices and spices products exports clearly show that Indian spices and spice products have a great demand in the international markets.

Usage of spices in the non-food applications such as dyeing, nutraceutical application etc is also increasing. The Indian nutraceutical market has grown from $1 billion in 2008 to $1.8 billion in 2013; it is likely to cross $4 billion by 2018. Like-wise, the demand for dehydrated spices is also increasing in both India as well as rest of the world. Currently, India consumes around 20,000-30,000 tonnes of dehydrated spices. Experts anticipate a growth of 10-12% a year in the next 5-10 years. As the demand for spices increases, the quality norms are also becoming stringent.

Our contributors have spared their valuable time to contribute on a range of topics related to spices industry in the current handbook. I take this opportunity to thank all our contributors. I also thank all our advertisers who have supported and trusted us in this initiative. Lastly, special thanks to my team members at Foretell—research team, data team, marketing team and the design team - for their dedication.

All our work is directed at making your business more productive and profitable. We value your suggestions and feedback. Please do send in your valuable suggestions to gsv@fbspl.com, tas@commodityindia.com

Best wishes and good luck.
Sajna Srinivas Gowda
Head - Spices Research
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Guidelines for Nutraceutical Products with Respect to Spices

Sateesh Kulkarni, Director, Corporate Catalyst India

Definition

Nutraceuticals is a broad term that is used to describe any product derived from food sources with extra health benefits in addition to the basic nutritional value found in foods. They can be considered non-specific biological therapies used to promote general well-being, control symptoms and prevent malignant processes.

The term “nutraceutical” combines two words—“nutrient” (a nourishing food component) and “pharmaceutical” (a medical drug). The philosophy behind nutraceuticals is to focus on prevention. Most often they are grouped in the following categories: dietary supplements, functional food, medicinal food, pharmaceuticals. Pharmaceuticals are medically valuable components produced from modified agricultural crops or animals. The term is a combining of the words “farm” and “pharmaceuticals”.

A dietary supplement represents a product that contains nutrients derived from food products, and is often concentrated in liquid, capsule, powder or pill form. Although dietary supplements are regulated by the FDA as foods, their regulation differs from drugs and other foods. According to their generally accepted definition, functional food is a category which includes whole foods and fortified, enriched or enhanced dietary components that may reduce the risk of chronic disease and provide a health-benefit beyond the traditional nutrients it contains.

Nutraceuticals use Spices for their phytonutrients essential oils, antioxidants and vitamins which are known to have disease preventing and health promoting properties. The increasing awareness of benefits of dietary supplements and shift of the healthcare market in favour of nutraceuticals will drive the business forward.

Spices

Spices, the predominant flavoring, coloring and aromatic agents in foods and beverages, are now gaining importance for their diversified uses. The nutritional, anti-oxidant, anti-microbial and medicinal properties of spices have far-reaching implications. In the present scenario, the anti-diabetic, anti-hyper cholesterolemic, anti-carcinogenic, anti-inflammatory effects of spices have paramount importance, as the key health issues of mankind nowadays are diabetes, cardio-vascular diseases, arthritis and cancer. Spices or their active principles could be used as possible ameliorative or preventive agents for these health disorders.

Extensive studies on animal models carried out indicate that spices could be consumed at higher dietary levels without any adverse effects on growth, organ weights, and food efficiency ratio and blood constituents.
Curcumin, the coloring pigment present in turmeric, capsaicin, the pungent principle in red pepper, allicin, the active principle in garlic, gingerol, the pungent principle in ginger, saponin and fiber present in fenugreek are immensely valuable in health care with their multiple physiological effects.

India is the land of spices and could exploit the fast growing nutraceutical sector with her high intrinsic quality spices. The scope of spices like turmeric, ginger, fenugreek, garlic and red pepper in the nutraceutical industry with their possible role in the control/prevention of important health disorders. **Non-traditional use of spices including nutraceuticals now accounts for nearly 15% of spice production in the country. The new lines of applications are growing at a rate of 10-12%, according to Spices Board officials.** Nutraceutical and life sciences companies and R&D Labs are beginning to tap the healing, nutritive and health benefits of spices. This segment has opened out various possibilities of using spices to create fortified foods and organic medicine.

The demand for nutraceutical products has gone up as more people are turning to natural products for treating lifestyle diseases. The *nutraceutical sector is growing at 12-14% in the U.S., 8-10% in Europe, 14% in China and almost 9% in Japan, while it is still at a nascent stage in India*. At the same time, the growth in the food industry globally, where spices are traditionally used, is 3-5%.

**Export of spices**

USA, Canada, Germany, Japan, Saudi Arabia, Kuwait, Bahrain and Israel are the main markets for Indian spices. Mexico continues to be the major importer of cinnamon and cassia while Saudi Arabia, Bahrain, Kuwait and Israel are the major markets for green cardamom, black pepper, ginger and turmeric. We have near monopoly in spice oils and oleoresins and Indian spices have obtained geographical indicators such as Malabar pepper, Alleppey green cardamom, Coorg green cardamom and Naga chilli.

**Level of Safety Standards**

Developed countries are the major markets for India’s food exports and these countries have their own stringent food laws and regulations. India exports spices mostly to USA, UK, Germany, other European countries, Japan, Canada etc. These countries have very stringent food laws and regulations to ensure that foods which include spices, are safe, wholesome and produced under sanitary and hygienic conditions. The main objective of the laws is to protect the health and safety of their citizens. They allow import of food materials only when they conform to the provisions of their food laws and regulations.

The laws with respect to items of food are meant to protect the consumers from food of inferior quality, or those which are likely to be contaminated by impurities or poisonous substances. Therefore any food item that we export, be it marine products, cashews, pepper, cardamom or ginger, it is important that the product conforms to the quality standards demanded by the importing country. In the context of thousands of people getting infected with foodborne diseases or even dying of food poisoning, it is only just and reasonable that countries which depend on imported food stuffs should take such extreme precautions. Food materials that have become rotten, spoiled, infected with micro-organisms or contaminated by other impurities are either destroyed by the import inspection authorities or sent back to the exporting country. This not only results in loss of market but also damages the exporting country’s reputation.

**Export requirements**

FSSAI is the apex food regulator in India for implementation of new & evolving Act – Food Safety & Standards Act, 2006. FSSAI is responsible for laying down the science based standards for the manufacture, storage, distribution, sale & import of the food articles for the safety of the consumer.

**Food Safety & Standards (Packaging & Labelling) Regulations, 2011** have specified the labelling guidelines for all prepackaged food articles which need to be followed by all the manufacturers & importers of the nutraceuticals products meant to be sold in India.

In case of export/import of Spices/Spice products, Certificate of Registration as Exporter of Spices issued by the Board is also required in addition to the IE Code.
number. Spices Board issues Certificate of Registration as Exporter of Spices [CRES] under Section 11 of the Spices Board Act.

Health supplements, nutraceuticals, probiotics and other functional food products will have to go through a stringent regulatory scanner and comply with specific norms before entering the market. The Food Safety and Standards Authority of India (FSSAI) has come up with a gazette notification issuing benchmark standards covering as many as eight different categories of foods.

The regulations, in line with international food safety standards, make it mandatory for food business operators to declare essential composition of their products on the packaging. This includes a detailed declaration of nutrient as well organism content in products like nutraceuticals and probiotics.

Besides, the regulations also pertain to claims and labelling. For instance, these items that often claim health benefits will have to mandatorily differentiate themselves from pharmaceutical products by declaring on the label “not for medicinal use”. Health supplements, on the other hand, will have to carry the words “health Supplement” on their label. Similarly, FSSAI has also defined different categories and set norms for claims for each of the category. For instance, if a “nutrient content claim” is being made in case of food products falling under health supplement categories, the individual nutrient content shall not be less than 15% of the recommended daily allowance, as per the FSSAI.

Product approvals in future will be in compliance with the new regulations, an official said. The FSSAI has given a year’s time to food operators to comply with the regulations, which will be effective from January 1, 2018.

The regulations assume significance with increasing number of functional foods entering the Indian market.

Global Standards
India commands a formidable position in the spice trade. Four years ago, the United Nations’ Food and Agricultural Organization noted that India produces approximately 75 percent of world’s spices. And, according to the India Brand Equity Foundation, India exported nearly 894,000 tons of spice in 2014. That’s an extraordinary number. Moreover, India is the world’s largest exporter of spices to the United States, totaling $410 million in 2014.

Joint Institute for Food Safety and Applied Nutrition (JIFSAN) is also partnering with the India Spices Board, the Confederation of India Industry, the Food and Agriculture Center of Excellence (CII-FACE), and the FDA to develop a Collaborative Training Center focused on Supply Chain Management for Spices and Botanical Ingredients (SCMSBI). The goal of the Center is to establish a cadre of in-country experts who can offer training in all aspects of food safety management throughout the supply chain.

Indian Regulations
FSSAI has a greater role to play in defining standards that will streamline the entire operations required for nutraceuticals. They need to address concerns about

• Quality of raw materials
• Safe manufacture of product
• Health claims
• Labelling
• Distribution & storage

The manufacture, storage, distribution, sale and import of nutraceuticals in India are regulated under the Food Safety and Standards Act (FSSA), 2006. The FSSA has consolidated a collection of earlier laws relating to food and nutraceutical safety and standards. However, no concrete regulations are in force and the government is still seeking draft suggestions.

Nutraceutical companies themselves feel that regulations related to quality and safety will benefit the industry and will keep a check on unregulated practices. Presently, the fragmentary nature of the regulations is making it difficult for players to comply fully or to make necessary investments.

For further details please contact: sateesh.kulkarni@cci.in
Leader in manufacturing of natural ingredients
100% Traceability for Quality Control
Customer support and product forecast
Botanical Extracts
CO2 Extraction
Natural Carotenoids
Colors
Various aspects of Spice Packaging to enhance Shelf Life

Dr Gopal Kumar Sharma, Dr Pal Murugan M & Dr Anil Dutt Semwal
Defence Food Research Laboratory, DRDO

Spices and condiments have been considered indispensable produces in the culinary arts for flavoring foods. ‘Spices and Condiments’ are natural plant products or mixtures used in whole or ground form as food adjuncts, mainly for imparting flavour, aroma and pungency to foods. It is also used for seasoning of foods and flavoring of beverages. India has been known as the ‘Land of Spices’ from time immemorial. India has wide diverse variety of spice crops and Indian spices are renowned for their excellent aroma, flavour and pungency, not easily matched by any other country. Out of 109 spices recognized by the International Organization for Standardization (ISO) in the world, more than 52-60 spice crops are grown in India. India contributes about 20-25% of the world trade in spices. In medieval times, the word India conjured up a vision in the minds of foreigners as a land of maharajas, diamonds, and fine textiles, ivory and, of course, spices. The world still looks upon India as the real ‘Home of Spices’. Centuries before the birth of Greece and Rome, sailing ships carried Indian perfumes, spices and textiles to Mesopotamia, Arabia and Egypt. It was the lure of these commodities that brought many sailors to the shores of India.

Some of the important spices grown in India are pepper (King of Spices), cardamom (Queen of Spices), chilli, ginger, turmeric, coriander, cumin, fennel, fenugreek, celery, saffron, tamarind and garlic. Other spices produced and exported in small quantities are aniseed, bishop's weed (ajawan), dill seed, poppy seed, tejpat, curry leaves, cinnamon, kokum and a few other culinary herbs. The tree spices like clove, nutmeg, mace, star-anise, allspice and some of the herbal spices like rosemary, thyme, marjoram, oregano, chive, parsley, sage, savory, tarragon and basil are produced in small quantities, which are mainly utilized in domestic purpose.

In India, spice exports have been consistently moving up during the last decade. The Spices Board under the Ministry of Commerce has the mandate for the export of spices from the country. Spices account for about 16% in quantity and 19% in value of the total horticultural exports from India. India’s share of the world spices trade is estimated as 40-50% by volume and 25% by value. According to the estimates of the Spices Board, during 2015-16, a total of 8,43,255 tons of spices and spice products valued Rs. 16238.23 crore (US$ 2482.83 Million) have been exported from the Country as against 8,93,920 tons valued Rs. 14899.68 crore (US$ 2432.84 Million) in 2014-15, registering an increase of 9% in rupee terms and 2% in dollar terms of value. The total export of Spices during 2015-16 has exceeded the target in terms of both
quantity and value. Compared to the target of 8,08,000 tons valued Rs.14014.00 crore (US$2260 million) for the financial year 2015-16 the achievement is 104% in terms of volume and 116% in rupee and 110% in dollar terms of value.

Even though, spice industry has played an important role in enhancing the Indian economy, lack of availability of quality planting materials, low productivity, non-adoption of recommended cultural practices, integrated pest and disease management practices, storage, processing & packaging facilities, inadequate extension network for effective transfer of technology and high fluctuations in prices of the commodities and the absence of a support price are considered as important constraints in production and marketing of spices.

Maintenance of optimum flavour and quality aspects during storage and transportation of spices plays a major role in fetching prices and consumer acceptance. Spices in powder form, are hygroscopic in nature and absorb moisture from the atmosphere results in sogginess and caking/lumping of the powder. Moisture absorption obstructs free-flowing nature of the spice powder. Spices contain volatile oils, which impart the characteristic aroma/flavour to the product. Improper storage and packaging led to loss in the volatile oil content or oxidation of some aromatic compounds result in aroma and flavour loss. The spices like green cardamom, red chillies, turmeric, and saffron contain natural pigments and exposure to light can affect the pigments resulting in loss or fading of colour and deterioration. They are also prone to spoilage due to insect infestation and microbial contamination due to high humidity, heat and oxygen. So proper packaging of spices is necessary to maintain its original flavoring over a prolonged time.

Spice packaging is more intricate than other packaging, given that different spices have different requirements. The different forms of spices such as Whole spices (cardamom, black pepper, clove, turmeric, ginger, cinnamon, cassia), Seed spices (celery, fennel, cumin, fenugreek), Powdered or ground spices (turmeric, chillies, ginger), Spice mixes (curry powders and masalas), Paste (curry paste, ginger/garlic paste), Concentrates (tamarind concentrate), Oils and oleoresins, and different distribution channels need design and development of suitable packaging material to enhance the shelf life.

Continuous quality monitoring should be implemented to remove substandard materials, contaminants and foreign matter throughout the processing and final stages of packaging. Processed plant materials should be packaged in clean, dry boxes, sacks, bags or other containers in accordance with standard operating procedures and national and/or regional regulations of the producer and the end-user countries. Materials used for packaging should be non-polluting, clean, dry and in undamaged condition and should conform to the quality requirements for the plant materials concerned. Reusable packaging material such as jute sacks and mesh bags should be disinfected and thoroughly dried prior to reuse, so as to avoid contamination by previous contents. Packaging materials should be stored in a clean and dry place that is free from pests and inaccessible to livestock, domestic animals and other sources of contamination.

Packaging is defined as enfolding of food to protect it from tampering or contamination from physical, chemical and biological sources. Packaging maintains the benefits of food processing after the process is complete, enabling foods to travel safely for long distances from their point of origin and still be wholesome at the time of consumption. The primary purpose of food packaging is to protect the food against attack from oxygen, water vapor, ultraviolet light, and both chemical and microbiological contamination.

The Directorate of Marketing and Inspection, Department of Agriculture & Cooperation, Govt of India through its AGMARK Certification programme established standards for Packaging spices in order to maintain quality and purity of spices. The agency gives mark to products that pass the grading and certification tests. Agmark is used for agricultural products that need to be exported as well as for domestic trade. There are varied grading standards for different agricultural commodities like wheat, paddy, pulses, cereals, vegetable oils, fruits, vegetables, noodles, fibre crops, animal products and spices. The packaging standards established by Directorate of Marketing and Inspection for whole and ground spices packaging and packaging standards with respect to individual spices are described in table 1 & 2.
1) Spices (whole and powder) shall be packed in gunny bags/jute bags, polywoven bags, poly pouches, cloth bags or other suitable packages which shall be clean, sound, free from insects, fungal infestation and the packing material shall be as permitted under the Prevention of Food Adulteration Rules, 1955 made under Section 23 of the Prevention of Food Adulteration Act, 1954 (37 of 1954).

2) Suitable lining of food grade polypropylene/polyethylene shall be used for packing of Spices (whole and powder) in gunny bags/jute bags, polywoven bags, cloth bags, paper bags and cardboard cartons;

3) Containers and packaging material shall be made of substances which are safe and suitable for their intended use. They should not impart any toxic substance or undesirable odour or flavor to the product;

4) Spices (whole and powder) shall be packed in pack sizes as per the instructions issued by the Agricultural Marketing Adviser from time to time;

5) Each package shall contain Spices (whole and powder) of the same type and of the same grade designation;

6) Graded material of small pack sizes of the same lot/batch and grade may be packed in a master container with complete details thereon along with grade designation mark;

7) Each package shall be securely closed and sealed

8) Suitable number of small packages for consumers containing the product of the same grade and from the same lot/batch may be packed in a multi-piece package

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<th>Name of the spice/spice Products</th>
<th>Packaging Standards</th>
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<td>1) shall be packed in gunny bags/jute bags, polywoven bags, poly pouches, cloth bags or other suitable packages which shall be clean, sound, free from insects, fungal infestation and the packing material shall be as permitted under the Prevention of Food Adulteration Rules, 1955 made under Section 23 of the Prevention of Food Adulteration Act, 1954 (37 of 1954). 2) Suitable lining of food grade polypropylene/polyethylene shall be used for packing of Spices (whole and powder) in gunny bags/jute bags, polywoven bags, cloth bags, paper bags and cardboard cartons; 3) Containers and packaging material shall be made of substances which are safe and suitable for their intended use. They should not impart any toxic substance or undesirable odour or flavor to the product; 4) Spices (whole and powder) shall be packed in pack sizes as per the instructions issued by the Agricultural Marketing Adviser from time to time; 5) Each package shall contain Spices (whole and powder) of the same type and of the same grade designation; 6) Graded material of small pack sizes of the same lot/batch and grade may be packed in a master container with complete details thereon along with grade designation mark; 7) Each package shall be securely closed and sealed 8) Suitable number of small packages for consumers containing the product of the same grade and from the same lot/batch may be packed in a multi-piece package</td>
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<td>Mixed Masala Powders</td>
<td>Shall be packed in new clean and sound containers made of jute or cloth or tinplate with inner lining of 200 gauge high density polyethylene or in sound and clean glass bottles or in new sound and clean pouches of 200 gauge polypropylene or high density polyethylene or containers in the form of bottles, jars. or pouches made of laminated/extrusioned/metalled/multilayer plastic materials</td>
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<td>Ajwain</td>
<td>The graded article shall be packed in clean, sound and dry containers such as jute bags, cotton bags, polywoven bags, paper bags, polyethylene laminated pouches, cardboard cartons, tin, grass, plastic container, and wooden cases.</td>
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<td>Caraway</td>
<td>1) Whole shall be packed in sound, clean and dry jute, cloth bags, polyethylene or poly propylene or in pouches made of food grade plastic materials. 2) Caraway powder shall be packed in new, clean, sound dry containers made of tin, glass, and notches made of laminated/extrusioned metallised/multilayer food grade plastic materials. 3) The net weight of Caraway whole and/or powder packed in container shall be 25g., 50g, 100g, 500g, 1kg. and thereafter in multiples of 500 g as per Packaged Commodities Rules, 1977 and amendments thereof from time to time; 4) Each package shall contain Caraway either whole or powdered of one grade only;</td>
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### Mace

1) Mace whole shall be packed in clean, sound and dry jute cloth bags laminated with polyethylene or poly propylene or in pouches made of food grade plastic materials;

2) Mace powder shall be packed in new, clean, sound and dry containers made of tin, glass or in pouches made of laminated/ extrusioned/ metallised/ multiplayer food grade plastic materials;

3) The net weight of the graded mace and mace powder packed in container shall be 25 grams, 50 grams, 100 grams, 200 grams, 500 grams, 1 Kg. and thereafter in multiples of 1 kg. as per the packaged commodities Rules, 1977, as amended from time to time;

### Cloves

1) Cloves whole shall be packed in new, clean, sound and dry bags of Jute cloth laminated with polyethylene of poly-propylene or high density polyethylene bags/pouches

2) Cloves powder shall be packed in new clean sound and dry containers made of glass, tin, aluminum or in pouches made of laminated/metallised/multilayered food grade plastic materials.

### Sundried Mango powder

1) The graded article shall be packed in sound, clean and dry containers made of paper, cloth, poly pouches, Jute bags, tin plates with inner lining of 200 guage high density polyethylene, glass bottle, plastic container, polywoven or any other packing material as may be required by the buyer and approved by the Agricultural Marketing Adviser.

2) Sundried raw mango slices or powder shall be packed in containers which will safeguard the hygienic, nutritional, technological and organoleptic qualities of the product; (vi) Each package shall contain raw mango slices or powder of one grade designation only; (vii) The Sundried Raw mango slices or powder shall be packed in the pack sizes as per instructions of Agricultural Marketing Adviser issued from time to time.

### Compounded asafoetida

1) Compounded asafoetida shall be packed in sound, clean, dry plastic container or lacquered in container or jute bag with polythene lining or polythene bag or any other container as may be approved by the Agricultural Marketing Adviser from time to time.

2) The net weight of the compounded asafoetida packed in a container shall be 5 gms, 10 gms, 15 gms, 20 gms, 25 gms, 50 gms, 100 gms, 200 gms, 500 gms, and kg and thereafter in multiples of 1 Kg.

3) The container shall be securely closed and sealed in such a manner as may be approved by the Agricultural Marketing Adviser. (3) Each package shall contain compounded asafoetida of the same grade designation

### Nutmeg

1) Nutmeg whole shall be packed in clean, sound and dry jute and cotton bags or in pouches made of food grade plastic;

2) Nutmeg powder shall be packed in new, clean sound and dry containers made of tin, glass or in pouches made of laminated/extrusioned/metallized multilayer food grade plastic materials;

3) The net weight of the nutmeg whole and nutmeg powder packed in a Container shall be 25 grams, 50 grams,100 grams, 500 grams, 1 Kg. and thereafter in multiples of 500 grams.
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<th>Spices</th>
<th>Packaging Requirements</th>
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| Curry powder   | 1) Only new and clean tins, bottles or papers cartons properly lined with some suitable material, shall be used for packing curry powder and these shall be securely closed and sealed in a manner approved by the Agricultural Marketing Adviser to the Government of India.  
2) When more than one package is put in a large container, all the packages shall bear Agmark label and outer container shall also bear Agmark label. |
| Saffron        | 1) Saffron and saffron powder shall be packed in new and clean tins, glass containers, plastic containers, polythene bags of food grade quality or any other packing material of food grade quality as approved.  
2) Saffron and saffron powder shall be packed in the pack sizes as per the provisions of the Legal Metrology (Packaged Commodities) Rules, 2011 or as per the instructions issued by the Agricultural Marketing Adviser from time to time.  
3) Graded material of small pack sizes of the same lot or batch and grade shall be packed in a master container with complete details thereon along with grade designation mark.  
4) Each package shall contain saffron and saffron powder of the same type and of the same grade designation. |
| Tejpat          | 1) The graded material of the Tejpat shall be packed in new, clean, sound and dry jute bags, polywoven bags, polyethylene, polypropylene or cellophane of paper packs and in other food grade plastics materials or any other packing material.  
2) The net weight of the Tejpat shall be 25 gms, 50 gms, 100 gms, 500 gms, 1Kg and thereafter in multiples of 500 gms as per the standards of weights and Measures (Packaged Commodities) Rules, 1977 as awarded from time to time.  
3) Each package shall contain Tejpat of one grade designation only. |
| Poppyseeds     | 1) The graded article shall be packed in clean, sound and dry containers using lining of polypropylene, in jute bags, cloth bags, polywoven bags, paper bags only in the case of consumer packs polyethylene of polypropylene of minimum 100 microns and metallised polyester voucher or any other packing materials. |

As described above, gunny bags/jute bags, polywoven bags, poly pouches, cloth bags, glass bottles of various sizes and shape with labels on it provided with metal or plastic caps, flexible pouches (pillow pouch, gusseted pouch, stand-up pouch) with various laminated composition (Polyester/metallised polyester/LDPE, BOPP/LDPE, BOPP/metallised polyester/LDPE, Polyester/Al foil/LDPE, and aluminium foil laminate) were used in the packaging of spices depending on the requirement.

The spices which are exported to the developed foreign countries are consumed in three main segments i.e. industrial, institutional and retail. Various types of packaging media are used according to the consumer's preference or choice. Different types of packaging media like plastic films, aluminium foils, laminations, flexible pouches are used. By exporting consumer packed spics, higher unit value for the same quantity can be earned.

Traditionally, spices were exported in bulk packages, however with efforts of Spices Board and the Government of India, exports in branded and value added consumer packages are gradually increasing. The packaging materials used for packaging of spices are given below:

**Industrial Packaging**

Bulk or industrial packaging of whole spices weighing 25-90 kg is carried out by using gunny/jute bags, jute bags with a loose liner (with or without liner) of polyethylene, and double gunny bags with inner polyethylene liner.
The dynamic 3-day International Spice Conference will discuss about the recent evolution of markets and value networks which might ultimately lead to the disruption of the Spices and Allied Industries in the 21st century.

**SCHEDULE**

**Session**

**Sunday, February 12, 2017**
- 100 hrs - 1600 hrs: Registration
- 1700 hrs - 1900 hrs: Inaugural Session
- 1900 hrs - 2100 hrs: Inauguration of Exhibition
- 2100 hrs - 2200 hrs: Networking, Cocktails and Dinner

**Monday, February 13, 2017**
- 0930 hrs - 1100 hrs: Tea Break
- 1100 hrs - 1115 hrs: Session 1: Spice Cultivation – Challenges Ahead
- 1300 hrs - 1400 hrs: Lunch Break
- 1400 hrs - 1530 hrs: Session 3: Disruptions in Spice Quality standards – Food Safety and Sustainability
- 1545 hrs - 1630 hrs: Codex MRLs – Need for Reforms
- 1645 hrs - 1745 hrs: UN - ITC & Indian Spice Industry: SITA Project
- 1730 hrs - 1730 hrs: IOSTA Meeting (Spice Association Office Bearers)

**Tuesday, February 14, 2017**
- 0930 hrs - 1100 hrs: Tea Break
- 1100 hrs - 1115 hrs: Session 4: Value Added Spices: Building the Culture of Innovation
- 1115 hrs - 1215 hrs: Session 5A: Crops & Markets: Turmeric, Onion & Garlic and Herbs - What the future holds?
- 1215 hrs - 1300 hrs: Session 5B: Crops & Markets: Cumin - What the future holds? (Audio Visual Presentation)
- 1300 hrs - 1400 hrs: Lunch Break
- 1400 hrs - 1545 hrs: Session 5C: Crops & Markets: Red Pepper/Chillies - What the future holds? (Audio Visual Presentation)
- 1615 hrs - 1900 hrs: Valedictory Session
- 1900 hrs Onwards: Gala Dinner

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**TESTIMONIAL**

Mr. Jean Mane It was very exciting to be here in the first conference. I was much honored to be the key note speaker. The program was extremely exhaustive and very enlightening for all participants. I have a feeling that the whole industry of spices across the value chain is ready to move to safer positions and it is very encouraging that there is willingness to change the way of ensuring safe spices. I am sure that most of them have learned a lot and personally, I have learned a lot."

For more information please contact us at:
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registration@internationalspiceconference.com
or Call +91 9895 146 966

Optional Spice Tour, February 15-17, 2017:
Tropical Spice Tour, Kerala and Chilli Tour, Andhra Pradesh.
by processing industry and traders. The quality of the jute fabric used with respect to the grammage and the weave (ends/picks) varies from one trader to the other. A variety of jute fabrics such as hessian, light weight DW, A-twill, heavy Cee etc. as depicted in figure 1 are used depend upon the availability by traders and producers

Alternate bulk packaging media such as woven plastic bags laminated with loose liner bag, multiwall paper sacks with a plastic liner bag, Jumbo bags (Flexible Intermediate Bulk Containers) (FIBCs) with capacity of up to one tonne have been used by traders in recent times. The plastic based alternate packaging materials are used to overcome the contamination problems associated with jute. Moreover, the plastic bags / liners also help in retaining the quality of the spices packed inside for a longer time. The Jumbo Bags used for bulk packaging has following advantages

- Bags are flexible, collapsible and durable
- Can be used for packaging of granules, powder, flakes and any free flowing material
- Product wastage / spillage and tampering can be avoided
- Since the handling is mechanized, less labour is required
- Saving in time for loading and unloading
- Bags are light in weight and, therefore, freight costs are reduced
- Creates eco-friendly, pollution free working atmosphere

<table>
<thead>
<tr>
<th>Jute Hessian Cloth</th>
<th>Light weight DW</th>
<th>A-twill</th>
</tr>
</thead>
<tbody>
<tr>
<td>woven plastic bags</td>
<td>Heavy Cee Jute bags</td>
<td>Multiwall Paper Sacks</td>
</tr>
<tr>
<td>Jumbo bags</td>
<td>Jumbo bags</td>
<td>Paper Sacks</td>
</tr>
</tbody>
</table>

**Fig 1. Different type of bulk packaging material used in spice industry**
Studies conducted at Indian Institute of Packaging (IIP), Mumbai on packaging of whole black pepper in different packaging materials for enhanced shelf life revealed that conventional jute and cotton bags offer a lower shelf-life, particularly at accelerated and cyclic conditions of storage.

Under these conditions there was loss of aroma, as well as moisture loss / gain beyond the acceptable limits. At the test conditions, where the relative humidity was high, the moisture pickup was very rapid leading to fungus growth and deterioration of the product. In these packs, the shelf-life at normal conditions was 3 to 4 weeks.

It was also concluded that the packaging materials which could offer the product a shelf-life of around one year and more at normal climatic conditions (27°C ± 1°C and 65% ± 2% RH) in order of performance are:
- 40 gsm paper / 0.12mm Al foil / 25μ LDPE
- 12μ metallised polyester / 50μ LDPE
- 25μ BOPP / 40μ LD – HD
- 12μ polyester / 50μ LDPE 90μ LD – Tie – Nylon – Tie – LD

The above materials (a, b, c & d are laminates and e is a co-extruded film) as well as other materials with similar barrier properties were recommended for use as consumer pack materials.

These materials could be used as flat pillow pouches, gusseted pouch or stand-up pouches. IIP also came up with specification details with respect to some of plastics based packages for consumer packs, intermediate packs and bulk packs (http://icpe.in/icpefoodnpackaging/pdfs/16_spices.pdf)

Institutional packaging
Many trading companies and Spice traders export and market spices in the institutional packages of varied capacities ranging from 0.3 to 25 kg in laminated flexible pouches and plastic woven sacks.

Consumer Packages
The use of flexible attractive consumer packs for ground and whole spices is gaining popularity in the internal market of India in recent past. The attractive consumer packages will also help to establish the brand image of companies in the international market. Wide varieties of consumer packages were available to the traders and spice packers to meet varied requirement such as Shelf-life period of spice products, Climatic conditions during storage, transportation and distribution. The type of packaging material used for making attractive consumer packages is described below:

Glass bottles of various sizes and shapes with labels and provided with metal or plastic caps. The plastic caps have added inbuilt features of tamper evidence, dispensing, and grinding etc. Glass bottle packages attract more consumer than other concealed packaging material due to open view of inside material. Besides Glass bottles preserve the flavour of spice for much longer than other types of packaging. This is because the material is less likely to allow contents to mix with air or other possible chemicals. Moisture is also less likely to get in the container, keeping your food safe from mold.
Containers made up of tinplate with/without dispensing system, composite material with dispensers Plastic with plugs and caps with dispensing and tamper evidence features were also used for making the consumer package of spices. The tin plate containers have advantage such as Low weight and high strength - making tinplate packaging easy to ship and store, Optimum protection of food products - from impurities, bacteria, moisture, light, and odors and unsurpassed safety of tinplate containers for chemical/technical products. Tinplate is an eco-friendly packaging material offering 100 percent recyclability - any number of times, and without quality loss. Plastic containers, especially of stretch blown PET of different shapes are reported to be suitable for a shelf-life of about 180 days for Masala mixes. PET containers have the advantage of being clear, light in weight and have the desired barrier properties.

The printed flexible pouches generally laminates of various compositions of polyester/metalized polyester/ LDPE, BOPP/LDPE, BOPP/metalized polyester/LDPE, Polyester/Al foil/LDPE have become very popular due to their easy availability, excellent printability, light weight, machinability and cost-effectiveness. Polyester and BOPP based laminates are generally more popular for spice packaging due to certain advantageous characteristics of each of these two films.

Polyester used for lamination is generally 10 or 12μ thick. High transparency with excellent clarity, gloss and printability nature of polyester helped in making consumer attractive packaging. Low moisture & gas permeability and very high mechanical strength sure prolonged shelf-life of the contents with aroma, flavour and taste retention and minimal damage to the contents during handling and transportation. The film is free from additives and, therefore, does not impart any odour or taint to the sensitive spice product that is packed.

BOPP films may be heat sealable or non heat sealable. The film has high yields, is stable under climatic changes and has excellent moisture barrier. This film is smooth, glossy, and crystal clear has high mechanical strength and non-contamination property for food contact applications. The sealant layer of LD – HD or LDPE can be replaced by LLDPE or cast PP. Co-extruded films can also be used. PVDC, EVOH and EVAL based flexible materials also need to be studied as they are now in the market and these materials have high barrier properties.

Paper bags continue to be popular in spice packaging despite competition from plastic bags. It is a popular choice for shopping and food items due to the increased durability and their eco-friendly disposition. Paper bags have become something of a fashion and status symbol in today’s market, due to the amount of time and effort that brands spend designing an attractive paper bag for their wares. With attractive paper bags that advertise the
company’s brand, customers are providing a form of free advertising and endorsement. Development of paper spice packages with tight sealing provision, box-shaped design to stand upright to hold more goods is gaining popularity now a days. Paper bags are also manufactured with multiwall paper using sack Kraft paper or with HDPE laminated to paper, multiwall can be of 2 or 3 ply and can be manufactured for various variants to fill 5, 10 or 25kgs. The bags can be printed as per customer requirement. Bags with smaller variants can be fitted with handle and can be used as carry bags.

![Fig 1. Aluminium Tin & Plastic containers used in spice packaging](image)

Multi-color printed best quality folding Lined Carton boxes of various sizes and shapes also used for packing spices to attract the consumers. These boxes are generally made of duplex board, mill board, grey board, etc to meet different requirements. The material should be dust proof and designed to prevent undesirable physical and chemical contamination.

![Fig 1. Spices packed in pouch in carton](image)

Oleoresins and volatile oils obtained from ground dried spices are sensitive to light and highly volatile in nature. These products are packed in epoxy coated narrow mouth aluminium container of 1 to 5 liters capacity.

Stretch blown PET bottles are also being used because of their excellent barrier properties to oxygen and volatile oils and compatibility with the product. 5 liters food grade HDPE Jerry cans and 25kg wide mouth HDPE containers with high thickness are also used.

**Conclusion**

Maintenance of good manufacturing practices, optimum processing condition grading and quality packaging of spices in bulk, institutional and consumer packages fetches good price for the ground and whole spices. Improper packaging leads to spoilage of spices, loss of quality and pest disease infestation.

Despite several efforts by spice board and other organization, spices were packed in unscientific way
especially in the farmer’s field. The spices procured from primary producers were exported to foreign countries for value addition and other product development.

There is an urgent need to create awareness among the primary producers and traders about the new generation packaging material, value addition practice to have geo specific brand images for different spices produced in India.

References

- http://agmarknet.nic.in/spices.pdf
- http://www.indianspices.com
- www.icpe.in/icpefoodnpackaging/pdfs/16_spices.pdf
- www.intracen.org/Packaging-for-organic-foods-for-web
Our turnkey plants:

* Cleaning, grading and powdering of coriander, fennel, fenugreek, cumin etc.
* Cleaning, grading and hulling plant for Cardamom, mustard, sesame.
* Pepper processing plant.
* Cleaning, grading, de-stoning and pulverizing plant for red chilies, turmeric.
* Cleaning, grading and hulling of dried neem seed.
* Cleaning, grading & sorting plant for dried Hibiscus flowers and senna leaves.
* Cleaning and grading and de-podding plant for garlic.
* Cleaning and grading of cloves, bay leaf, nutmeg etc.
* Cleaning, grading and de-stoning plants for all seeds and grains.
* Turnkey plant for Maize degeneration (also processed Soyabean).
* Turnkey plant for whole wheat 'Chakki Atta'.
* Turnkey plant for continuous, organic hulling of sesame.
Quality Certification of Spices

Beena Tilak, Laboratory Manager/Quality Manager
Geochem Laboratories Pvt Ltd

Introduction
Spices bring to mind, images of tempting culinary art, fascinating travels and bitter struggles for supremacy. Like our cultural diversity adds spices to our lives, spices add life to our food. We Indians are blessed with variety of spices having rare intrinsic qualities.

The aroma of spice fascinated people and we know how the Western people expedite to reach exotic islands in olden days in search of spices which culminated in rise and fall of empires. Thousands of years ago our great masters of Ayurveda, discussed in detail the use of spices in culinary and medicinal purpose. There are reports of spices using in preservation of meat during longer winter seasons.

India in the world of Spices
India is one of the largest producer, exporter and consumer of spices in the world.

Out of 109 spices listed by ISO About 75 are produced by India. India on an average exports around 550 thousand tones of spices annually. Major share is contributed by chilly, ginger, cumin and turmeric in terms of volume. Other important products are cardamom, black pepper, and nutmeg. In terms of value Mint and Mint products stands first followed by chilly and oleoresins. In the past 10 years the Indian spice exports increased substantially in terms of volume and value.

In the last few years exports of value added spices (oils and oleoresins) have increased significantly. Spices occupy a major position in Indian culinary scene; they are regularly used in the kitchen to add aroma and taste to food. In spite of the culinary importance the spice has some magical property which makes them an essential ingredient of nutraceutical, medicines, cosmetics and in food preservatives.

Spices and their products are playing a very important role in our food industry, cosmetics and pharmaceutical industries. So its quality is utmost important to avoid quality complaints occurring in the products contains spices as an ingredient.

We are not always in a position to buy fresh spices and ingredients. Thus when we buy prepackaged products we rightfully expect that the smell, taste, color and aroma should be identical with those of the original product and that they should be produced, stored and transported in a proper and safe way.

From the farm to table, spices pass through a handling at different stages which may cause contamination from physical chemical and biological contaminants. As most important importers of our spices are USA, UK, Germany and Iran it is ideal to emphasis on the quality parameters that are of major concern for these countries.

Spice mixes and seasoning blends
Blended spices or herbs are called spice mixes. The blended spices are used in many food industries. The blending is done in specific ratios of different spices. The combination are very specific for individual seasonings. Spice oleoresins, extracts and essential oils are classified as natural flavouring substances. It can be extracted from plants, leaves, seeds, tuber, roots, bark etc. It can be prepared by fermentation of certain spice precuts; liquid
blends are also available which constitute, spice extracts, oils or oleoresins.

They are highly potent in nature as they contain high amounts of volatile oil. An essential oil is highly concentrated liquid which is immiscible with water and contain volatile oil. It is also known as volatile oil and ethereial oil. Oleoresins are pure extracts of spices and herbs. They are generally in a semisolid form contains volatile oil.

MAJOR MARKETS AND THEIR QUALITY REQUIREMENTS

UNITED STATES OF AMERICA

USA is the most important buyer of our spices and their products. American spice trades Association (ASTA) is the authority which defines various quality parameters of spices import to USA.

In response to concerns raised following several recalls of spices due to Salmonella, ASTA has developed guidance for the Industry on pathogens in spices. The guidance includes five key recommendations.

• Minimize the risk for introduction of filth throughout the supply chains.
Spice manufacturers should adhere to the ASTA’s cleanliness specifications and USFDA Defect Action Levels for extraneous matter and filth in spices. Action should be taken at each stage of the supply chain to minimize the potential for contamination of spices by mammalian excreta, rodent hair, insect fragments and other foreign materials.

• Prevent environmental contamination, cross contamination and post process contamination during processing and storage.
Although some spices have the inherent quality of antibacterial activity many of them are harboring microorganism including pathogens. Most spices originate in tropical and subtropical countries where sanitation may not be adequate to handle the food hygienically. The producers are often small scale farmers who may not be fully aware of the need to protect their crops from conditions that lead to the presence of pathogenic microorganisms. Some pathogens are indigenous in the soil and some are come in contact with the spices during the growing, harvesting, drying, blending, packaging, transport and storage and distribution. Dust, dirt, insects, and animal parts are also sources of contamination.

• Use validated microbial reduction technique
ASTA recommends to use validated methods of bacterial reduction including Salmonella.

The methods should be approved by USEPA (United States Environmental Protection Agency). Ethylene Oxide (ETO) And Ethylene chlorhydrin are generally used methods with a maximum residue limit of 7mg/kg and 940mg/Kg respectively in spices and dry vegetables except in Basil leaves where it is banned. Propylene Oxide. Irradiation, Steam treatment are other methods. All methods should have validated to destroy the Salmonella.

• Perform post treatment testing to verify a safe product.
ASTA recommends post treatment test to verify the effectiveness of the treatment.

• Test to verify a clean and wholesome manufacturing environment.
The quality of the products can be affected at various stages like growing, harvesting, drying, transport, processing, post processing storage etc. Hence ASTA recommends to monitor the environment for its cleanliness.

Bacterial load is monitored by finding the Aerobic plate count, coliforms or Enterobactericea from the product contact areas.

Frequent monitoring of Salmonella also is mandatory from contact surfaces of the spices.

Regulation of the safety and cleanliness of spices in US.
The USFDA is the primary regulatory agency with authority to regulate the safety and cleanliness of spices.

Other jurisdictions over the aspects of spice trade are Customs and Border Protection (CBP), US Department of Agriculture(USDA) and the US EPA, the United States Environmental Protection Agency.

CBP is tasked with clearing merchandise through customs and determining appropriate duties. USDA regulates
meat and poultry including the use of spices in these foods.

The EPA regulates agricultural chemicals that may be applied to spices including fumigants, that may be used in microbial reduction strategies. These DAL is not applicable for turmeric, coriander, and cardamom. USFDA enforces EPA’s pesticide tolerances in food.

SAFE SPICES
The concept of “safety” within the context of US Food law and regulation is generally considered to be a reasonable certainty standard—absolute safety is not required,

Safe or safety means that there is a reasonable certainty in the minds of competent scientist that the substances are not harmful under the intended condition of use.

It is impossible in the present state of scientific knowledge to establish with complete certainty the absolute harmlessness of the use of any substance.

Therefore with specific reference to the potential presence of pathogens in spices, USFDA’s standard can be interpreted to require a reasonable certainty that active pathogens will not be present in spices, when spice are consumed either as ingredients of processed foods or applied to food by consumers in the home without cooking.

FDA REGULATORY ACTIVITIES
FDA relies on education and the prospect of regulatory enforcement action and monetary penalties to enforce and encourage industries to maintain its own programme to prevent food born diseases.

FILTH & FILTH REDUCTION STRATEGIES
USFDA considers contamination from filth to be a potential hazard to human consuming spices. Filth can be any objectionable matter contributed by insect, rodent, birds, decomposed materials, and miscellaneous such as sand, soil, glass, rust and other foreign objects.

<table>
<thead>
<tr>
<th>Name of the spice, seed, herb</th>
<th>Whole insects dead by count</th>
<th>Excreta mammalian by mg/lb</th>
<th>Excreta Other by mg/lb</th>
<th>Mould % by weight</th>
<th>Insect defiled / infested % by weight</th>
<th>Extraneous/foreign matter % by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>All spice</td>
<td>2</td>
<td>5</td>
<td>5.0</td>
<td>2.0</td>
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<tr>
<td>Anise</td>
<td>4</td>
<td>3</td>
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<td>1.0</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>Sweet basil</td>
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<tr>
<td>Caraway</td>
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<td>1.00</td>
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<tr>
<td>Cardamom</td>
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<td>Cassia</td>
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<tr>
<td>Celery seed</td>
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<td>3.0</td>
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<td>1.00</td>
<td>0.50</td>
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<tr>
<td>Chillies</td>
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<td>1</td>
<td>8.0</td>
<td>3.0</td>
<td>1.00</td>
<td>0.50</td>
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<tr>
<td>Cloves</td>
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<td>5</td>
<td>8.0</td>
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<td>1.00</td>
<td>0.50</td>
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<tr>
<td>Coriander</td>
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<td>3</td>
<td>10.0</td>
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<td>1.00</td>
<td>0.50</td>
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<td>Cumin seed</td>
<td>4</td>
<td>3</td>
<td>5.0</td>
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<td>0.50</td>
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<td>Dill seed</td>
<td>4</td>
<td>3</td>
<td>2.0</td>
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</tr>
<tr>
<td>Fennel seed</td>
<td>SF2</td>
<td>SF2</td>
<td>SF2</td>
<td>1.0</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>Ginger</td>
<td>4</td>
<td>3</td>
<td>3.0</td>
<td>SF3</td>
<td>SF3</td>
<td>1.00</td>
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<tr>
<td>Laurel leaves</td>
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<td>10.0</td>
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<tr>
<td>Mace</td>
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<td>3</td>
<td>1.0</td>
<td>2.0</td>
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<td>0.50</td>
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<tr>
<td>Marjoram</td>
<td>1</td>
<td>1</td>
<td>10.0</td>
<td>1.0</td>
<td>1.00</td>
<td>1.00*</td>
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<td>Nutmeg broken</td>
<td>4</td>
<td>5</td>
<td>1.0</td>
<td>SF4</td>
<td>SF4</td>
<td>0.50</td>
</tr>
<tr>
<td>Nutmeg whole</td>
<td>4</td>
<td>0</td>
<td>0.0</td>
<td>SF5</td>
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<td>Oregano</td>
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<td>1</td>
<td>10.0</td>
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<td>Black pepper</td>
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<td>1</td>
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<td>3.0</td>
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<tr>
<td>Rosemary leaves</td>
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<td>1</td>
<td>4.0</td>
<td>1.0</td>
<td>1.00</td>
<td>0.50*</td>
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<tr>
<td>Sage**</td>
<td>2</td>
<td>1</td>
<td>4.0</td>
<td>1.0</td>
<td>1.00</td>
<td>0.50</td>
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<tr>
<td>Savory</td>
<td>2</td>
<td>1</td>
<td>10.0</td>
<td>1.0</td>
<td>1.00</td>
<td>0.50*</td>
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<tr>
<td>Sesame seeds</td>
<td>4</td>
<td>5</td>
<td>10.0</td>
<td>1.0</td>
<td>1.00</td>
<td>0.50</td>
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<tr>
<td>Sesame seed hulled</td>
<td>4</td>
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<td>Thyme</td>
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<td>1.0</td>
<td>1.00</td>
<td>0.50*</td>
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<td>Turmeric</td>
<td>3</td>
<td>5</td>
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<td>3.0</td>
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</tbody>
</table>

GROUND PROCESSED SPICE (CANNOT EXCEED)

<table>
<thead>
<tr>
<th>Spice</th>
<th>Whole equivalent insects</th>
<th>Insect fragments</th>
<th>Mites</th>
<th>Other insects</th>
<th>Rats/ mouse hairs</th>
<th>Animal hairs</th>
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</thead>
<tbody>
<tr>
<td>Ground paprika</td>
<td>Average of more than 75</td>
<td>25g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fennel seed: In the case of fennel seed, if 20% or more of the subsamples contain any rodent, other excreta or whole insects, or an average of 3 mg/lb or more of mammalian excreta, the lot must be reconditioned.

(3) Ginger: More than 3% moldy pieces and/or insect infested pieces by weight
(4) Broken nutmeg: More than 5% mold/insect defiled combined by weight.
(5) Whole nutmeg: More than 10% insect infested and/or moldy pieces, with a maximum of 5% insect defiled pieces by count.
(6) Black pepper: 1% moldy and/or infested pieces by weight.
(7) White pepper: 1% moldy and/or infested pieces by weight.
Δ Whole insects, dead: Cannot exceed the limits shown.
☐ Extraneous matter: Includes other plant material, e.g., foreign

ASTA cleanliness specifications establish limits for macroscopic extraneous matter for domestic and imported spices and herbs coming to US.

The cleanliness specification also includes microscopic filth limits.

The cleanliness specifications do not address microbiological contaminants of spices or the adulteration by dyes etc.

ASTA specifications are widely accepted and as per that extraneous matter is defined as everything foreign to the product itself and include stone, dirt, glass, string, stem, sticks, nontoxic foreign seeds, excreta, manure and animal contamination.

REMEDIES FOR ENSURING A SAFE FOOD

Action should be taken at each step of the supply chain to minimize the contamination of filth. Adherence to Good Agricultural Practices (GAP) and Hazard analysis Critical control Point (HACCP) reduce the risk of food safety hazards in finished products by identifying the potential risk in the process.

The primary objective of implementation of HACCP is to eliminate the risk of contamination of spices by insects that pose a threat to human health.

Each spice manufacturers should develop and implement HACCP in the manufacturing units.

EUROPEAN UNION

Among the importers of Indian food products, stringent quality parameters are introduced by European Union.

The European Spice Association is the umbrella organization of the European Spice Industry. The standards for quality of food in European countries both manufactured in EU or imported from other states are determined by European Food Safety Authority.

Like USA, in the case of spices EU also insists for Good Agricultural Practices to follow in the farming activities. But they have not defined any specification for filth and foreign matters in spices.

In the case of spices very few items are covered under their quality purview and standards are fixed for parameters like Aflatoxins and some of the pesticide residues.

EU legislation covers only Capsicum species (dried fruit including chillies, chilly powder, paprika) Piper species (Black pepper and white pepper) Nutmeg and Mace.

Specification for sulphur dioxide is fixed for dry ginger, Onion Garlic and Shallot pulp. Another quality concern is regarding the pesticide residues that may present in the spices.

In this case Maximum Residue Limit is fixed for only few parameters like Thiabendazole (0.1mg/kg) and Ethofumesate (0.05mg/Kg).

Quality parameters of some of the spices are listed with the specified limit of EU

<table>
<thead>
<tr>
<th>TEST</th>
<th>SPICE</th>
<th>SPECIFIED LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aflatoxins</td>
<td>Capsicum spp (dried fruit including chillies, chilly powder, paprika) Piper species (Black pepper and white pepper) Nutmeg and Mace</td>
<td>81 - 5μg/kg</td>
</tr>
<tr>
<td>Sulphur Dioxide</td>
<td>Dry Ginger &amp; Turmeric</td>
<td>150 mg/Kg</td>
</tr>
<tr>
<td>Sulphur Dioxide</td>
<td>Onion, Garlic &amp; shallot paste</td>
<td>300mg/Kg</td>
</tr>
</tbody>
</table>
SPICES THAT ARE INCLUDED IN THE EU LIST

<table>
<thead>
<tr>
<th>S.No</th>
<th>NAME OF SPICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anise</td>
</tr>
<tr>
<td>2</td>
<td>Celery seeds</td>
</tr>
<tr>
<td>3</td>
<td>Coriander seeds</td>
</tr>
<tr>
<td>4</td>
<td>Cumin seed</td>
</tr>
<tr>
<td>5</td>
<td>Dill seed</td>
</tr>
<tr>
<td>6</td>
<td>Fennel seed</td>
</tr>
<tr>
<td>7</td>
<td>Fenugreek</td>
</tr>
<tr>
<td>8</td>
<td>Nutmeg</td>
</tr>
<tr>
<td>9</td>
<td>Allspice</td>
</tr>
<tr>
<td>10</td>
<td>Caraway seeds</td>
</tr>
<tr>
<td>11</td>
<td>Cardamom</td>
</tr>
<tr>
<td>12</td>
<td>Vanilla</td>
</tr>
<tr>
<td>13</td>
<td>Tamarind</td>
</tr>
<tr>
<td>14</td>
<td>Cinnamon</td>
</tr>
<tr>
<td>15</td>
<td>Ginger</td>
</tr>
<tr>
<td>16</td>
<td>Turmeric</td>
</tr>
<tr>
<td>17</td>
<td>Cloves</td>
</tr>
<tr>
<td>18</td>
<td>Saffron</td>
</tr>
<tr>
<td>19</td>
<td>Mace</td>
</tr>
<tr>
<td>20</td>
<td>Black pepper</td>
</tr>
<tr>
<td>21</td>
<td>White pepper</td>
</tr>
<tr>
<td>22</td>
<td>Garlic</td>
</tr>
<tr>
<td>23</td>
<td>Onion</td>
</tr>
<tr>
<td>24</td>
<td>shallots</td>
</tr>
</tbody>
</table>

Contamination of spice crop from pesticides is of major concern. EU has formulated regulations for some of the pesticides that are listed below. Maximum Residue Limit (MRL) is fixed for these contaminants. The MRL is generally fixed for the pesticides for which specific tolerances are not fixed is, 0.01 mg/kg.

NAME OF PESTICIDES AND THEIR TOLERANCE LEVELS AS PER EU

<table>
<thead>
<tr>
<th>S.No</th>
<th>NAME OF PESTICIDES</th>
<th>MRL (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thiabenzzone</td>
<td>0.1</td>
</tr>
<tr>
<td>2</td>
<td>Ethofumesate</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>2,4-D-T</td>
<td>0.05</td>
</tr>
<tr>
<td>4</td>
<td>Barban</td>
<td>0.05</td>
</tr>
<tr>
<td>5</td>
<td>Bromofosethyl</td>
<td>0.05</td>
</tr>
<tr>
<td>6</td>
<td>toxofene</td>
<td>0.05</td>
</tr>
<tr>
<td>7</td>
<td>Carbofuran</td>
<td>0.05</td>
</tr>
<tr>
<td>8</td>
<td>Chloroxuron</td>
<td>0.05</td>
</tr>
</tbody>
</table>

MRL for other parameters like heavy metals and microbiology are not defined and made available for the compliance.

Other emerging markets are the MIDDLE EAST, CANADA, SOUTH AFRICA, NORTH AMERICAN COUNTRIES OTHER THAN USA, JAPAN, AUSTRALIA, NEWZEALAND, AND MALAYSIA.

As per the available information the standards followed by European Union are adopted by Middle East.

Specifications are available for some of the microbiology parameters in spices are Staphylococcus aureus, Salmonella, Yeast & mould and Salmonella for UAE.

GSO STANDARD FOR SPICES IN MICROBIOLOGY

<table>
<thead>
<tr>
<th>Product</th>
<th>microorganism</th>
<th>Limit per gram</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>c</td>
</tr>
<tr>
<td>Spices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Salmonella</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Yeast &amp; mould</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>E.coli</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>
Spice & Seasoning Ingredients

Pesticide free steam sterilized spices from Indonesia

Black Pepper, White Pepper, Anduliman Pepper, Nutmeg, Clove, Turmeric, and others. Also Customized Formulation/Blending.

A reliable manufacturer of spice and seasoning ingredients, with the support of modern machinery and advanced processing facility.

We provide quality products with reduced pathogen microbial and chemical substances that makes our products has a longer shelf life and safe.

Haldin Pacific Semesta, PT
Jl. Jalan V Blok MM-2
Cibitung Industrial Town MM-2100
Bekasi 17520, Indonesia
T +62 21 8998 1788
F +62 21 8998 1789
E sales@haldin-natural.com
QUALITY PARAMETERS MANDATORY FOR EXPORTING SPICES AND SPICE PRODUCT TO CERTAIN COUNTRIES ARE LISTED BELOW:

<table>
<thead>
<tr>
<th>Name of the Country</th>
<th>Product</th>
<th>Parameter With Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CANADA</strong></td>
<td>Chilly whole</td>
<td>Aflatoxin total 15µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Chilly powder &amp; powder product</td>
<td>Aflatoxin total 15µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Curry powder, Masala</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Curry paste &amp; pickles</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Turmeric powder</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Cumin seeds</td>
<td>Extraneous matter 3% Max</td>
</tr>
<tr>
<td></td>
<td>Other seeds</td>
<td>0.25% Max</td>
</tr>
<tr>
<td></td>
<td>Sugar coated fennel</td>
<td>Sunset Yellow Not detected</td>
</tr>
<tr>
<td><strong>SOUTH AFRICA</strong></td>
<td>Chilly whole</td>
<td>Aflatoxin B1 5µg/Kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aflatoxin total 10µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Chilly powder &amp; powder product</td>
<td>Aflatoxin B1 5µg/Kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aflatoxin total 10µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Curry powder, Masala</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Curry paste &amp; pickles</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Turmeric powder</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Cumin seeds</td>
<td>Extraneous matter 3% Max</td>
</tr>
<tr>
<td></td>
<td>Other seeds</td>
<td>0.25% Max</td>
</tr>
<tr>
<td></td>
<td>Sugar coated fennel</td>
<td>Sunset Yellow Not detected</td>
</tr>
<tr>
<td><strong>OTHER NORTH AMERICAN COUNTRIES</strong></td>
<td>Chilly whole</td>
<td>Aflatoxin total 30µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Chilly powder &amp; powder product</td>
<td>Aflatoxin total 30µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Curry powder, Masala</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Curry paste &amp; pickles</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Turmeric powder</td>
<td>Sudan I, II, III, IV Not detected</td>
</tr>
<tr>
<td></td>
<td>Cumin seeds</td>
<td>Extraneous matter 3% Max</td>
</tr>
<tr>
<td></td>
<td>Other seeds</td>
<td>0.25% Max</td>
</tr>
<tr>
<td></td>
<td>Sugar coated fennel</td>
<td>Sunset Yellow Not detected</td>
</tr>
<tr>
<td><strong>JAPAN</strong></td>
<td>Chilly whole</td>
<td>Aflatoxin total 10µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Iprobenfos</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Profenofos</td>
<td>&lt; 0.05mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Triazofos</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Ethion</td>
<td>5.00mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Phorate</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Parathion</td>
<td>&lt; 0.60mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Chloryprin</td>
<td>1.00mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Methylparathion</td>
<td>&lt; 5.00mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Chilly powder</td>
<td>Aflatoxin total 10µg/Kg</td>
</tr>
<tr>
<td></td>
<td>Iprobenfos</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Profenofos</td>
<td>&lt; 0.05mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Triazofos</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Ethion</td>
<td>5.00mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Phorate</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Parathion</td>
<td>&lt; 0.60mg/Kg</td>
</tr>
<tr>
<td>Item</td>
<td>Chlorpyrifos</td>
<td>Methylparathion</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Cumin seeds</td>
<td>&lt; 1.00mg/Kg</td>
<td>&lt; 5.00mg/Kg</td>
</tr>
<tr>
<td>Extraneous matter</td>
<td>3% Max</td>
<td></td>
</tr>
<tr>
<td>Other seeds</td>
<td>0.25% Max</td>
<td></td>
</tr>
<tr>
<td>Cumin seeds &amp; powdered cumin seeds</td>
<td>Iprobenfos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profenofos &lt; 0.05mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Triazofos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethion &lt; 3.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phorate &lt; 0.50mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parathion &lt; 0.60mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorpyrifos &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methylparathion &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td>Turmeric whole</td>
<td>Iprobenfos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profenofos &lt; 0.05mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Triazofos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethion &lt; 3.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phorate &lt; 0.50mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parathion &lt; 0.60mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorpyrifos &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methylparathion &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td>Turmeric powder</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td></td>
<td>Iprobenfos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profenofos &lt; 0.05mg/Kg</td>
<td></td>
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<tr>
<td></td>
<td>Triazofos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethion &lt; 3.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phorate &lt; 0.50mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parathion &lt; 0.60mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorpyrifos &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methylparathion &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td>Sugar coated fennel</td>
<td>Sunset Yellow</td>
<td>Not detected</td>
</tr>
<tr>
<td>Cardamom whole &amp; Ground</td>
<td>Aflatoxin total 10µg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iprobenfos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profenofos &lt; 0.05mg/Kg</td>
<td></td>
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<tr>
<td></td>
<td>Triazofos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethion &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phorate &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parathion &lt; 0.60mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorpyrifos &lt; 1.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methylparathion &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td>Black pepper whole &amp; ground</td>
<td>Aflatoxin total 10µg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iprobenfos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profenofos &lt; 0.05mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Triazofos &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethion &lt; 5.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phorate &lt; 0.01mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parathion &lt; 0.60mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorpyrifos &lt; 1.00mg/Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methylparathion &lt; 5.00mg/Kg</td>
<td></td>
</tr>
</tbody>
</table>
JAPAN

<table>
<thead>
<tr>
<th>Product</th>
<th>Residue</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenugreek whole &amp; ground</td>
<td>Iprobenfos</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Profenofos</td>
<td>&lt; 0.05mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Triazofos</td>
<td>&lt; 0.01mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Ethion</td>
<td>&lt; 3.00mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Phorate</td>
<td>&lt; 0.50mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Parathion</td>
<td>&lt; 0.60mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Chlorpyrifos</td>
<td>&lt; 5.00mg/Kg</td>
</tr>
<tr>
<td></td>
<td>Methylparathion</td>
<td>&lt; 5.00mg/Kg</td>
</tr>
</tbody>
</table>

AUSTRALIA & NEWZEALAND

<table>
<thead>
<tr>
<th>Product</th>
<th>Residue</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilly whole</td>
<td>Aflatoxin total</td>
<td>15µg/Kg</td>
</tr>
<tr>
<td>Chilly powder &amp; powder product</td>
<td>Aflatoxin total</td>
<td>15µg/Kg</td>
</tr>
<tr>
<td>Curry powder, Masala</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td>Curry paste &amp; pickles</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td>Turmeric powder</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td>Cumin seeds</td>
<td>Extraneous matter</td>
<td>3% Max</td>
</tr>
<tr>
<td>Other seeds</td>
<td></td>
<td>0.25% Max</td>
</tr>
</tbody>
</table>

MALAYSIA

<table>
<thead>
<tr>
<th>Product</th>
<th>Residue</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar coated fennel</td>
<td>Aflatoxin B1</td>
<td>5µg/Kg</td>
</tr>
<tr>
<td>Sugar coated fennel</td>
<td>Aflatoxin total</td>
<td>10µg/Kg</td>
</tr>
<tr>
<td>Chilly powder &amp; Chilly product</td>
<td>Aflatoxin total</td>
<td>30µg/Kg</td>
</tr>
<tr>
<td>Curry powder, Masala</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td>Curry paste &amp; pickles</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td>Sugar coated fennel</td>
<td>Sunset Yellow</td>
<td>Not detected</td>
</tr>
<tr>
<td>Cumin seeds</td>
<td>Extraneous matter</td>
<td>3% Max</td>
</tr>
<tr>
<td>Other seeds</td>
<td></td>
<td>0.25% Max</td>
</tr>
</tbody>
</table>

OTHER COUNTRIES

<table>
<thead>
<tr>
<th>Product</th>
<th>Residue</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilly whole</td>
<td>Aflatoxin total</td>
<td>30µg/Kg</td>
</tr>
<tr>
<td>Chilly powder &amp; Chilly product</td>
<td>Aflatoxin total</td>
<td>30µg/Kg</td>
</tr>
<tr>
<td>Curry powder, Masala</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td>Curry paste &amp; pickles</td>
<td>Sudan I, II, III, IV</td>
<td>Not detected</td>
</tr>
<tr>
<td>Sugar coated fennel</td>
<td>Sunset Yellow</td>
<td>Not detected</td>
</tr>
<tr>
<td>Cumin seeds</td>
<td>Extraneous matter</td>
<td>3% Max</td>
</tr>
<tr>
<td>Other seeds</td>
<td></td>
<td>0.25% Max</td>
</tr>
</tbody>
</table>

CONCLUSION:
The change in food habit among the people in countries like USA, UK and other European countries has augmented the exports of spices to those destinations. The spices are used in medicines, cosmetics and nutraceuticals as well as in those countries. It is the responsibility of the traders to maintain the quality and update the regulations and quality requirements of the importers to compete with other countries like Vietnam, Sri Lanka and Thailand. Maintaining the quality is the only solution for facing the competition in the market from other countries. Other strategy is the value addition.

Presently demand for value added spices is high in the domestic as well as in the international market. The stakeholders are required to update the regulatory requirements of the importing countries like USA, UK, JAPAN, AUSTRALIA and Germany for their sustainability.

It is high time to empathize our farmers about the importance of adopting Good Agricultural Practices (GAP) and concept of to maintain healthy, wealthy and strong.


For further details please contact us: beenatilak@gmail.com
IPM Approach for Reducing Pesticide Residue in Chilly

Mr. Sanjiv Rangrass, Divisional Chief Executive
ITC - Agri Business Division - ILTD

Declining productivity and Pesticide Residue – A looming Threat

Spices and condiments are significant ingredients of Indian cuisine. The country is the largest producer of spices in the world. From time, India has been known as the Land of Spices, having a long culinary tradition of creating flavourful dishes that are better known for their rich taste. However, in recent years the excessive use of agro-chemicals by farmers worried about declining productivity has resulted in sharp increase in presence of harmful pesticides across all crops including spices like chilly.

Solution – The IPM Approach

Over past decade or so, most of the organizations involved in exporting agri produce are advocating Integrated Pest Management (IPM) practices to address the issue of pesticide residues by integrating different ways of controlling pest and diseases viz., biological, mechanical, cultural and chemical methods.

A host of IPM tools like border crops, sticky traps, spray of neem oil, etc. are available which have been found to be very useful in controlling pesticide residues. A thorough follow up with the farmers combined with proper monitoring system ensures that farmers are aware of the prevalent IPM technologies and scientific help is available to them at all times.

But, most of the chilly produced in the country is traded and consumed in domestic market, which is predominantly insensitive towards pesticide residues and hence, farmer’s adherence to such programmes is not up to the expected global food safety levels.
cultivation in an environmentally sustainable manner is important to meet the market requirements and make Indian agriculture globally competitive.

Success Story – ITC’s IPM Programme for Chilly

Agriculture is vulnerable to the vagaries of nature. Apart from weather, agriculture is also dependent on several variables such as pest, soil, inputs, competing crops, competing nations, and customer requirements etc., which change from year to year and are beyond control. Over the years, the Agri-Business Division of ITC has been offering customised solutions to farmers by continuously aligning with the preferences of global regulation.

Our operations span the entire spectrum of activities starting from agri-services/ crop development to risk management, including sourcing at the farm gate, processing, supply chain, multimodal logistics, stock management, and customer service. The solutions offered are a combination of all or some of these interventions. Working closely with the chilly farmers, we have constantly transferred technology from the lab to the land with appropriate solutions thereby making agriculture a profitable business for our farmers.

Moving to the Future – ICE (Integrated Crop Engagement) Approach

Most of the farmers cultivating chilly in India are small farmers with an average land holding of less than 1.5 Ha. They lack access to latest technologies and innovations. The real challenge here is to enhance “Farmer Profitability” and produce “Food Safe Chilli” meeting the stringent US & EU specifications.

Recognizing that dearth in small scale farming is primarily a result of the poor capacity of farmers in terms of lack of access to knowledge, information, price discovery, quality agricultural inputs and markets, the Company has devised an unique model called “ICE” in rural villages that not only support sustainable agriculture but also contribute to substantial livelihood creation for inclusive development.

Our approach to sustainable rural livelihood’s focuses on supporting villages to become economically, ecologically and socially sustainable. The objective is to drive smart and sustainable community development in villages by empowering Indian farmers through deployment of Good Agricultural Practices.

The sustainable crop production system enhances the crop competitiveness and ensures surplus income generation to the farming community. With economic stability, it is believed that a village will develop faster in other areas like health, education and environment; thereby reducing the vulnerability of the village in a long run.

Enabled by a team of agronomists, agriculture experts, engineers and development managers, the ICE programme has helped ITC in substantially improving the quality table of chilli production in India.

The customers/consumers derive value from “quality assured” and “identity preserved” spices at competitive prices, whereas the farmers derive value from better productivity & market incentive.
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Growing Black Pepper in Tea Estates of North East India

Arup Borgohain, Senior Manager, Agri Business, Amalgamated plantations Pvt Ltd
Vishwas Garg, Business Head, Agri Business, Amalgamated plantations Pvt Ltd

The vast stretch of land in the North East of India are naturally laid out in congenial locations for cultivation of spices having unique generic properties.

Many of the spices grown in the North Eastern States are sought after for its superior quality. These are much preferred by the exporters and processors on account of intrinsic traits.

One of these Spices from the North East is Black Pepper which cultivation is taking momentum in the last couple of years. Specially, Assam and Meghalaya had been traditionally producing pepper on arecanut trees because of the favorable soil and climate.

Interestingly, a number of tea estates have also taken up black pepper as an additional crop. Tea estates utilize shade trees in the tea gardens for black pepper as a bonus crop or companion crop.

While it was the erstwhile Tata Tea Ltd that took the lead in this respect, more and more tea companies are looking at black pepper as an additional crop.

Intercropping Black Pepper in Tea Gardens in Assam was started by erstwhile Tata Tea way back in 1989 in few Tea Estates in between 1990 to 2000. Between 2001 and 2009 the activities took a dip but 2009 onwards Amalgamated Plantations Private Limited, APPL (A Tata Enterprise) a divested Company formed out of Tata Tea Ltd, again started focusing on this crop and from 2012 onwards actual work of pepper started.

APPL has 21 tea gardens in Assam and 4 gardens in Dooars region of North Bengal. We are the 2nd largest producer of Tea in India. We produce 40 million kgs of CTC and Orthodox Tea and have forayed into planting black pepper in all our tea estates. There are almost 7 lac shade trees out of which 5 lac shade trees have been planted with pepper vines and planting completion in 100 % shade trees is planned in a couple of years. The current total pepper production is 40 to 50 MT from 0.75 lac numbers of fully mature vines and the production will increase in the years to come as more and younger vines will come in production. APPL is currently the single largest grower of quality black pepper in the North East India.
Tea has mixed shade tree species. To avoid monoculture a suitable mixture of shade species is selected. Shade trees are planted to provide natural shade to Tea bushes and protect them from seasonal fluctuations in temperature. The common shade species are Albiziaodoratissima, Albizialebbek, Acacia lenticularis, Derrisrobusta planted at a spacing of 11 m x 13 m, which can accommodate approximately 65 to 70 shade trees per hectare.

Since Pepper is a climbing vine, shade tree can be used as a live standard. Pepper can be easily taken up in tea gardens because soil and climatic conditions of Assam have been found to be ideally suited for it.

A major advantage of pepper is the inter-cropping, i.e. both tea and pepper can co-exist without interfering each other. Also, the efficient use of land and judicious deployment of labor can be achieved.

Considering the steadily rising demand for Black Pepper it can be one of the most compatible crops in Tea plantations.

Seeing the benefit of this high-value Crop majority of the small tea growers has started cultivating Black Pepper as an intercrop. So for generating additional revenue per hectare area, intercrops such as Pepper can be a good option to generate additional income for Tea Gardens. Cost of cultivation of the pepper as an intercrop is not much. Some of the common cultural operations such as weeding, irrigation, fertilizer and others are commonly shared together which brings down the total cost of cultivation.

On the economic side, in a hectare of Tea, there are about 65-70 shade trees. If Pepper is planted on the shade trees and if one Pepper vine yields about 1.5 kgs of dried pepper, farmers can get about 80 to 100 kgs of dry Black Pepper per hectare, substantially augmenting the income per hectare.

Climate change has tremendously affected the Tea Industry. The price of Tea in the global and domestic markets fluctuates. Intercropping is one of the options that can protect this industry from vagaries of these market fluctuations.

Intercropping of Black Pepper in Tea plantations leads to optimize utilization of horizontal and vertical space.

For long term sustainability of pepper in tea plantations choosing of proper variety (pepper cultivars) which will be suitable for different climatic zones is very important.

As most of the local pepper varieties are low yielding or have alternate fruit bearing characteristic.

Growing of black pepper vines in live standards will also have an added advantage and contributes to protect the ecological environment. This can be viewed as soft measures for mitigating climate change as the surface area of a pepper vine (conical or cylindrical canopy with green foliage) will also help the environment.

Spices cultivation in the North East had a stunted growth as it remained under-exploited due to lack of system-specific production technologies, poor infrastructure and underdeveloped credit and extension facilities. The difficult terrains had retarded easy accessibility and reach from the rest of India.

The potential for North East to become the major spice
producing region in the country is yet to be tapped to the fullest. With more focus this land locked paradise can become a major spice producing hub in India.

For further details please contact:vishwas.garg@amalgamated.in

| Good for the Stomach | Pepper increases the hydrochloric acid secretion in the stomach, thereby facilitating digestion. Proper digestion is essential to avoid diarrhea, constipation and colic. Pepper also helps to prevent the formation of intestinal gas, and when added to a person’s diet, it can promote sweating and urination, which remove toxins from the body. |
|-weight loss | The outer layer of peppercorn assists in the breakdown of fat cells. Therefore, peppery foods are a good way to help you shed weight naturally. When fat cells are broken down into their component parts, they are easily processed by the body and applied to other, more healthy processes and enzymatic reactions, rather than simply sitting on your body and making you look overweight. |
| Skin Health | Pepper helps to cure Vitiligo, which is a skin disease that causes some areas of skin to lose its normal pigmentation and turn white. |
| Respiratory Relief | Pepper provides relief from sinusitis and nasal congestion. It has an expectorant property that helps to break up the mucus and phlegm depositions in the respiratory tract, and its natural irritant quality helps you to expel these loosened material through the act of sneezing or coughing. |
| Peptic Ulcers | A number of studies have shown that black pepper may have beneficial effects on gastric mucosal damage and peptic ulcers, due to its antioxidant and anti-inflammatory properties. More research is still being done on this aspect of black pepper health effects. |
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India has a Great Future in Cumin Exports

Shailesh Shah, Director, Jabs International Pvt. Ltd.

Cumin commonly known as Jeera belongs to the family Apiaceae. Cumin is mainly grown in India, Syria, Iran and Turkey. India is the largest producer of cumin in the world. India produces around 323,000 tonnes of cumin annually which accounts for 70% of world cumin production. Indian cumin production has remained in the range of 290,000-402,000 tonnes in the last five years.

Syria is the 2nd largest producer of cumin in the world, it produces around 30,000-32,000 tonnes of cumin annually. Production in Syria is declining over the years. Syrian cumin production during 2002 was around 84,000 tonnes which has declined to 32,000 tonnes in the last 15 years. Decline in production is due to two reasons. 1. Farmers are shifting to other lucrative crops, 2. On going war across Syria. Though there is a war going on in Syria, exports of cumin are taking place from Syria. Syria exports around 25,000-30,000 tonnes of cumin from Lattakia port to Morocco, Egypt, Saudi and Arabian countries.

Iran and turkey are the other producing regions of cumin in the world which produces around 4,000-10,000 tonnes of cumin annually. Cumin production across Iran and Turkey has declined over the years this is mainly because farmers across the growing regions have shifted to other crops like dry fruits. Cumin is very sensitive crop and is more susceptible to fluctuating weather and the cost viability; this has forced the farmers to shift to other crops. Turkey exports around 7-10 thousand of cumin annually. European countries are the major buyers of Turkey’s cumin.

Processing and storing of cumin
Cumin requires 6 stage of cleaning and the cost of involved in processing is around Rs.4000/Tonne. After cleaning Jeera can be stored for 2 years, during season storing is not a problem because of summer season during off season cumin stored in cold storage. Cost involved in storage of cumin is around Rs.110-120/Tonne /month.

Indian Cumin trade
India is the largest producer of cumin, exports around 114,000 tonnes of cumin annually. U.A.E Central America, China and Vietnam are the major importers of Indian cumin. India has 70% market share in world cumin trade,
Indian cumin exports are growing at a rate of 22% annually (CAGR). Indian cumin exports have started increasing from 2012-13. Cumin exports from India increased mainly because of the following reasons:

- Good pricing
- Awareness about the product has increased
- Increase in Indian production and in the meanwhile production across other major growing regions has declined.

India exports cumin mainly in the form of whole, demand for processed cumin has still not picked up because of lack of awareness about these products. Also culture plays a major role; most of the consumers in Arab nations prefer whole spice instead of value added cumin. In the mean while most of the importers prefer buying whole cumin and processing it in their own country based on the countries taste.

Fig: 1 shows that India exports around 80% of cumin in the whole form, 20% in the form of oleoresin and 5% in the form of powder and oil. Overall, Indian cumin exports are growing at a rate of 18% in the form of Whole cumin, in oil and oleoresin form it is increasing at a rate of 14% and 10% respectively. Indian cumin exports are likely to increase further in the coming days. Increase in production will definitely help the overall Indian cumin exports.

Challenges faced by Indian Cumin exporters
The biggest challenge for India is to produce Pesticide free or IPM Cumin Seeds. Because now a day’s all the developed countries demanding with lower MRL of Pesticide Residue Levels. Cumin seed traders and Government need to act on the same on priority.

### Health Benefits of Cumin (Jeera)

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehydrate Body</td>
<td>Drinking luke warm jeera water is considered as to rehydrate the human body and keep refresh all the time.</td>
</tr>
<tr>
<td>Keeps Skin Free of Spots</td>
<td>It acts as a natural remedy to remove acne problem. Applying boiled jeera water regularly on the skin makes it toned, clear and acne-free.</td>
</tr>
<tr>
<td>Promote Digestive System Functioning</td>
<td>It helps in improving the saliva secretion, enhancing appetite and relieving the digestive disorders.</td>
</tr>
<tr>
<td>Improves Milk Production in Mothers</td>
<td>Eating cumin seeds in food and cumin water improves the breast feeding in the lactating mother.</td>
</tr>
<tr>
<td>Maintains Blood Sugar Level</td>
<td>It manages the proper blood content in the body and lowers the blood sugar level in the blood.</td>
</tr>
<tr>
<td>Keeps Body Fresh</td>
<td>It increases the blood haemoglobin level thus enhances the oxygen carrying capacity of the cells throughout the body.</td>
</tr>
<tr>
<td>Treats Asthma</td>
<td>Jeera/Cumin seeds act as a good bronchodilator and have a compound called Thymoquinone which helps in reducing the inflammations and treating asthma.</td>
</tr>
<tr>
<td>Boosts Immunity System</td>
<td>It is a very good anti-oxidant spice which fights with the free radicals in the body and enhances the body immunity to better fights with all the infections.</td>
</tr>
<tr>
<td>Prevents from Cancer</td>
<td>It is very effective against the cancer and prevents from the colon, stomach, liver and breast cancer as it contains the variety of anti-carcinogenic agents such as thymol, dithymoquinone</td>
</tr>
<tr>
<td>Treats Sleeping Disorder</td>
<td>Regular intake of cumin water helps in treating the sleep disorder and enhances the sound sleep.</td>
</tr>
</tbody>
</table>
Relevance of Dietary Intake of Spices in relation to Aflatoxin Contamination

Vasanthi Siruguri, Scientist E, National Institute of Nutrition (ICMR)

Introduction:
Spices are important flavouring components in the dietaries of several countries particularly in Asia, Africa and Europe. Several spices including chilli, black pepper, nutmeg, cinnamon, ginger, and turmeric are important in World trade. India leads in spice production 1525000 metric tons, valued at $1060114 (Mohan et al 2013). According to Code of Hygienic Practice for Spices and Dried Aromatic Plants (CAC/RCP 42-1995) spices are defined as follows: “The term spices, which includes dried aromatic plants, relates to natural dried components or mixtures thereof, used in foods for flavouring, seasoning and imparting aroma”. The term applies equally to spices in the whole, broken or ground form” (Codex 1995). Consumption of spices is generally higher in Asian countries such as India, China, and Thailand. However, there has been an increasing trend in their intake in developed countries such as in Europe and the USA, because of changing food habits and preference for ethnic and spicy food (Williams 2006; CBI Ministry of Foreign Affairs 1999).

Spices, like cereal, grains and oilseeds are susceptible to fungal and mycotoxin contamination when conducive conditions are presented, such as high relative humidity, moisture levels above 12% during post-harvest storage, presence of insect infestation or mould damaged seeds (Yogendrarajahet al 2014). Natural occurrence of mycotoxins such as aflatoxins and ochratoxins have been well documented in spices such as dried red chillies, black pepper and also nutmeg from producing countries such as India, Indonesia, Turkey (Reddy et al 2001; Madhyastha 1985; Filazi ans Sirell 2013). The hepatotoxic and carcinogenic properties of aflatoxins are well recognized and several countries have established maximum limits in food commodities to control and reduce dietary exposure in consumers (FAO 2004). Recently several quality issues in spices affected their export important among them being aflatoxin contamination (RASFF). The international food standards setting body namely the Codex Alimentarius Commission of the United Nations (UN) expressed the need to harmonize maximum aflatoxin limits in spices in order to facilitate trade and protect consumer health (Codex 2014). The Codex Committee on Contaminants in Foods (CCCFs) recommended that the modus operandi of fixing the MLs for aflatoxins in spices will be decided based on data generated/available on dietary intake of spices, aflatoxin levels in spices, and risk assessment by JECFA.
**Dietary intake of spices:**

Measuring dietary intake of spices is gaining importance in order to quantify the health promoting benefits of various phytochemicals present in spices and their preventive role in chronic diseases (Kaefer and Milner 2008; Ferrucci et al. 2010). Evolving a methodology for assessing dietary spice intake and generation of spice intake data gains much relevance in view of their use restricted as flavouring agents in the diet, and their lower level of consumption than other dietary components such as staple cereals with quantities constituting 0.8-2.2% of the total dry matter content of the diet (Siruguri and Bhat 2015). Quantifying spice intake at the individual level presents several challenges as the frequency and quantity of intake varies with the type of spice, form in which it is used, quantity added to various dishes and the frequency of preparing and consuming such dishes.

Spice intake varies considerably between different countries, geographic regions within the same country, and also with different dietary cuisines within the same region. The WHO Global Environmental System database (WHO GEMS), GEMS Cluster country food consumption database indicates spice intake ranging from 0.4g/person/day in Latin American regions to 2.7g/person/day in the African countries. Various studies carried out to quantify dietary intake of spices indicated that intake of chillies was the most frequently recorded followed by black pepper, ginger, and turmeric (Siruguri and Bhat 2015; Ferrucci et al 2010; Yogendrarajah et al 2014; Carlsen et al 2011; Pradeep et al 1993). In India where spice consumption is generally considered to be high, intake of chillies could range from 3-6g/day in India (Thimmayamma et al 1983; Pradeep et al 1993). Intake of other spices such as cumin, coriander; turmeric, cinnamon, cardamom, and nutmeg are less frequently quantified. Among the various food consumption survey methods such as food frequency questionnaires supplemented with dietary recall, and weighed records, estimation of portion size of spice consumed per eating occasion or frequency is emerging as a useful approach for quantifying spice intake (Tantipopipat et al 2010; Carlsen et al 2011).

Recently, a study was carried out in the Hyderabad city to quantify spice intake at the individual level by assessing the pattern of spice use and portion size of spice consumed from routinely prepared dishes (Siruguri and Bhat 2015). A spice intake questionnaire was developed that could provide information on the pattern of spice use and intake based on the type and frequency of spices used, the frequency and quantity of spices used in routine dishes, and the quantity of prepared dish consumed by an adult individual in order to calculate the portion size of the added spice consumed. The results of this study indicated that major part (53%) of spice intake consisted of chillies followed by turmeric and cumin (14%). The remaining spices were observed to contribute less than 10% of total spice intake. This was particularly observed with nutmeg and mace which contributed only 0.3% of total spice intake. Highest portion size intake was observed for chillies (mean 3.0 g; range 0.05-20.2 g) and lowest for nutmeg (mean 0.14 g; range 0.02-0.64 g) and mace (mean 0.21 g; range: 0.02-0.6 g). The mean spice intake was observed to be 8g/person/day in this study (Siruguri and Bhat 2015).

The frequency of spice intake becomes important especially while assessing the impact on health or risk to aflatoxin contamination. For example in the above study it was observed that chillies and turmeric were consumed daily but other spices such as cloves, cardamom, cinnamon, nutmeg, mace were consumed mostly at weekly or monthly frequencies. The use and consumption of spices is generally known to be high in India as compared to the countries in the west where intakes of spices ranged from 0.8 to 14.7 times per month (Sherman and Hash 2001). 

**Aflatoxin exposure from spices:**

Exposure assessment of aflatoxin is an important component of risk assessment that forms the basis for regulatory measures. Hazards of aflatoxin are well recognized from various toxicological studies in experimental animals and also from epidemiological studies in human populations exposed to these toxins.
through diet (IARC 2002). Among the spices red chillies and nutmeg are the high risk spices to aflatoxin contamination. The EU’s Rapid Alert System for Food and Feed (RASFF) database indicated that maximum notifications occur for chillies followed by nutmeg from producer and exporting countries. Highest levels up to 1200µg/kg were reported in nutmeg imported into EU from producer countries. Occurrence of aflatoxin in black pepper has been reported with maximum levels up to 60µg/kg. Limited data is available on aflatoxin contamination in other spices such as cumin seeds, coriander seeds, cinnamon, anise, fennel, cloves, cardamom, and mace.

Although high aflatoxin levels have been found to occur in chillies and nutmeg the contribution of spices to aflatoxin exposure may be considered to be low. This may be attributed to their use mainly as flavoring agents and intake at considerably low levels. Few independent studies are available that documented aflatoxin intake from spices such as chillies, black pepper, turmeric, or total spices. JECFA estimated aflatoxin exposure ranging from 0.01-0.1ng/kg bwt/day based on spice intake ranging from 0.4-2.7g/person/day in GEMS cluster diets (WHO 2008). Aflatoxin exposure ranging from 0.4-15ng/kg bwt/day from an intake of 2.5-15g of chillies/person/day was observed in India. In China it is reported that spices contributed 10% of total dietary aflatoxin intake (Zhao et al 2013). In Sri Lanka from an intake of 1.13g of black pepper/person/day aflatoxin intake of 0.2ng/kg bwt/day was observed (Yogendrarajah et al 2014).

Setting of maximum aflatoxin limits in spices:
According to JECFA risk assessment data the aflatoxin intake from spices is almost an order of magnitude less than cereals (WHO 2008). However; several importing countries have fixed regulatory limits for spices (FAO 2004). About 11 countries including EU and some countries in Europe and Asia have fixed MLs for spices either individually or for a group of spices that ranged from 2-30µg/kg for aflatoxin B1 and 5-20µg/kg for total aflatoxins. Since exposure assessment is the key component for risk assessment of aflatoxins as described by JECFA, the criteria of the Codex General Standard for Contaminants and Toxins in Food and Feed (GSCTFF) may gain considerable relevance for fixing maximum aflatoxin limits in spices namely, “MLs shall only be set for foods in which the contaminant may be found in amounts that are significant for the total exposure of the consumer” (Codex 2014). Thus, for realistic risk assessment of aflatoxin exposure from spices for setting of MLs, the key issues that need to be addressed are whether the significance and risk of aflatoxin exposure from spices is considerable as that of cereals and other foods with higher quantities and frequencies of intake and whether fixing single ML for all spices leads to potential for over estimation of risk in view of the variation in the frequency/quantity/significance of various spices in the diet.

Conclusions: While spices are important in international trade maintaining quality and controlling fungal and aflatoxin contamination also gain considerable importance. Aflatoxins are unavoidable contaminants in various foods including spices. Thus harmonization of MLs to facilitate international trade and protect consumer’s health becomes important. Setting of MLs is based on risk assessment of aflatoxin exposure from spices in which level of dietary spice intake plays a critical role. Thus generation of spice intake data for various spices in various countries is important in understanding the role of spices in the diet as well as in contributing to aflatoxin exposure.

References:


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Simple and Modular Solar Drying Unit for Turmeric

Dr. Munishamappa Chandrashekar, CEO, Urvi Food-Park [P] Limited and its subsidiary Basil Technologies

India is the largest producer of turmeric accounting for nearly 80% of the world’s total production. According to the statistics derived from the spice board, the area under turmeric cultivation is about 183000 hectare in the year 2013 and the average yield being about 4000-5000 Kg per hectare. The annual output conservatively estimated at about 800000 tons and 90% of which is domestically consumed and while 6-8% accounts for export. The turmeric crop production is mainly concentrated in the Indian states of Andhra Pradesh, Tamil Nadu, Orissa and Assam. The other states the crop where marginally grown include Karnataka, Kerala and West Bengal. The major importing country is UAE followed by the other European and Middle East countries. The potential use of turmeric in food and medicinal preparations together is propelling the demand graph towards high value commodity in trade and realization.

Crucial Steps in Postharvest Handling:
Curing is the first step that involves boiling the rhizomes until they are soft and free from the earthy odour. During the process the starch gets gelatinized and the rhizome fingers attain uniform diffusion of colouring. Over cooking deteriorates the colour diffusion and the rhizomes become hard of varying shapes and textures. Under cooking makes the rhizomes brittle and it would be ideal if the rhizomes of same size are cooked in separate batches for uniformity. In the context of optimal cooking or curing decides the quantitative and qualitative parameters of the finished product.

Further the resurgence of traditional ayurvedic formulations with proven scientific studies has enhanced the scope and profile of turmeric as a major source for extraction of active pharmaceutical ingredients (APIs).

The key second step after curing is drying and is mainly attributed to size and shape of the rhizome figures. Drying method employed determines the quantitative aspects of recovery percentage of the raw material.
and curcumin content in the finished produce. Drying method plays a very crucial role for longer shelf life and stability of the material during storage.

Important Quantitative and Qualitative Factors for Curing and Drying: The turmeric market is segmented on basis of form and application that include the dried form (Used in Food Processing and Beverages Industry), powdered form (Used in Culinary Dishes, Bakery Products, Dairy Products and Beverages) and the liquid form (Used in Pharmaceutical and Cosmetic Preparations). The increasing demand is redefining the focus on specific attributes of quantitative and qualitative parameters needed for the emerging food and pharmaceutical industries.

The specific quantitative parameters include recovery percentage, curcumin content after processing and moisture content after processing. The qualitative parameters critically required both during and after processing include hygienic processing techniques, hygienic drying, no color degradation due to heat and ultra violet rays, low running cost for higher savings, low energy cost, easiness to operate, longer shelf life after drying and limited control of air and temperature in storage unit.

Value Chain Propositions interfaced by BASIL TECHNOLOGIES for Turmeric grown in Chamarajanagar District:

Karnataka ranks 6th in terms of cropping area and 3rd in productivity in the country. Chamarajanagar district accounts for 80% of the turmeric cropping area and productivity in the state. The base line survey conducted by the research team at Urvi Food-Park Private Limited revealed the some of the explicit opportunities towards building the competitive verticals for the turmeric grown in the district. Due to the lack of processing facilities all the fresh harvested turmeric is enrouted to Erode district in Tamil Nadu thereby having very little control over selling and prospective trade realization.

BASIL TECHNOLOGIES aims to build a niche framework business plan for the turmeric grown in Chamarajanagar district integrating end-end verticals. The strategic focus is towards identification and embedding specific solutions in the value chain activities starting from training, digitalization of farms, land preparation, supply of all inputs (seed rhizomes, fertilizers, safe chemicals, organic inputs, etc) and ensuring the follow of procedures for safe-food production practices (Traceability Index). The centralized facilities shall include the processing facility with a capacity to handle 10tons/day/shift, the solar tunnel drying units and spot marketing window options.

A Simple and Modular Solar Conduction Drying Unit:
Working on a low cost solar cabinet or conduction dryer is carried out in a major effort to boost the drying of the produce locally. The main principle of this low cost solar conduction dryer is based on greenhouse effect.
where the solar heat trapped inside the drying chamber and thus increasing the temperature level. Drying air temperature achieved will be around 42°-48°C for an ambient temperature in the range of 28°-32°C.

The design and template include construction of a 5000SFT polyhouse with 600µ thickness translucent high density polythene sheet. The drying area comprises of four chambers with four tier tray dryers covering a surface area of 1.0m² each. The upper surface of the tray is covered with transparent polythene sheet and the exhaust is passed from the vents provided to the rear end of the each tray. The solar conduction drying unit is a mixed modular solar cabinet wherein the combined actions of solar radiation incident on the surface generate heated air in the solar collector.

The atmospheric air enters through inlet portion of the solar collector at the bottom and the air gets heated and passes through the outlet portion. A low height air vent is created for the air current to pass in horizontal direction. The preheated air from the outlet portion is passed through an insulated pipe or duct into the open space beneath the trays, where the cured turmeric is spread.

The heated air enters from beneath the trays and carries away the moisture from the sample through the exhaust fans at the top of the polyhouse. The trays are coated with black color non-corrosive special food grade coating.

Solar collector is a cubical shape having breadth equal to the breadth of the bottom of the drying chamber (side opposite to the door of the chamber). Solar collector is so connected with drying chamber that it does not allow air to enter from any other side except air inlet portion.

The solar collector is connected with the chamber in an inclination of 270 from bottom of the chamber and to the ground level base. It is designed with an air inlet and the bottom portion is fitted with non-corrosive GI sheet and dark black paint is painted on it. Upper portion of the collector is covered with transparent plastic paper. The established facility can be utilized for drying 800Kg of cured material/batch or one cycle. One cycle of operation takes about 4-6 days depending on the external ambient temperature. Conventionally the drying takes about 15-18 days under open field conditions.

The biggest disadvantages include improper drying and altered textural features including discoloration. Using of the solar conduction driers aids in maintaining the required moisture level of 6-8% in the finished product besides having 90% uniform textural features. Ramp can be for scaling-up with a lead time of 30 days for creating add on facilities. The proactive support from the State Department of Horticulture, initiative program “Public-Private Partnership and Integrated Horticulture Development (PPP-IHD)” adds on the new facets in building the project.
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Investment in Spice Traceability is a need for Industry’s Sustainability

Kunal Prasad, Co-Founder & COO, CropIn Technology Solutions Pvt Ltd

Today, customers and consumers are more informed and inquisitive to look backward in finding the origin and safety of the food they consume, look around for awareness and look forward to lead healthy lives.

In fact, the digital platform is one of the major decision making platform of 21st century which has the power to collect, store, process, manage, disseminate all kind of data and empower consumer to make informed decisions. Food labelling and bar coding, is just the beginning.

Traceability or ‘Going back to roots’ is the backward integration of information. It means the ability to track food that will be used for consumption through all stages of production, processing and distribution. Traceability is the way of responding to potential risk that can arise in food/Spice, to ensure that foods are safe for citizens to consume and reduces challenges incurred in overseas shipping, exports and certifications.

In agriculture business, traceability is a complex issue and when it comes to spices it becomes more complex. In the spice context, such as dried seeds, fruits, berries, leaves, roots or bark of plants grown as herbs, shrubs, climbers, cumin, chilli, black pepper, oregano, ginger, and cinnamon and trees which are used to enhance food flavors across the world and agricultural product such as culinary herbs may be contaminated by pathogens, naturally occurring toxins such as mycotoxins, agrochemicals such as pesticides, and accidental contaminants.

Due to such importance in our daily food and eating habits, spices have become essential for culinary and medicinal purposes in several regions around the world, the trading of these spices has been an important commercial activity since ancient times and a mean of economic development.

Unfortunately, many agriculture related business still keeping manual records that are not always an easy or efficient way to locate a problem. Often these actions are not traced and sometimes it is costly and time-consuming process to retrace the producer. This leads to huge business loss due to rejection at the customer end as well as inability of businesses to increase the export horizon and be global exporters in true sense.

So, what need to be done?
Technology solutions has been an enabler to ensure quality management and traceability by integrating
all data from producer to consumer through out the value chain. Business who have adopted technology have efficiently managed their farmers, take care of the IPM and chemical application schedules, PHI, Chemical residue helping them in building efficiency in their entire production, processing and exports operations. Technology can help maintain the integrity of the traceability chain so that it will be possible to identify the materials and other ingredient used in the process.

Benefits

• Traceability can be added to the value chain of farming via farm analytics and OQ coding of the agriculture produce, thus aids in following various certificate compliances globally.
• A system not only determines traceability of farm produce but even helps in early decision making due to harvest prediction and follow ups on the package of practices defined for agriculture and monitored through the web and mobile applications.
• Helps enable management cost, operational efficiency and market expansion for companies due to processes followed which are transparent and defined.
• Traceability solutions help remove out of date product losses, lower inventory levels, and raise the effectiveness of logistics and distribution operations.
• Improved customer confidence also helps with branding and improved brand equity through word of mouth within the industry.

Methodology

• Need Assessment: The sector, the supplier profile, customer requirements (contractual requirements) and regulatory requirements. Identify and evaluate the internal and external data that needs to be traced and define the parameters of traceability.
• Assess internal capacities: Review the data that is recorded for production management, customer relations, marketing, and accounting. Compare with the specifications of the external requirements.
• Prepare: Prepare a traceability action plan. Articulate the benefits to the company and customer
• Set in place a project: Put together a team, working methodology, schedule, budget and reporting.

Using agile methodology and continuous testing to provide timely and quality outcome. Assess the robustness of the system and periodically review the system with changes in context, clientele, suppliers, processes, products, and/or regulations.

Tools and Technologies

Traceability initiatives rely on technologies to provide efficient and accurate ways to track and trace products and their movement across the supply chain. This includes technology for product identification, information capture, analysis, storage and transmission of data as well as overall systems integration.

Such systems include hardware such as measuring/sensing equipment, identification tags and labels, with remote sensing capabilities. All these are then stored over cloud server and further data algorithms are carried out for valuable farm insights.

Implementation Challenges

• Cost: Traceability-related costs include services, technology and software costs, changes in processes, training and ongoing operating costs
• Skill and implementation: Need to rely on many smallholder farmers. Related support associations may not have the capacity to provide the necessary orientation and training the producers would need to create traceability documentation and set in place the requisite systems and processes
• Multiple requirements: Each buyer may also have their own requirements from suppliers, including slightly different documentation that results in duplicated or time consuming effort

Overcoming challenges

Applying (Web-Mobile-Cloud-Analytic platform) in traceability systems which includes information systems management; scanning and digital technology for product identification, image capture, storage and display; biosensors for quality; and geospatial tracking technology. Meeting the needs of medium-scale farms and larger agribusinesses. Making rural access inexpensive and robust combining emerging and traditional technologies to overcome constraints,
organizational design that brings together partners with specific value proposition

Conclusion
As the use of spices continues to expand and develop it is now even more important to ensure that all stages of the supply chain play their role in ensuring safe spice products, which are free from potential hazards, are provided to the global consumer market.

Additional investment is necessary for productivity and growth, but probably not as expensive as the financial impacts which eats market share, reduce revenue and increase cost.

“Decision is left to us whether we want to grow in the fast changing market and provide reliable and relevant information to all the stakeholders of Agri value chain”
Sterling Exports Inc.

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- Fenugreek Seed
- Chilli
- Turmeric
- Cardamom
- Ginger
- Nigella Seed (Kalonji)

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Cardamom Production and Market Prospectus- Guatemala and India 2016 – 2017

James Mathew, Crops and Market Research Analysts, James Mathew Brokerage

Production

Guatemala, one of the largest producers of green cardamom, is expected to produce around 28,000-30,000 tonnes of cardamom for the crop year 2016-17 against the last year production of 32,000-35,000 tonnes. Production for the crop year 2016-17 declined mainly because of higher temperature across the cardamom growing belt of Guatemala; also the rainfall across the growing regions were 30% less compared to last year. Carry forward stocks for the crop year 2016-17 is expected to be around 4,000 tonnes. So, total supply for the year 2016-17 would be around 36,000 tonnes against the last year supply of 40,000-42,000 tonnes.

Harvesting of cardamom has started in December; so far (14th of Jan’17) totally 13,000 tonnes of cardamom has been harvested. The 2nd round picking will start from 15th of Jan’17 and expected to continue till 28th of Feb’17. Production from the 2nd picking is expected to be round 14,000 tonnes which is slightly higher than the 1st round picking. The 3rd round picking will start from 15th Mar and expected to end by 30th May’17.

Local market -Guatemala

Large scale consumers i.e.; Coffee Grinding and roasting companies, Spices Grinding Companies, Super Market Importers, Large Scale Bakers and Confectionaries based in consuming countries USA, Europe, Middle East and South East Asia are buying directly from the Guatemala Cardamom Exporters, hence demoralizing the speculation role and incentives for local trader, stockiest and middle men in their consuming markets. As major share of Cardamom consumption is being supplied directly by Guatemala Cardamom Exporters to large scale buyers and consumers.

Exports

Guatemala normally exports around 30,000 tonnes of green cardamom annually. Currently two major Cardamom Exporters are holding approximately around 8,000 tonnes of the new 2016 - 2017 crops (4,000 tonnes of Green Qualities, 3,000 tonnes of Pale Greens and 1,000 tonnes Yellow Qualities).

The crops are now held at the farm gate levels or stored in warehouses waiting for export. The crops were allegedly bought at an average of USD7.00 Per Kg – USD8.00 Per Kg (sorting, packing, and grading costs included). Most of the Pale Green Qualities have been shipped to South East Asia and the Middle Eastern aggressive buyers. Yellow Qualities and MYQ have been shipped to Europe and the USA at premium prices.
On the other hand, even Saudi Arabia, Dubai, Egypt, Jordan, Kuwait, Iraq, Pakistan, Bangladesh, Nepal and other small consuming markets are also holding huge stocks from last year’s crops (2015 – 2016), those cargoes are still being traded in the local market.

**Indian prospectus**

Indian cardamom production for the year 2016-17 is expected to be around 20,000-21,000 tonnes against the last year production of 28,000 tonnes. Total supply for the year 2016-17 is around 24,000-25,000 tonnes and exports are projected to be around 4,000 tonnes.

Whereas, the exports of Indian Cardamom during 2015-2016 are estimated around 5,800 tonnes and the local consumption is estimated roughly around 14,000 - 15,000 tonnes. Approximately 2,000 -3,000 tonnes is imported legally into India and around the same quantity is smuggled into India through neighboring countries' land routes from Nepal and Bangladesh, which is further mixed up with the Indian Cardamom and exported to Middle Eastern countries in premium as India Origin Cardamom.

Overall there is sufficient availability of cardamom in India and Guatemala so there will not be any shortage of cardamom for the marketing year 2017-18.
Changing Consumption Pattern of Spices across India

S. K. Srivastava, Scientist (Agricultural Economics),
ICAR-National Institute of Agricultural Economics and Policy Research

Food and Agriculture Organization (FAO) defines “spices” as vegetable products such as leaves, flowers, seeds and roots that are rich in essential oils and aromatic principles. The spices are commonly used as condiments or employed for other purposes on account of their fragrance, preservative or medicinal qualities. India, known as ‘home of spices’, produces about 75 spices in its varied agro-climatic regions and has emerged as one of the largest producer, consumer and exporter of spices in the world. More than 90 per cent of the spices produced in the country are used to meet domestic demand and India contributes about 44 per cent of total value of the world spices trade (Srivastava et al., 2013). This shows a huge domestic market and trade potential for spices products in the country. The present article provides empirical evidences on temporal changes and inter-regional variations in consumption of spices in India using nationally representative National Sample Survey (NSS) data.

Consumption pattern of spices:
Spices are the integral part of Indian diet. Presently, an average Indian consumes 3.25 kg spices in a year which constitutes 4.40 per cent share in total food expenditure (Fig 1 and 2). Due to varying food habits of Indian households, consumption pattern of spices varies significantly across geographical regions of the country. During 2011-12, the share of spices in total food expenditure varied from 3.21 per cent in north-east region to 5.34 per cent in southern region. In quantity terms, spices consumption varied from 2.15 kg in north-east region to 4.92 kg in southern region in 2011-12.

Regional variations in spices consumption was studied by dividing India into five geographical regions viz. Northern (Uttar Pradesh, Punjab, Haryana, Delhi, Chandigarh, Himachal Pradesh, Uttrakhand and Jammu and Kashmir), Western (Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Goa, Dadar and Nagar Havelli and Daman and Diu), Southern (Karnataka. Kerala, Tamilnadu, Andhra Pradesh, Puducherry, Lakshadweep and Andaman and Nicobar), Eastern (West Bengal, Bihar, Odisha, Jharkhand and Chhattisgarh) and North-East (Assam, Arunachal Pradesh, Manipur, Nagaland, Sikkim, Meghalaya, Mizorumand Tripura) regions.
Over the years, spices are gaining importance in the Indian food basket. This is reflected from their increasing food share from 3.65 per cent to 4.40 per cent, and increasing per capita annual consumption from 2.88 kg to 3.25 kg during 1993-94 to 2011-12. Interestingly, north-east and eastern regions, where spices consumption is less, have witnessed maximum increase during the period under consideration.

**Composition of spices consumption basket:**

In India, spices are consumed as whole spice or mixed spices. According to NSS data, mixed spices constitute 39 per cent of total spices budget of Indian households (Fig. 3b). Among whole spices, dry chilli occupies a predominant share of 18 per cent share in total spices expenditure. Dry chilli is followed by turmeric, garlic, ginger, tamarind and black pepper with their respective share of 15 per cent, 12 per cent, 7 per cent, 5 per cent and 4 per cent.

Due to changing food habits, and taste and preferences of Indian households, the relative importance of spices is changing over the years. Between 1993-94 and 2011-12, the share of dry chilli in spices budget has reduced by 6 percentage points (Fig. 3a and 3b). Similarly, tamarind has lost its share by 2 percentage points during the same period. On the other hand, the share of garlic, ginger and turmeric has increased. Further, Indian households are increasing their spending towards mixed spices as shows by its increasing share over time. The rising importance of mixed spices is consistent with peoples’ inclination towards ready-to-cook, ready-to-eat and processed food products. This offers a great scope to trap the rising market of value added spices products by improving the processing infrastructure and services in spices sector.

**Consumption of whole spices**

**Dry Chilli:**

An average Indian consumes 543 grams dry chilli in a year (Fig 4a). Among the regions, the consumption of
Dry chilli varies widely from 165 grams in north-east region to 926 grams in southern region. Between 1993-94 and 2011-12, the per capita consumption of dry chilli declined from 769 gram to 543 grams and highest reduction is noticed in southern region.

This indicates that the preferences of Indian households are moving away from dry chilli across all the geographical regions.

Turmeric:
The average per capita annual consumption of turmeric in India is 343 grams (Fig 4b). Among the regions, turmeric consumption is highest in eastern region and lowest in southern region. The past 18 years have witnessed marginal reduction in turmeric consumption. But, the decline in turmeric consumption is taking place in north, west and north-east regions only.

The south Indian households are increasing their turmeric consumption over the years. The eastern region has witnessed no change in turmeric consumption over the years.
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- Serving the Industry since 1950’s. Experienced from Generations.
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- A Correlation Project with Spices Industry Vs Agricultural Institutions.
- Delivering crops according to the Industry Standards and requirements.
- Root level Quality check before season starts and evaluating the crops before cultivation and prepare for sale.
- On top of each products quality based on proper Analysis and Research.
- Proper communication between the buyers from the time of Order confirmation to the delivery, via emails and SMS.
- Dedicated Quality Check Team discusses best methods to identify the best crops filtering, with the buyers before signing the deal with each consignments.
- A long term trusted partner, who in touch with the farmers always and for generations.
Garlic:
The average per annual capita consumption of garlic is 586 grams, varying from 466 in eastern region to 702 grams in southern region of the country (Fig. 4c). During the past 18 years, garlic consumption has increased 45 per cent. The increase in garlic consumption is observed across all the geographical regions indicating increasing consumer preference towards garlic.

Ginger:
Among all the whole spices, ginger has witnessed highest increase in its consumption (Fig 4d). The per capita annual consumption of ginger has increased from 206 grams in 1993-94 to 460 grams in 2011-12. Among the regions, ginger consumption is highest in north-eastern region of the country.

Tamarind:
In India, tamarind is primarily consumed in southern region (Fig. 4e). The per capita annual consumption of tamarind in southern region is 1014 grams which is four times higher than the average consumption in the country. Over the years, consumers’ preference is moving away from tamarind leading to decline in per capita tamarind consumption.

Black pepper:
An average Indian consumes about 52 grams of black pepper in a year (Fig. 4f). Among the regions, consumption of black pepper varies from 18 grams in north-eastern region to 99 grams in southern region. During the past 18 years, black pepper consumption has increased in all the regions except north. The north Indian households have significantly reduced consumption of black pepper over the years.

Overall, the study reveals increasing consumption and changing composition of spices in Indian diet over the years. The consumers’ preferences are changing away from dry chilli, tamarind, turmeric and towards ginger, garlic and mixed spices. Increasing consumption of mixed spices shows rising domestic market of value added spices products in the country. Notwithstanding, the changes are not uniform across geographical regions which necessitate devising region-specific marketing strategies to meet the household demand of spices in the country.
Indian Spices: A Food Safety Perspective

Lalitha R Gowda Ph.D, Former Chief Scientist, CSIR–Central Food Technological Research Institute

Introduction

The center-piece in the world of food flavors, seasonings, aromas and colors is the spice industry. Spices available as whole, cracked, crushed, ground, dehydrated or in liquid form added in small quantities to food enhance the flavor aroma and other sensorial properties. In addition they are used to extend the shelf-life of foods by their inherent antioxidant activities and their potential to stem growth and destruction of harmful microorganisms.

The spice industry, involving a heterogeneous group of agricultural commodities is, mainly supported by millions of small farmers around the world and important to international trade. Spices as agricultural commodities are either fruit or berry-based (such as chillies and black pepper), leaf based (such as bay leaf or basil), bark or flower-based (such as cinnamon, saffron and cloves), root or rhizomes based (such as turmeric and ginger) and seed-based (such as cumin and aniseed).

Spices include various parts of the plant, such as aril, bark, berries, buds, bulbs, leaves, rhizomes, roots, seeds, stigmas, pods, resins, fruits, or plant tops (Table 1). All these forms develop their flavors and fragrances post-harvest by fermenting in the sun, drying in the open air, winnowing and using finishing processing techniques like roasting and grinding. Once the appropriate flavors and aromas are attained they are packaged, fumigated and stored and transported worldwide.

The safety and quality of spices begins with the grower and continues through the food chain terminating at the table. However, food safety and quality standards during post-harvest processing (drying mechanically or naturally), and manufacturing in spice growing regions worldwide do not meet the expectations of regulators and consumers.

Spices, as per the Code of Hygiene Practice for Spices and Dried Aromatic Plants (CAC/RCP 42-1995), must be protected from contamination by human, animal, domestic, industrial and agricultural waste, at levels likely to be a health hazard. The regulations and food safety standards for spices and the products thereof are stringent and differ around the world. The safety of spices and their products depends on maintaining Good Hygienic Practices (GHP) during primary production, processing, packing, retail, and at the point of consumption.
### Table 1 List of spices commonly used in Indian cuisine

<table>
<thead>
<tr>
<th>Common name</th>
<th>Indian Name</th>
<th>Botanical Name</th>
<th>Plant part used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aniseed</td>
<td>Saunfpatli</td>
<td>Pimpinellaanisum L.</td>
<td>Seed</td>
</tr>
<tr>
<td>Basil (sweet)</td>
<td>Tulasi</td>
<td>Ocimumbasilicum</td>
<td>Leaf</td>
</tr>
<tr>
<td>Black Cardamom</td>
<td>Badielachi</td>
<td>Amomumsubulatum</td>
<td>Seed</td>
</tr>
<tr>
<td>Black cumin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Wild onion seed)</td>
<td>Kalonji</td>
<td>Nigella sativa L</td>
<td>Seed</td>
</tr>
<tr>
<td>Black Pepper</td>
<td>Kali mirch</td>
<td>Piper nigrum L</td>
<td>Berry</td>
</tr>
<tr>
<td>Caraway</td>
<td>Siahjira</td>
<td>Carumcarvi</td>
<td>Seeds</td>
</tr>
<tr>
<td>Cardamom</td>
<td>Elaichi</td>
<td>Elettariacardamomum</td>
<td>Seeds</td>
</tr>
<tr>
<td>Carom (Bishops) seed</td>
<td>Ajwain</td>
<td>Trachyspermumammi</td>
<td>Seed</td>
</tr>
<tr>
<td>Cassia</td>
<td>Taj</td>
<td>Cassia senna</td>
<td>Bark</td>
</tr>
<tr>
<td>Celery seeds</td>
<td>Anjud</td>
<td>Apiumgraveolens L</td>
<td>Seeds</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>Dalchini</td>
<td>Cinnamomumzeylanicum</td>
<td>Bark</td>
</tr>
<tr>
<td>Cloves</td>
<td>Laung</td>
<td>Syzygiumaromaticum Eugenia caryophyllis</td>
<td>Dried flower buds</td>
</tr>
<tr>
<td>Coriander</td>
<td>Dhania</td>
<td>Coriandrum sativum</td>
<td>Leaf and seeds</td>
</tr>
<tr>
<td>Cumin White</td>
<td>SafedZeera</td>
<td>Cuminumcyminum</td>
<td>Seed</td>
</tr>
<tr>
<td>Curry leaf</td>
<td>Kari patta</td>
<td>Murrayakoenigii</td>
<td>Leaf</td>
</tr>
<tr>
<td>Fennel</td>
<td>SaunfMoti</td>
<td>Foeniculumvulgare</td>
<td>Seed</td>
</tr>
<tr>
<td>Fenugreek</td>
<td>Methi</td>
<td>Trigonellafoenum-graecum L</td>
<td>Seed</td>
</tr>
<tr>
<td>Garlic</td>
<td>Lassun</td>
<td>Allium sativum</td>
<td>Bulb</td>
</tr>
<tr>
<td>Ginger</td>
<td>Adrak</td>
<td>Zingiberofficinalae</td>
<td>Rhizome</td>
</tr>
<tr>
<td>Indian Bay Leaf</td>
<td>Tejpatta</td>
<td>Cinnamomum tamale</td>
<td>Leaf</td>
</tr>
<tr>
<td>Indian capers</td>
<td>Shalmali</td>
<td>Ceibapentandra</td>
<td>Unopened flower buds</td>
</tr>
<tr>
<td>Long pepper</td>
<td>Pippali</td>
<td>Piper longum</td>
<td>Fruit</td>
</tr>
<tr>
<td>Mace</td>
<td>Jaipatri</td>
<td>MyristicafragransHouttuyn</td>
<td>Aril</td>
</tr>
<tr>
<td>Mint</td>
<td>Pudina</td>
<td>Menthaspp</td>
<td>Leaf</td>
</tr>
<tr>
<td>Mustard</td>
<td>Sarson/Rai</td>
<td>Brassica alba, Brassica nigra</td>
<td>Seed</td>
</tr>
<tr>
<td>Nutmeg</td>
<td>Jaiphal</td>
<td>MyristicafragransHouttuyn</td>
<td>Seed</td>
</tr>
<tr>
<td>Oregano</td>
<td></td>
<td></td>
<td>Leaf</td>
</tr>
<tr>
<td>Poppy seed</td>
<td>KhasKhas</td>
<td>Papaversomniferum</td>
<td>Seeds</td>
</tr>
<tr>
<td>Red Chillies</td>
<td>Mirch</td>
<td>Capsicum annuum or frutescens</td>
<td>Fruit</td>
</tr>
<tr>
<td>Rosemary</td>
<td></td>
<td>Rosmarinus officinalis</td>
<td>Leaf</td>
</tr>
<tr>
<td>Saffron</td>
<td>Kesar</td>
<td>Crocus sativus Linnaeus</td>
<td>Flower stigma</td>
</tr>
<tr>
<td>Star anise</td>
<td>Chakra phool</td>
<td>Illicium verum</td>
<td>Seed</td>
</tr>
<tr>
<td>Stone flower</td>
<td>Kalpasi</td>
<td>Parmotrempyleratum,</td>
<td></td>
</tr>
<tr>
<td>Thyme</td>
<td></td>
<td>Thymus vulgaris</td>
<td>Leaf</td>
</tr>
<tr>
<td>Turmeric</td>
<td>Haldi</td>
<td>Curcuma longa L</td>
<td>Rhizome</td>
</tr>
</tbody>
</table>

### Biological Safety of Spices

Food safety refers to all hazards (physical, chemical and biological), whether chronic or acute that may make food injurious to the health. It is not negotiable. Quality includes all other attributes that influence a product’s value to the consumer. This includes negative attributes
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- Quality Survey of Indian and imported raw cashew nuts.
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- Training of Technologists/ QC Personnel/ Supervisors/ workers.
such as spoilage, contamination with filth, discoloration, off-odors and positive attributes such as the origin, colour, flavour, texture and processing method of the food. The two major biological safety hazards of spices are 1) bacterial pathogens and 2) mycotoxins.

Water activity is a key parameter that affects microbiological growth. Spices, are classified as low-moisture foods (LMFs), defined as food items that have water activity (a_w) of less than 0.85. LMFs are considered to be an unlikely source to be implicated in food borne illness. Although the minimum a_w for the majority of bacteria is 0.88–0.91 (Farkas J., Doyle M., Beuchat L. (2007). “Physical methods of food preservation,” in Food Microbiology: Fundamentals and Frontiers eds Doyle P., Beuchat L. R., Montville T. J., editors. (Washington, DC: American Society for Microbiology Press) 685–712), food-borne pathogens can survive for extended periods in products at a_w < 0.85 (Carrasco E., Morales-Rueda A, García-Gimeno R. M. (2012). Cross-contamination and recontamination by Salmonella in foods: a review. Food Res. Int.45, 545–556). The a_w for mold and yeast growth is about 0.61 with the lower limit for growth of mycotoxigenic molds at 0.78 a_w (Table 2) [Beuchat, L.R. Influence of water activity on growth, metabolic activities, and survival of yeasts and molds. Journal of Food Protection(46), pp. 135-141. 1983]. The European Spice Association (ESA) recommends a target value of max a_w of 0.65 for spices and their products.

Food pathogens such as pore forming bacteria Bacillus cereus, Clostridium perfringens, and Clostridium botulinum, and non-sporeforming vegetative cells of Escherichia coli, Staphylococcus aureus, and Salmonella spp. have been found in spices. Many of the reported food-borne outbreaks (70-80%) associated with consumption of spices and seasonings involve contamination with Salmonella spp. 7% of all spices imported into the USA were contaminated with Salmonella. The number of rejections of Indian spices exported to EU in the years ending 2016 and 2015 range between 40-50 (Rapid Alert System for Food and Feeds (RASFF) portal accessed on January 7th 2017), of which 10% is due to Salmonella contamination.

Table 2 Aw values of food pathogens

<table>
<thead>
<tr>
<th>Organism</th>
<th>a_w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspergillus flavus</td>
<td>0.80-0.75</td>
</tr>
<tr>
<td>Bacillus cereus</td>
<td>0.93</td>
</tr>
<tr>
<td>Campylobacter spp</td>
<td>0.98</td>
</tr>
<tr>
<td>Clostridium botulinum Type A &amp; B</td>
<td>0.93</td>
</tr>
<tr>
<td>Clostridium botulinum Type E</td>
<td>0.97</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>0.943</td>
</tr>
<tr>
<td>Enterohemorrhagic Escherichia coli</td>
<td>0.95</td>
</tr>
<tr>
<td>Listeria monocytogenes</td>
<td>0.92</td>
</tr>
<tr>
<td>Molds (mycotoxigenic Penicillia)</td>
<td>0.87-0.80</td>
</tr>
<tr>
<td>Salmonella spp.</td>
<td>0.94</td>
</tr>
<tr>
<td>Shigella spp.</td>
<td>0.97</td>
</tr>
<tr>
<td>Staphylococcus aureusgrowth</td>
<td>0.83</td>
</tr>
<tr>
<td>Staphylococcus aureus toxin</td>
<td>0.88</td>
</tr>
<tr>
<td>Vibrio para-haemolyticus</td>
<td>0.94</td>
</tr>
<tr>
<td>Vibrio vulnificus</td>
<td>0.96</td>
</tr>
<tr>
<td>Yersinia enterocolitica</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Spare reported in Turmeric powder, chilli powder, onion powder, curry powder, coriander powder, cumin powder, nutmeg, ground ginger and whole green pepper. The Salmonella spp identified in these spices include S. derby, S. agona, S. bareilly, and S. cubana. Poor sanitation practices, substandard facilities, equipment design, and improper maintenance are among the major causes of Salmonella contamination of spices (Carrasco E., Morales-Rueda A, Garcia-Gimeno R. M. (2012). Cross-contamination and recontamination by Salmonellain foods: a review. Food Res. Int.45, 545–556). Contamination with Salmonella, a soil-borne pathogen, generally occurs at the post-harvesting stage of spice processing. In the less developed spice producing countries black pepper, chilli, coriander, cumin and fennel are dried on the floor or on mud/cow dung plastered yards, conducive for Salmonella contamination. Further the practice of storing spices in gunny bags in warm moist conditions, also aids Salmonella contamination. Salmonella remains viable in spices during storage and is of special concern when spices are used to flavor raw uncooked foods, or when added to flavor food after cooking. Steam sterilization is the preferred method to combat Salmonella as well as other types of microbial contaminants. Irradiation is used to control microbial contamination of dried spices.
Irradiation is less damaging to the taste of spices and herbs than steam sterilization, but negative consumer opinion limits its use, although it is permitted by several food regulators (Beuchat L. R., Komitopoulou E., Beckers H., Betts R. P., Bourdichon F., Joosten H. M., et al. (2011). Persistence and Survival of Pathogens in Dry Food Processing Environments.


The second major biological hazard is the contamination of spices with the mycotoxins. Mycotoxins can be produced both before and after harvest and most mycotoxins are heat stable and survive food processing. Warm and humid climate coupled with unhygienic storage conditions favor fungal contamination leading to myco toxin accumulation The two most commonly observed mycotoxins in spices include the aflatoxins and ochratoxin A. The aflatoxin producing molds are Aspergillusflavus or Aspergillusparasiticus) and ochratoxin A are Aspergillusochraceus, Aspergilluscarbonarius, or Penicilliumverrucosum. Aflatoxin contamination of food has gained global significance as a result of its detrimental effects on human and animal health. 50-60% of the Indian spice exports rejected by the EU are due to the exceeding safe limits of either aflatoxin or ochratoxin A. Fungal spoilage of spices occurs at high relative humidity and elevated temperature. The complex supply chain for spices makes it difficult to identify the stages where mycotoxicogenic fungi contamination occurs, but evidence has demonstrated that contamination can occur throughout and therefore it is necessary to maintain the relative humidity and temperatures to prevent fungal propagation. The maintenance of GHP and GMP, coupled with application of HACCP principles, is therefore of great importance during growing, harvesting and processing.

Chemical Safety

Chemical hazards such as heavy metals and pesticides and physical hazards such as stones, glass, wire, extraneous matter and other objectionable material, such as rodent excreta, hair, sand and filth can contaminate spices. Heavy metals are usually toxic in low amounts and the source generally is the soil the crop is grown in and water used. These contaminants become endemic and cannot be removed by processing. A survey focused on heavy metals and pesticides in pepper, paprika, cinnamon, turmeric, nutmeg, garam masala and curry powder imported from New Zealand has revealed the presence of Cd and Pb but it did not constitute an immediate risk to human health (Chemical Contaminants in Imported Dried Spices Imported Foods Monitoring Programme (2012) available at http://www.foodsafety.govt.nz/industry/importing/monitoring-and-review/surveys.htm).

Along with these Organo-chlorine compounds, organophosphorus and carbamates are the main pesticide residues that contaminate spices. 13 % of the spices had detectable levels of pesticide residues in the New Zealand survey. The fungicide Carbendazim, and insecticide Imidacloropid exceeding the legal permissible limits were reported in a masala exported from India to Australia. The MRL’s for spices are elaborated under Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011. MRLs have been prescribed for a couple of spices only (Table 3)

### Table 3 Pesticide in Spices Regulated by FSSA(2006)

<table>
<thead>
<tr>
<th>Spice</th>
<th>Pesticide regulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>All spices</td>
<td>Inorganic bromide (determined and expressed as total bromide from all sources)</td>
</tr>
<tr>
<td>Cardamom</td>
<td>Endosulfan</td>
</tr>
<tr>
<td></td>
<td>Monocrotophos</td>
</tr>
<tr>
<td></td>
<td>Quinolphos</td>
</tr>
<tr>
<td></td>
<td>Fosetyl-A1</td>
</tr>
<tr>
<td>Chillies</td>
<td>Carbaryl</td>
</tr>
<tr>
<td></td>
<td>Dicofol</td>
</tr>
<tr>
<td></td>
<td>Dimethoate</td>
</tr>
<tr>
<td></td>
<td>Endosulfan</td>
</tr>
<tr>
<td></td>
<td>Monocrotophos</td>
</tr>
<tr>
<td></td>
<td>Dithiocarbamates.</td>
</tr>
<tr>
<td></td>
<td>Quinolphos</td>
</tr>
<tr>
<td></td>
<td>Triazophos</td>
</tr>
<tr>
<td></td>
<td>Mancoszeb</td>
</tr>
<tr>
<td>Mustard seeds</td>
<td>Iprodione</td>
</tr>
<tr>
<td></td>
<td>Phenthoate</td>
</tr>
<tr>
<td></td>
<td>Phorate</td>
</tr>
<tr>
<td></td>
<td>Trichlorfon</td>
</tr>
<tr>
<td></td>
<td>Carbofuran</td>
</tr>
<tr>
<td></td>
<td>Cypermethrin</td>
</tr>
</tbody>
</table>
Polyaromatic hydrocarbons (PAHs) have been found in dried spices. Artificial drying with fire, and when the thick smoke emanating mixes with the product leads to PAH contamination. Traditional smoking and processing methods applied to smoked paprika and cardamom result in high levels of PAHs. However, these products are exempt from the maximum levels. Scientific and hygienic drying facilities combat this contamination.

Fraudulent adulteration of spices
Spices are high in value, therefore intentional adulteration, for economic gain is a serious malpractice, extending beyond quality to one of health and safety of the consumer when a toxic substance is added to them as an adulterant. Spices are more prone to adulteration as most often they are sold in ground or powdered form, rendering them as prime targets for substitution or alteration with low cost imitation products and fillers. Some common adulterants used as fillers in spice powders range from talc powder, ground walnut shells, cassia bark crushed wood, rice husk and sand, wheat starch, saw dust, millet, buckwheat, and corn starch. The use of low grade spices aging, and the addition of fillers are masked by the use of toxic or potentially carcinogenic dyes such as metanil yellow color, Sudan dyes and lead chromate. Several other contaminating dyes have been detected in spices in the international market (Table 4). Table 5 lists some common adulterants of Indian spices. Emerging adulterants of spices include black paint in black pepper, broom grass in cumin seeds, almond and walnut husk powder in powdered spices (Figure 1).

Any kind of adulteration of spices and their products, including the addition of colors and colouring matter will be considered as “unsafe food” as per the Food Safety and Standards Act (2006).

The penalty for unsafe food ranges from one lakh to ten lakhs. If unsafe food causes a non-grievous injury the punishment is Rs Three lakhs with one year imprisonment. In the case of a grievous injury the penalty is six years imprisonment with a fine of Rs Five lakhs. If there is death as a result of unsafe food the punishment is seven years or life imprisonment and a fine of Rs Ten lakh. Anyone having in their possession any adulterant is also liable to be punished. As per Section 272 of the Indian Penal Code, adulteration of any food or drink intended for sale shall be punished with imprisonment of either description for a term which may extend to six months, or with fine which may extend to one thousand rupees, or with both.

Table 4 Contaminant coloring matter reported in spices and their products

<table>
<thead>
<tr>
<th>Common name</th>
<th>Synonym</th>
<th>Chemical name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythrosine</td>
<td>Food Red - 14</td>
<td>Disodium 2-[(2,4,5,7-Tetraido-3-oxido-6-oxoxanthen-9-yl) benzoe monohydrate</td>
</tr>
<tr>
<td>Butter yellow</td>
<td>Butter Yellow</td>
<td>N-N-Dimethyl-4-(phenylazanenyl)aniline</td>
</tr>
<tr>
<td>Orange II</td>
<td>Acidorange7, 2-naphthol orange</td>
<td>Sodium 4-{[(2E)-2-(2-oxonaphthalen-1-ylidene) hydrazinyl]benzenesulfonate</td>
</tr>
<tr>
<td>Ponceau 4R</td>
<td>Acid Red 18</td>
<td>(Trisodium 2-hydroxy-1-(4-sulfonato-1-naphthylazo)- naphthalene-6,8-disulfonate</td>
</tr>
<tr>
<td>Carmine</td>
<td>Cochineal Red A</td>
<td>by boiling dried cochineal insects in water to extract the carminic acid</td>
</tr>
<tr>
<td>Tartrazine</td>
<td>Food Yellow - 4</td>
<td>Tri-sodium 5-hydroxy-1-(4-Sulfonato phenyl phenylazo) pyrazole-3-carboxylate</td>
</tr>
<tr>
<td>Rhodamine B</td>
<td>Basic Violet 10; Brilliant Pink B</td>
<td>9-(2-Carboxyphenyl)-6-(diethylaminio)-N,N-diethyl-3H-xanthen-3-iminium chloride</td>
</tr>
<tr>
<td>Sunset Yellow FCF</td>
<td>Food Yellow - 3, Orange Yellow S</td>
<td>Disodium salt of 1-(4-sulphophe-nylazo)-2-naphthol-6-sulfonic acid</td>
</tr>
<tr>
<td>Azorubine</td>
<td>Carmoisine, Food Red 3,</td>
<td>Disodium 4-hydroxy-3-{4-sulfonato-1-naphthylazo}- 1-naphthalenesulfonate</td>
</tr>
<tr>
<td>Sudan I</td>
<td>Solvent Yellow 14;, Grasal Orange; Spirit Orange; Fast Orange</td>
<td>(1Z)-1-{phenylhydrazinylidene}naphthalen-2-one</td>
</tr>
<tr>
<td>Sudan 4</td>
<td>Scarlet red; Sudan IV; C.I. Solvent Red 24; Solvent red 24; Lipid crimson</td>
<td>1-{[2-Methyl-4-{2-methylphenyl}diazeyl]phenyl}diazeylnaphthalen-2-ol</td>
</tr>
</tbody>
</table>

Detecting adulterants that have approximately the same chemical composition/physical appearance of the food product is an analytical challenge. Some of the modern methods include 1) Determining the ratio between some chemical constituents and assume these ratios are a constant component of the particular spice. Associated with a large set of analyses would be the use of chemo metrics (pattern classification procedures) such as : Principal component analysis, Hierarchical cluster analysis, Linear discriminant analysis and Artificial neural networks and 2) Search for a specific marker in the product, which could be a chemical constituent (complexes, molecules, nucleic acids) or morphological component (plant cells), that proves either the adulteration or authenticity of the food.

A list of quality and safety parameters that are required to be tested for compliance to Food Safety and Standards Rules and Regulations, 2011 for spices can be downloaded at (http://old.fssai.gov.in/Portals/0/Pdf/Order_Lab_Parameters_18_04_2016.pdf). The tests include physical examination, chemical and microbiological tests, tests for heavy metals, pesticide residues and naturally occurring toxic substances. Pre-packaged spices and spice products sold to consumers must adhere strictly to labeling requirements as detailed in Food Safety and Standards (Packaging and Labeling) Regulation 2011.

Contents on the label should be clear, prominent, indelible and readily readable by the consumer under normal conditions of purchase and use. Mandatory list for the label are- 1) Name of the food, 2) List of ingredients in descending order (if more than one spice used), 3) name and complete address of manufacturer/packer, 4) net content by weight or volume 5) lot no/Batch identification, 6) date of manufacture/packing, 7) Best Before Date, 8) Veg/Non Veg logo of appropriate dimensions, and 10) FSSAI logo and License Number. Whole spices being agricultural commodities, single spice powders and spice mixes are exempt from declaring nutritional information.

Specific labeling requirement for every package containing 1) Light black pepper shall in addition to the AGMARK seal bear the label ‘Light Black Pepper (Light berries)’, 2) Cassia Bark bear the label ‘CASSIA BARK(TAJ)’, and 3) Cinnamon bear the label ‘CINNAMON (DALCHINI)’. Every package of Chillies, which contains added edible oil shall bear the label ‘CHILLIES IN THIS PACKAGE CONTAINS AN ADMIXTURE OF NOT MORE THAN 2% OF---------(Name of oil) EDIBLE OIL ’ These labels must be boxed.

Conclusion
Indian spices command a formidable position in the international market. As food safety is a top priority extra guarantees and stringent quality control measures in the form of quality certification such as implementation of a (HACCP-based) food safety management system or other internationally recognized food safety management systems such as BRC, IFS, FSSC22000 and SQF are an added advantage for ensuring spices safe for human consumption. Strict checks on physical, chemical and microbial parameters of all spices, including pesticide...
residues, aflatoxin, heavy metals and other contaminants/adulterants and inspection by the Spices Board of India coupled with testing with the American Spice Trade Association, International Pepper Community and ISO-17025 accredited labs must be adhered to.

In the year 2016 there were 40 rejections of Indian spices/spice products exported to the European Union of which 35 were due to mycotoxins exceeding the permissible limit and three due to Salmonella contamination and aflatoxin levels exceeding the permissible results indicate that current processes for control and elimination of aflatoxin producing fungi and Salmonella are either not efficacious or not correctly implemented.

Attention should be focused on monitoring the hygienic and sustainability practices, and strengthening the commitment to produce spices and their products in a safe and responsible manner. The most significant challenge facing the spice industry is mitigating these two risks.

### ASTA Cleanliness Specifications for Spices, Seeds, and Herbs

<table>
<thead>
<tr>
<th>Name of spice, seed, or herb</th>
<th>Whole insects, dead</th>
<th>Excreta, mammalian</th>
<th>Excreta, other</th>
<th>Mold</th>
<th>Insect defiled/infested</th>
<th>Extraneous/foreign matter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By count</td>
<td>By mg/lb</td>
<td>% ByWeight</td>
<td>By mg/lb</td>
<td>% ByWeight</td>
<td>% ByWeight</td>
</tr>
<tr>
<td>All spice</td>
<td>2</td>
<td>5</td>
<td>5.0</td>
<td>2.00</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Anise</td>
<td>4</td>
<td>3</td>
<td>5.0</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Caraway</td>
<td>4</td>
<td>3</td>
<td>10.0</td>
<td>1.0</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Cardamom</td>
<td>4</td>
<td>3</td>
<td>1.0</td>
<td>1.00</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Cassia</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>2.5</td>
<td>0.50</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0.50</td>
</tr>
<tr>
<td>Celery seed</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0.50</td>
</tr>
<tr>
<td>Chillies</td>
<td>4</td>
<td>1</td>
<td>8</td>
<td>3</td>
<td>2.5</td>
<td>0.50</td>
</tr>
<tr>
<td>Cloves*</td>
<td>4</td>
<td>5</td>
<td>8.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.00</td>
</tr>
<tr>
<td>Coriander</td>
<td>4</td>
<td>3</td>
<td>10.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Cumin seed</td>
<td>4</td>
<td>3</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Dill seed</td>
<td>4</td>
<td>3</td>
<td>2.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Fennel seed</td>
<td>SF(2)</td>
<td>SF(2)</td>
<td>SF(2)</td>
<td>1.0</td>
<td>1.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Ginger</td>
<td>4</td>
<td>3</td>
<td>3.0</td>
<td>SF(4)</td>
<td>SF(4)</td>
<td>1.00</td>
</tr>
<tr>
<td>Mace</td>
<td>4</td>
<td>3</td>
<td>1.0</td>
<td>2.0</td>
<td>1.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Nutmeg (broken)</td>
<td>4</td>
<td>5</td>
<td>1.0</td>
<td>SF(2)</td>
<td>SF(2)</td>
<td>0.50</td>
</tr>
<tr>
<td>Nutmeg (whole)</td>
<td>4</td>
<td>0</td>
<td>0.0</td>
<td>SF(4)</td>
<td>SF(4)</td>
<td>0.00</td>
</tr>
<tr>
<td>Black pepper</td>
<td>2</td>
<td>1</td>
<td>5.0</td>
<td>SF(2)</td>
<td>SF(2)</td>
<td>1.00</td>
</tr>
<tr>
<td>White pepper****</td>
<td>2</td>
<td>1</td>
<td>1.0</td>
<td>SF(2)</td>
<td>SF(2)</td>
<td>0.50</td>
</tr>
<tr>
<td>Poppy seed</td>
<td>2</td>
<td>3</td>
<td>3.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Rosemary leaves</td>
<td>2</td>
<td>1</td>
<td>4.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.50</td>
</tr>
<tr>
<td>Turmeric</td>
<td>3</td>
<td>5</td>
<td>5.0</td>
<td>3.0</td>
<td>2.5</td>
<td>0.50</td>
</tr>
</tbody>
</table>

*Clove stems**: Less than (<) 5% allowance by weight for unattached clove stems over and above the tolerance for Other extraneous matter is permitted.

**Laurel leaves and sage**: “Stems” will be reported separately for economic purposes and will not represent a pass/fail criteria.

***Oregano**: Sumac negative/Analysis for presence of Sumac shall not be mandatory if samples are marked “Product of Mexico.”

****White pepper**: Percent black pepper will be reported separately for economic purposes and will not represent pass/fail criteria.

(2)Fennel seed: In the case of fennel seed, if 20% or more of the subsamples contain any rodent, other excreta or whole insects, or an average of 3 mg/lb or more of mammalian excreta, the lot must be reconditioned.

(3)Ginger: More than 3% moldy pieces and/or insect infested pieces by weight.

(4)Broken nutmeg: More than 5% mold/insect defiled combined by weight.

(5)Whole nutmeg: More than 10% insect infested and/or moldy pieces, with a maximum of 5% insect defiled pieces by count.

(6)Black pepper: 1% moldy and/or infested pieces by weight.

(7)White pepper: 1% moldy and/or infested pieces by weight.

Δ Whole insects, dead: Cannot exceed the limits shown.

Extraneous matter: Includes other plant material, e.g., foreign leaves.

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Email: bc@commodityindia.com
Overview of Dehydrated Spice Sector

*Savji Thanth, Managing Partner, Maahir Foods*

What is the recovery rate in processing the dehydrated spices and Vegetables?

Recovery rate of dehydrated spices and Vegetables varies from product to product and region to region.

For example recovery rate of onion grown in Maharashtra and Madhya Pradesh is 9:1 whereas onion from Gujarat has the recovery rate of 8:1. Similarly, in general recovery rate of garlic is 4:1 for the garlic grown in Gujarat / Maharashtra and MP states, where as the garlic which is procured from North Indian States has the recovery rate of 5:1. As Recovery rate of any spices or vegetable varies depending on the percentage of TSS (total soluble solids) levels present in the product. For ginger the recovery rate is also dependent on breed of ginger.

Suppose if we use ginger which has grown for fresh consumption or making puree/ juice the recovery rate will be lower and it would be around 6.5: or 6:1 (normally ginger recovery rate is around 5:1)

Please tell us the varieties used by MAahir FOODS for processing.

Onion: We at MAahir FOODS uses fresh onion procured from varieties like Gujarat 1 & 2 and Bhima Safed 1 & 2 for processing. We prefer these variety mainly because the TSS is higher compare to other verities, which is around 10.7 to 11.5%, even these verities has difference in TSS value depending on the sowing season and geographical locations.

Garlic: we mostly procure Hybrid variety like Agrifound G-41 & Yamuna Safed-4 (G-323)

Ginger: Ginger is procured from North-East Indian origin, Karnataka and Kerala, which is mostly sun dried however as per need of industry. Dehydration and grinding of fresh ginger is done mainly for applications in Nutraceutical and Dietary supplements, India also imports ginger from Nigeria and other origins.

What is the cost and time involved in processing the dehydrated process?

The cost and processing time involved in processing spices varies from product to product. For Onion the cost involved in converting fresh onions to dehydrated onion is around Rs20-25/Kg. The cost depends on production steps involved, primarily to dehydrate the onion to dehydrated onion flakes it requires around 8 hrs of continues drying process. For Garlic the processing time is less since the water content in the garlic is less compare
to onion and the cost involved in converting fresh garlic to dehydrated garlic is around Rs10-15/Kg, whereas the duration of drying for garlic is around 6hrs.

**Brief us about the storing method followed before and after processing of spices.**

At MAAHIR FOODS, Primarily fresh raw materials like Fresh onion and garlic are stored at ventilated storage areas, where as dehydrated products are stored in the temperature controlled Cold storages, where the temperature would be around 15°-17°C for cooling. So that the characteristics of the products are preserved for longer period compare to ambient storage places.

Green chili, curry leaves, Ginger and turmeric are processed during season time and based on customer requirement so these materials are not stored in our warehouse, whereas onion and garlic are mainly stored in the warehouse which we process it throughout the year as the Raw material is available in a ventilated storage for processing in off season.

**Brief us about the problems faced while procuring and what are the methods to be followed to overcome these problems?**

In India, the farmers awareness and education towards current need for farming practices to produce products for industry is not available also they are not industry oriented, farmers lack awareness about the quality and good farming practices and impact of pesticide residues and other pre & post harvesting procedures issues at farm level. In order to overcome these problems we have opted for production through contract farming. We follow two types of contract farming in 1st type we cultivate the crops in our own farm and while in the 2nd villages are formed into clusters of farmers whom we supply quality seeds, fertilizers and also we give training and workshop about how to take care of pesticide residue and how to manage the quality of the product at the post harvest stage.

These have helped us in minimizing the industry risk and problems faced while procuring and post production.

---

**Who are the major importers of Indian dehydrated spices?**

India produces around 120,000-130,000 tonnes of dehydrated Vegetables and Dehydrated spices annually. Major importing markets are Europe, ME, USA, Latin America and Africa are the major importer of Indian dehydrated spices. China and Egypt is the major competitor for Indian dehydrated Onions.

**Please comment on the quality certification of dehydrated spices.**

We at Maahir Foods adopted the highest current standard of Food Safety and Quality certification as per GSFI, more over to add value to our production at our factory we have processing technologies and mechanisms to remove pathogens and pesticide residues before drying process so to keeping the quality levels and our specification level as per international standards.

Generally Quality certification varies from country to country, and even in India consumers are more concerned with quality of the product.

These days certifications agencies of other countries keeps changing their guidelines based on their bad experiences with the exporting country, this is causing a lot of problems to the exporters. Exporting countries cannot implement the guidelines as quickly as the consuming countries change their guidelines because these things have to be changed from the grass root level.

For example last year there was problem of peanut allergens in many parts of the world especially in Canada. The actual reason for the allergens was the farming practice or the crop cycle what Indian farmers practice over the years. If we want to control these allergens the whole crop cycle has to be altered this intern affects the economy and the farmer’s life.

In order to change the farming pattern there are major cost and risk of post production is involved, accordingly the supply chain has to be absorb the cost involved in farming at each stage in order to change the current
pattern of farming and get the product as per industry standards, farmer should get training about the cultivation, policies has to be reviewed at the consuming countries. Currently there are lot of developmental activities are taking place in order to meet the international standards.

All in all a little more education to farming communities and little ground level reality at farming and expectations should be checked by customers this will intervene to level the actual possibilities and changes compare to the expectation of the market.

How is the demand in India growing?

In India demand for dehydrated products are increasing at a rate of 4-5% and it is expected to grow up to 10-12% average in the next 5 year, Since the food habits and kitchen practices of Indian population is changing over these years. Presently India roughly consumes around 25,000-30,000 tonnes of dehydrated onion and garlic annually. Most of the demand comes from the seasoning / Masala industry and ready to eat or ready to cook producer, there are very few shops / super-markets where the dehydrated products are available on the shelf for the common people this can be increased by creating the awareness about the products among the consumers.
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A Novel Process for Production of Turmeric Powder from Fresh Turmeric Rhizomes

M.Madhava Naidu, Head, Department of Spices & Flavour Science, CSIR- Central Food Technological Research Institute (CFTRI)

Abstract
The novel CSIR-CFTRI process consists of separation of fingers from mother rhizomes followed by washing with running tap water or water under pressure to remove the soil, stones, dirt and other foreign materials. Washed rhizomes were subjected to a slicing machine to obtain slice thickness of 1-3mm. Slices were dried by a mechanical drier at controlled temperature for about eight hours to obtain dried turmeric slices which has a moisture content of 8-10%. Dried slices were packed in gunny bags. Dried turmeric slices will have good keeping quality, with typical turmeric aroma. Slices can be subjected to hammer mill for size reduction/powdering and pass through 25-40 mesh to get fine hygienic turmeric powder, and is free from microbial load. Powder can be packed and stored in polythene lined bags.

Keywords: Turmeric, curcumin, volatile oil, slices, mechanical drier, quality

Introduction
Turmeric is the “golden spice”, and valuable cash crop, native to Southern tropical Asia. It is rich in phenolic compounds- Curcuminoids, is widely used as a dietary spice and coloring agent in food, herbal, medicine and textile industries (Ravindranet al., 2007). World production of turmeric is estimated to be about 1.115 million tons of which India alone accounts for about 80% (Pradeep et al., 2016).

Presently, turmeric is recognized as neutraceutical due to its content of polyphenols, which offer health benefits such as hypoglycemic, hypocholesterolemic, anti-microbial and anti-oxidant properties (Palanisamy et al., 2012).

Curcuminoinds in turmeric powder contain curcumin, demethoxy curcumin and bisdemethoxycurcumin to the extent of 70-75, 20-18 and 10-7 %, respectively (Madhava Naidu et al., 2009).

Traditional Turmeric Processing
Curing is essentially a process of boiling (Cooking) of raw rhizomes in water till the bulbs become soft. Cooking gives the rhizomes (or bulbs) a uniform colour; the starch gets gelatinized, and the time of drying is considerably reduced. Cooked turmeric rhizomes is spread on prepared yards and dried in the sun for 20-23 days (Fig.1) It gives a metallic sound when shaken inside the palm or broken. The dried turmeric rhizomes (dry yield being usually 20 to 25 percent) is polished either manually or by mechanical aberration of the surface. Mechanical polishing drums have been developed to handle small or large batches (Govindarajan, 1980). Hitherto, the process of conversion turmeric rhizomes to powder was time consuming, energy intensive &labour intensive. This also had the limitation of lower yield and lesser content of curcumin in the powder.
CSIR-CFTRI Novel Turmeric Processing

Recently, CSIR-CFTRI provides a newer method for processing turmeric (Fig.2). The process for obtaining turmeric powder directly from the fresh turmeric rhizome has been developed. This novel process eliminates the labor intensive and energy intensive operation of cooking, which also consumes enormous amount of Agri-fuel for boiling water and the time consuming (20~25 days) drying. This process would pave way for the possible mechanization of the process. The process involves slicing of the rhizomes followed by drying and size reduction, all within 8 ~12 h. Dried turmeric slices have good keeping quality with typical turmeric aroma and the finished hygienic turmeric powder is found to be relatively free from microbial load.

Advantages of this process are:
- Reduction in drying time from several days (20-25 days) to a few hours (8-12 h).
- Higher content of curcumin (20-25%) and volatile oil (40-50%) in the finished product compared to the traditional process in vogue.
- Substantial decrease in labor cost because of reduction in processing time / processing steps.
- Advantage of saving water 9000 KL of potable water per annum (45 Lakh ton of turmeric rhizomes needs 9000 KL, at material to water ratio of 1:2) (Ref: Govindarajan, 1980)
- Increase in yield of turmeric powder by 10% by the elimination of polishing of rhizomes which amounts to 90,000 MT, estimated to cost Rs.900 crore annually. [Calculations are based on Turmeric powder production of 9 lakh tons (Ref: Spice Board Website, 2014-15) and savable polishing loss of ~10% (CFTRI Website, Turmeric: curing & polishing (Free Technology)).
- Saving of Agri-fuel by elimination of preliminary thermal treatment (cooking). Cooking 45 lakh tons of fresh turmeric rhizomes at present consumes 3,00,000 MT of Agri-fuel every year.
- Novel process is hygienic, and products are relatively free from microbial contamination.

Table.1 Comparison of processes traditional and CSIR-CFTRI novel method

<table>
<thead>
<tr>
<th>Process parameters</th>
<th>Traditional process</th>
<th>CSIR-CFTRI Novel method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post harvest storage in open fields</td>
<td>59 days</td>
<td>7 days</td>
</tr>
<tr>
<td>Loss</td>
<td>10-20% Polishing loss</td>
<td>No polishing – no loss</td>
</tr>
<tr>
<td>Turmeric powder yield</td>
<td>80-90%</td>
<td>100%</td>
</tr>
<tr>
<td>Financial benefit</td>
<td>Reduced return</td>
<td>10-20% additional</td>
</tr>
<tr>
<td>Cost of processing</td>
<td>Rs. 75/kg</td>
<td>Rs. 78/kg</td>
</tr>
<tr>
<td>Hardship to the worker</td>
<td>More</td>
<td>NIL</td>
</tr>
<tr>
<td>Cooking/heat treatment of rhizomes</td>
<td>Cooking rhizomes by use of agri-fuel</td>
<td>No cooking of rhizomes</td>
</tr>
<tr>
<td>Hygienic Practice</td>
<td>Poor</td>
<td>No human intervention as processed through machines</td>
</tr>
</tbody>
</table>

Fig.2 Flow Chart - Production of Turmeric powder using novel process
The results (Table 1 & Fig. 3) clearly show the advantage of the novel technology in terms of high volatile oil content, curcumin content & reduced total plate count. This improved process has potential to Turmeric processing clusters/industries in India as well as processing units around the Globe.

Turmeric processing by the traditional method is well established. Application of this technology is aimed at improving the overall productivity and thus innovation can be applied to upgrade the market. Process know-how developed has already been transferred to industries namely,

- M/s. Nani Agro Foods (Pvt) Limited, Erode, Tamil Nadu, India
- Mr. Shailesh D Vihol, VasanthVihar Society, Ahmedabad-382330, Gujarat
- M/s. Estern Condiments, Kerala
- M/s. Sarco Business Dynamics Pvt.Ltd, Hyderabad
- Many training/demonstration programmes under CSIR-800 have been carried out at CSIR-CFTRI to disseminate/popularize technology among turmeric growers (Maharashtra, Andhra Pradesh, Telangana, Karnataka Tamil Nadu and Spice Board officials).
- An MoU has been signed with a Turmeric cluster, to establish turmeric processing center at Chamarajanagar District, Karnataka. Further, Detailed Project Report (DPR) has been submitted to M/s Kamadhenu Turmeric Growers Association, Haradanahalli, Chamarajanagar District, Karnataka to get required funds from NABARD. Further work is in progress.

**Envisaged impact of the Technology**

**Economic impact**
Turmeric growers will have an additional yield of 90,000 MT of powder with an additional income of Rs 900 crores (at Rs 100/kg of turmeric powder). Secondly, saving of agri-fuel of 3,00,000 MT (at Rs 3/kg) 90 crores. In addition to reduced drudgery, processing/holding time of fresh rhizome is also reduced. The process can have a large impact on the Rs.9000 crores turmeric powder industry.

**Societal impact**
CSIR-CFTRI has initiated the popularization of the novel process in different clusters of the farmers, namely Guntur cluster (AP), Chamarajanagar cluster (Karnataka) and Sangli turmeric cluster (Maharashtra) are few to mention. As the process can generate additional 900 crores (recurring) by processing and substantially save water, energy and drudgery, societal impact is expected to be very high.

**Strategic impact**
Indian Spice Industry is holding the top position in the world market in the export of spices and spice products. The IPR generated will not only provide technological and economic benefits to India, but also prevent undue exploitation offered unscrupulous agencies. In view of this, India will continue to be a global leader in the production of best quality/hygienic turmeric powder.

**Conclusion**
Present study revealed that, Curcumin and volatile oil
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content is higher in CSIR-CFTRI novel turmeric process compared to traditional turmeric processing.

Dried turmeric slices have good keeping quality with typical turmeric aroma and the finished hygienic turmeric powder is found to be relatively free from microbial load. The process can be scaled up easily.

Acknowledgments
We thank Prof. Ram Rajasekharan, Director, CSIR-CFTRI, Mysore, India, for his keen interest in this study and the facilities provided. The financial support from CSIR, New Delhi, is gratefully acknowledged.

For further details please contact: sfs@cftri.res.in

References:


M.Madhava Naidu., Venkatesh Murthy, Puspha S Murthy and Hafeezakhanum, A novel process for production of turmeric powder from fresh turmeric rhizomes, DEL/250/2013


Health Benefits of Turmeric

<table>
<thead>
<tr>
<th>Health Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevents Cancer</td>
<td>Turmeric helps to prevent prostate cancer, stop the growth of existing prostate cancer and even destroy cancer cells.</td>
</tr>
<tr>
<td>Relieves Arthritis</td>
<td>The anti-inflammatory properties in turmeric are great for treating both osteoarthritis and rheumatoid arthritis. In addition, turmeric’s antioxidant property destroys free radicals in the body that damage body cells.</td>
</tr>
<tr>
<td>Controls Diabetes</td>
<td>Turmeric can be used in the treatment of diabetes by helping to moderate insulin levels. It also improves glucose control and increases the effect of medications used to treat diabetes.</td>
</tr>
<tr>
<td>Reduces Cholesterol Level</td>
<td>Helps to reduce serum cholesterol levels in human body.</td>
</tr>
</tbody>
</table>
Introduction of Ayurvedic dyed Spices Cloth

Spices Board of India

Kerala we say is ‘Gods own country’, it is possible to say that “Ayurvedic dyed Spices cloth” is ‘God’s own Vastra’ (God’s own cloth) was prepared and exported to China and Mesopotamia in the early periods of Christian era. Historic evidence exists that a piece of cloth adequate to cover the entire body of Queen Victoria 1st was packed in a match box and sent to her as a present from Travancore. This shows that the art and science of cloth making was in its zenith in the earlier periods. Modern India’s founding father, Mahatma Gandhi, championed hand-spun cloth and weaving. In olden days, cotton fabrics were dyed with plant extracts to be used as eco-friendly and natural commodity. But when modern dyeing technology with chemical dye evolves, the ethnic knowledge of herbal dyeing vanished from the scenario slowly.

Now all the textile materials are using chemical dyes for coloring. But it is reported that many side effects including skin allergy, skin allergic conditions, Asthma etc are occurring.

AYURVEDIC DYED SPICES CLOTH uses a dying method wherein the medicinal plants and other indigenous process stipulated in Ayurvedic system so as to achieve maximum eco-friendly and clinical effectiveness perfection in the cloth.

It is to be clarified here that when dying cotton fabrics with extracts from medicinal plants, vegetables and other herbs are practiced in many part of India for preparing cloth dyed with non-chemical colors, the Ayurvedic dyeing technology evolved as a part of this experiment is using basically medicinal plants and biological products described in Ayurvedic system of medicine. It is because of this reason the cloth dyed with extract from medicinal plant is christened as “Ayurvedic Handloom” and “Ayurvastra”.

To sustain the natural colours and aroma in the clothes, each AYURVEDIC DYED SPICES CLOTH products have been developed as per the instruction written by Asta Medicos, Arya Medicos, Ayurveda medicos etc. The finished product is organic, completely free of synthetic chemicals and biodegradable. It is believed that the skin absorbs the medicinal properties of the herbs and this helps treat a broad range of ailments.

Ayurvedic dyeing process:
Every step in the preparation of Ayurvastra cloth and clothing is carefully and precisely controlled. Ayurvastra, as a branch of ayurveda, begins with 100 per cent organic cotton that has been hand loomed - no chemical additives to prepare the cotton fibers for spinning and weaving, no chemical finishes. The organic cotton yarn or fabric is then dyed in a carefully controlled mixture of Ayurveda dyes depending upon the disease or ailment being treated. Dyes for Ayurvastra cloth typically contain between 40 and 60 specifically blended and carefully prepared medicinal herbs, plants, flowers, roots and barks.

The temperatures of the dyes, the duration and number of the dye soaks, the blend of herbs, and even the equipment used are carefully controlled. The entire process is organic. The cloth is bleached with cow’s urine, which has high medicinal value. The dyeing gum too is herbal. It does not pollute like synthetic dye. And the waste is used as bio manure and to generate bio gas. It is proved that cow’s urine to be highly beneficial in balancing an individual’s "doshas" or basic constituents of
an individual’s physiology and psychology, strengthening the immune systems and as an elixir in giving life.

**How AYURVEDIC DYED SPICES CLOTH works:**
When the tiny micro-capsules Ayurveda medicines of AYURVEDIC DYED SPICES CLOTH come into contact with body heat, they slowly release their chemical payloads which can contain fragrances or skincare lotions or other chemicals which might have some topical beauty or medicinal value to the skin that comes into contact with the micro-encapsulated fabric. By coming in contact with Ayurvastra, the body loses toxins and its metabolism is enhanced.

Dr. Viswanathan, Professor and head Department of Dravyaguna, Government Ayurveda College, Trivandrum is saying that ‘our experience is that when medicated clothes are used, a medicated environment will be produced within the space between skin and the clothes, hereby producing a micro-environment of medicinal action. This in turn, by the potency of the medicines used, its effects will be transferred to the skin, which will create a synergetic effect for providing cure to the disease. Thus, medicated cloth, AYURVEDIC DYED SPICES CLOTH, will act as an instrument to accelerate the curing action’.

**Benefits of AYURVEDIC DYED SPICES CLOTH:**
- To transform natural fibre cloth into a value-added product
- An effective instrument for curative treatment which is totally eco-friendly.
- By providing an eco-friendly and ayurvedic focus to the traditional handloom cloths, new paths are created for new marketing possibilities for the handloom sector in national and international markets.
- Kerala is a very important tourist destination worldwide, especially Ayurvedic tourism, to promote the development of handloom industry in tandem with the rapid development of Ayurvedic tourism. (So as to instrumentalise handloom sector as a symbiotically integrating factor in the process of tourism development and growth of Ayurvedic system.)
- To give a new life and eco-friendly orientation to the handloom sector and handloom products through a sustainable development technology [production of medicinally effective handloom products] and making such products as a component of promoting Ayurveda.
- To promote an opening for women empowerment through Ayurvastra [as women folk consist of more than 70 per cent of handloom weavers in Kerala]
- To promote Ayurvedic handloom so as to increase the income and there-by mitigate the poverty among Women weavers through creating eco-friendly value added products.
- To promote medicinal plant cultivation so as to provide income and employment opportunities to different segments of people (including tribal communities)

**Sustainability**
As the Ayurvedic handloom products are eco-friendly and clinically beneficial, the ultimate purchase price of the product is almost three fold more than chemically colored cloth. The additional economic gain accruing from the enhanced price and income benefit can be transferred to the weavers and there-by more income can be provided to them resulting in a conspicuous reduction in their poverty condition. Therefore, not only the Ayurvastra is going to be a win-win product for India; it is also going to be a notable contribution from India to other countries where handloom cloth making is a part of their traditional industry system. AYURVASTRA is focusing at multifaceted benefit to human kind including robust benefit to the weavers who are poorest of the poor.
Curcumin – Queen of Turmeric Value Addition

Alias P Varghese, MD & CEO,
Sathva Bioactives Pvt Ltd., Bangalore (India)

Introduction

Turmeric is called “SPICE of life.”
Curcumin is the product obtained by solvent extraction of the dried root of the rhizome of Turmeric (Curcuma longa) and purification of the extract by crystallization. Curcumin is not water-soluble, but it is soluble in ethanol. Curcumin has excellent properties such as anti-inflammatory and anti-oxidation.

Turmeric is widely consumed in dietary pigment and medicines for the treatment of various illnesses. Moreover, it supports the body’s natural detoxification system and helps maintain healthy hepatic function.

<table>
<thead>
<tr>
<th>Name</th>
<th>Mean yield (fresh) t/ha</th>
<th>Crop duration (days)</th>
<th>Dry recovery (%)</th>
<th>Curcumin (%)</th>
<th>Oleoresin (%)</th>
<th>Essential Oil (%)</th>
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</thead>
<tbody>
<tr>
<td>Suvarna</td>
<td>17.4</td>
<td>200</td>
<td>20.0</td>
<td>4.3</td>
<td>13.5</td>
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<td>Suguna</td>
<td>29.3</td>
<td>190</td>
<td>12.0</td>
<td>7.3</td>
<td>13.5</td>
<td>6.0</td>
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<tr>
<td>Sudarsana</td>
<td>28.8</td>
<td>190</td>
<td>12.0</td>
<td>5.3</td>
<td>15.0</td>
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<td>IISR Prabha</td>
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<td>195</td>
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<td>18.5</td>
<td>6.2</td>
<td>16.2</td>
<td>6.2</td>
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<td>Co-1</td>
<td>30.0</td>
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<td>23.3</td>
<td>3.1</td>
<td>11.0</td>
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<td>30.7</td>
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<td>9.3</td>
<td>13.2</td>
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<td>6.3</td>
<td>13.5</td>
<td>4.4</td>
</tr>
<tr>
<td>Rasmi</td>
<td>31.3</td>
<td>240</td>
<td>23.0</td>
<td>6.4</td>
<td>13.4</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Source: TNAU reports
The Lakadong variety of turmeric grown in the tribal areas of Meghalaya State (NE of India) has become popular recently due to its high content of Curcumin around 7%.

POST HARVEST PRACTICES

Cleaning of rhizomes
Finger rhizomes are separated from mother rhizomes for perfect boiling; since the mother rhizomes are bigger in size they take more time to boil.

Boiling of turmeric rhizomes
Fresh turmeric is cured for obtaining dry turmeric. The fingers are separated from mother rhizomes. Mother rhizomes are usually kept as seed material. Curing involves boiling of fresh rhizomes in water and cow dung slurry.

In the traditional method of curing, the cleaned rhizomes are boiled in water just enough to immerse them. Boiling is stopped when froth comes out and white fumes appear giving out a typical odour. The boiling should last for 15-20 minutes when the rhizomes turn soft. The stage at which boiling is stopped largely influences the colour and aroma of the final product. Over cooking spoils the colour of the final product while under-cooking renders the dried product brittle.

The cooked fingers are taken out of the pan by lifting the trough and draining the water into the pan. The water used for boiling turmeric rhizomes can be used for curing fresh samples. The processing of turmeric is to be done 2 or 3 days after harvesting. If there is delay in processing, the rhizomes should be stored under shade or covered with sawdust or coir dust.

Boiling of rhizomes through Steam boiler
In addition to the conventional method of boiling, now a day’s steam boiler method is followed by some of the farmers. The rhizomes were boiled in the steamer and then spread in the yard for drying.

Benefits of steam boiler: Enable uniform cooking of rhizomes - Saving the fuel and time, since this method boils higher quantity of rhizomes

Drying
The cooked fingers is dried in the sun by spreading them in 5-7 cm thick on the drying floor. A thinner layer is not desirable, as the colour of the dried product may be adversely affected. During night time, the rhizomes should be heaped or covered with material which provides aeration. It may take 10-15 days for the rhizomes to become completely dry.

Polishing
Dried turmeric has a poor appearance and a rough dull outer surface with scales and root bits. The appearance is improved by smoothening and polishing the outer surface by mechanical rubbing. Mechanical rubbing is done by using a power operated barrel or drum mounted on a central axis, the sides of which are made of expanded metal mesh.

When the drum filled with turmeric is rotated, polishing is effected by abrasion of the surface against the mesh as well as by mutual rubbing against each other as they roll inside the drum. The yield of polished turmeric from the raw material varies from 15-25%.

The colour of the processed turmeric influences the price of the produce. For an attractive product, turmeric powder (mixed with little water) may be sprinkled during the last phase of polishing.

Selling
Processed rhizomes are filled in the sacs and sold in regulatory markets like, Erode (Tamil Nadu state) through auction method of selling.

CURCUMIN STORAGE AND STABILITY

Packing Detail:
Packed in HDPE drums (Food Grade) and two polythene liners inside.
Net weight: 25kgs/drum.

Storage situation:
Store in a cool and dry well-closed container, keep away from moisture and strong light/heat.
Shelflife:
Two years under well storage situation and stored away from direct sun light.

Stability: Stable, but may be light sensitive. Incompatible with strong oxidizing agents.

WARNING: Irritates lungs, eyes, skin.

CAUTION: May irritate eyes, skin, and respiratory tract. Use Safety glasses. Do not breathe dust.

CURCUMIN PRODUCT MATRIX
Curcumin Extract is standardized to 95 per cent Powder by HPLC for the major application purposes. Different Commercial grades of curcumin like the Curcumin 95 per cent Granules, Curcumin 95 per cent DC Granules, Curcumin65 per cent etc are also being formulated based on the specific customer demands.

There is scope for potential value addition from the left-over oleoresin after the separation and purification of Curcumin 95 per cent. This left-over oil contains approximately 14-22% of Curcumin and the same is converted to value added products like Curcumin O/S 8-10%, Curcumin WS 8-10%, Curcumin WS12-14% etc which find applications in the traditional /functional food colouring segment. The left-over oil has huge demand now in the fragrance industry.

Spent Turmeric - residue left over after the extraction also finds some application in the fragrance industry and also being used as a boiler fuel.

CURCUMIN GLOBAL MARKET OVERVIEW

Industry Insights
Global Curcumin market is expected to reach USD94.3 million by 2022, according to a new study by Grand View Research, Inc. Therapeutic properties of Curcumin such as anti-inflammatory and anti-oxidant make them ideally suited for use in food and medical application. The market is expected to witness significant growth in light of the growing consumer awareness regarding the above mentioned therapeutic properties. Increasing demand for herbal and ayurvedic skin care products is also expected to boost demand for Curcumin over the forecast period. Curcumin or turmeric extracts are also gaining importance owing to the lower bio-availability of raw turmeric which is mostly consumed in food products.

Pharmaceutical was the largest application segment accounting for over 50% of the global volume owing to an increased demand for Curcumin based OTC supplements. Curcumin demand in food application also increased in 2016 in terms of absolute volumes on account of growing demand for natural coloring and flavoring substances. Similar trends are expected to continue over the forecast period. Growing penetration of herbal skin care products is expected to further augment Curcumin market growth. R&D in dye-sensitized PV technology is expected to open new market avenues for Curcumin.

Global Curcumin market, by application, 2012 - 2022 (Tons)

Application Insights
Based on application, global Curcumin market is segmented into pharmaceutical, food, cosmetics and others which include cyanide detection and dye. Among these, pharmaceuticals accounted for larger share of the Global Curcumin Market is expected to rise during the next 5 years. Growing demand for Curcumin in the pharmaceutical industry has boosted its market growth globally. The beneficial properties of Curcumin such as anti-cancer and anti-viral has made it useful in manufacturing wide range of medicines and herbal supplements. Therefore, pharmaceutical industry is anticipated to generate high demand for Curcumin in the near future. Food accounted as the second largest application segment of Curcumin. Curcumin is widely used as spice in Asia Pacific and as a food colorant in the...
West. Therefore, high demand is reported for Curcumin from Asia Pacific as it is used in the Asian cuisines. As Curcumin is insoluble in water and this is expected to hinder the growth of Global market. However, water soluble salts of Curcumin are expected to take over the market as they can be used in wide range of applications in end-user industries.

Curcumin market was valued at USD35.7 million in 2014 and is expected to reach USD84.3 million by 2022, growing at a CAGR of 11.6% during the period 2015-2022.

Regional Insights
- **North America** was the largest regional market for Curcumin with market revenue exceeding USD30 million in 2016. Curcumin is an established ingredient for pharmaceutical application in the region which is expected to act as a major driver for market growth. In addition, growing use of turmeric extract or Curcumin in cosmetic formulation is expected to further augment market demand over the forecast period.
- Curcumin production is highly dependent on turmeric production which is the region dominated by India. India is the largest manufacturer of Curcumin with production exceeding 80% of global market. Low consumer awareness of Curcumin as a health ingredient in India results in the country exporting majority of its product to North America and Europe.
- **Europe** is expected to be the fastest growing regional market for Curcumin with demand estimated to grow at a CAGR of over 17% from 2015 to 2022. Regulatory support, coupled with growing consumer awareness is expected to be a key factor responsible for high market growth in the region. European Food Safety Association (EFSA) has approved ADI of 3mg/kg of body weight for Curcumin making it a preferred pharmaceutical ingredient in turn resulting in increased market demand.
- **Asia Pacific region** is projected to have CAGR of 12% in the Curcumin demand during the next 5 years

Competitive Insights
Manufacturers of Curcumin are largely concentrated in India on account of proximity to raw material suppliers and relatively high content of Curcumin in Indian turmeric varieties. Almost 80% of the Global turmeric production is based in India. India holds the key in this product segment due to its natural competitiveness and the quality of Indian Curcumin and its value added products are well accepted and preferred by the Global customers.

**CHALLENGES**
The key demand driver segment of Curcumin is projected to register faster growth in the next 10 years globally. So the demand segment will continue to throw opportunities. The challenge is in ensuring adequate cultivation of the high yielding varieties of turmeric and also investing in better extraction technologies and efficiencies. The effort towards developing new innovative formulation ingredients across the application segment will play significant role in propelling the growth of this bioactive in the next phase of growth. In addition, focus on clinical data generation and regulatory compliance, meeting the international consumer requirement is inevitably important.

**CONCLUSION**
With a projected sales of approximately USD85 million in the next five years, Curcumin will continue to be the Queen of value addition of the Indian Spice - Turmeric. Indian Turmeric has the USP of the best quality and the market dynamics are positive towards the projected growth.

Let the “Spice of Life” continue to Glitter in flying Colours!!
Spices are agriculture commodity consumed across the globe irrespective of food habit, cuisine and culture. Spices are mainly seed, root, fruits, flower, bark, chips, of various types of plants. Spices are cultivated in specific geographical areas of the globe; hence it has gained importance for various less economically developed countries as compared to their developed counterparts. Spices exports are one of the key segments to earn foreign exchange for developing countries such as India.

India is a major producer and consumer of a variety of spices in the world. India, with versatile agro-climatic zones, produces 6.0-6.2 million tonnes of various types of spices annually. On the other hand, the country exports more than 0.8 million tonnes of various spices valued around USD 2.5 billion to more than 100 countries of the world.

Chilli (Dry, Red) is a major spice that contributes large share in terms of production and export of total spices in India. India is the world leader in production of chilli and also one of the largest exporters in the world. Despite these, Indian chilli production growth is stagnant and at the same the export too. One of the key reasons is that there is major disconnect between the producer and the buyer, the buyer buys ‘what is produced not what is demanded’. Similarly, the producers are not aware of what is in demand.

Chilli farmers are no different from any other crop producing farmers in the country. The land holding pattern, production practices and environment, marketing, revenue etc. are similar across India. Small and marginal land holding, livelihood dependency on the crop, limited access to modern techniques, quality inputs, infrastructure etc. are the broad profile of chilli farmers. Chilli farmers often come across various constraints and issues which limit the growth of the sector. Some of key issues are stated in the table.

### Table: Key Challenges of Chilli Farmers in India

<table>
<thead>
<tr>
<th>Problem Area</th>
<th>Key Issue</th>
<th>Probable Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of quality seeds and seedlings</td>
<td>Expensive seed of branded suppliers and Nurseries</td>
<td>Bulk buying of seeds and seedlings</td>
</tr>
<tr>
<td>Declining yield &amp; High level of pest &amp; disease</td>
<td>Poor Crop management, Quality Inputs, Environmental, Limited technical assistance</td>
<td>Crop planning under qualified Resource person, Paid consultation for farm solutions</td>
</tr>
<tr>
<td>Non-uniform quality of the produce &amp; Pesticide residue</td>
<td>Lack of drying infrastructure, Low awareness about the grade specification, High dosage and untimely application of pesticides, Cost consciousness while selecting pesticide</td>
<td>Follow uniform cultivation practices, establish mutual cooperation, develop community infrastructure, bulk sourcing of required chemicals</td>
</tr>
<tr>
<td>Non-remunerative prices, High Marketing Cost, Forced Selling</td>
<td>Low Production volume, Limited bargaining power, Lack of infrastructure, Lack of direct Linkage</td>
<td>Aggregation/Bulking, Quality standard adoption, Collective marketing</td>
</tr>
</tbody>
</table>
In summary, chilli farmer faces challenges like lack of quality inputs and higher cost, improved cultivation methods, market oriented crop production technologies, post-harvest and handling infrastructure, market and remunerative prices. Chilli is mostly grown in rain fed condition and farmers have limited cropping options with them. Each chilli growing region produces specific variety production and over the year farmers are continuing with the same, retaining and using the seed of the current crop for the next year is very common phenomenon. Due to this productivity declines, plant resistance weakens and produce quality deteriorates.

In the market, various companies have introduced improved seeds of popular varieties but price is exorbitantly high for these small-scale farmers, even if they could purchase, the same seed will again be retained for next crop. Farmers apply chemicals recommended by the dealer without diagnosing the actual cause, price of the chemical is again major selection/purchasing criteria. Chilli farms are clustered but fragmentally owned, any measure taken by individual to control pest and disease cannot be effective unless neighbours follow the same. At last, with small volume of produce farmers incur high transportation cost, face low bargaining power, forced to pay high marketing cost and land up earning low income.

On the other hand, the buyers (processor/corporate) face various challenges while marketing the chilli produced in hard situation complying with the necessary market requirement. The food safety norms are tightened and compliances are made mandatory, in such condition buyers dependence on the farmers increase. Uniform consistent quality of the produce, limited pesticide residue, traceability etc. are the major challenges faced by the exporter of chilli.

Majority of the chilli customers depend on traders/commission agents for sourcing the produce. The changing market requirements, usage and consumer demand is provoking suppliers (processors/exporters) to reach to the farm as the solution lies with the farmers.

<table>
<thead>
<tr>
<th>Problem Area</th>
<th>Key Issue</th>
<th>Probable Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniform quality</td>
<td>Small Volume of production, improper post-harvest management, excessive usage of chemicals</td>
<td>Sourced through group of farmers, Mass education and training</td>
</tr>
<tr>
<td>Material &amp; Minimal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pesticide Residue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-traceability</td>
<td>Small Land holding, unorganised supply chain, different cultivation practices</td>
<td>Developing e-platform for group of farmers, educating to follow standard cultivation practices</td>
</tr>
<tr>
<td>Inconsistent supply</td>
<td>Price sensitiveness, influential sale</td>
<td>Market Linked purchase agreement, Relationship building by providing technical guidance through experts, Paying up to the market procurement cost</td>
</tr>
</tbody>
</table>

These challenges lie in the value chain of any spices/commodities production and require efforts from all the major stakeholders to find the way forward. In any value chain, key stakeholders involved are producer (Farmers), private (Corporate- Buyers, Input suppliers, Laboratories) and public (Government- Departments, Research institutes, University etc). As the probable solution indicates, most of the challenges can be addressed if integrated approach is adopted and community as a whole put-in their efforts.

Collectivisation of farmers or organising community farming is a proven strategy that has helped many farmers across the globe. Community farming could benefit farmers in reducing costs by bulk buying/subscription, enhancing the ability to negotiate, developing economies of scale, etc. In India, various forms of community farming or mobilization are present like Self Help Group (SHG), Farmer Interest Group (FIG), Co-operative Societies, Federations etc. Farm Producer Organisation (FPO) is a recent addition to the list. FPO gives a corporate identity to the organisation while preserving the cooperative nature of ownership. Thus, it overcomes various drawbacks of previous forms and has emerged as an innovative concept to resolve issues and create a win-win platform for every farm stakeholders. FPO is a business entity formed by the farmers and deals in farming community development. FPO as a mediator agency can help the farmers to cultivate what customers require and enables the buyer to taken in what conditions they
want to buy. The FPO can act on behalf of both, farmers and the buyer/company. As service to the farmer, FPOs can source inputs in bulk, organises training, appoint/avail advisors or advisory services, create infrastructure in efficient and cost effective manner which individual farmer finds expensive, also buy or aggregate the produces. As farmer themselves are the shareholders, any benefits or profit will be re-distributed to them in the form of dividend.

**Key Strength of FPOs**
- Group of farm producer individuals aggregated homogeneous or heterogeneously
- A corporate body in terms of structure and functioning
- Professional management practices
- Eligible to obtain all mandatory and regulatory licenses (APMCs, Input trade etc)
- Initial share capital base (Govt. also gives additional grant/finance in case of Karnataka) can be utilised for creating infrastructure and other required facilities.
- Capable of serving the farmers (input sale, advisory, CHC, purchase etc) and buyers (aggregating, primary processing, facilitating linkage b/w famer & Buyers)

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**Table: List of Farm Producer Organisation (FPO in Spices as Major) in Karnataka**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>District</th>
<th>Taluk</th>
<th>FPO Name</th>
<th>Spice Crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Haveri</td>
<td>Haveri</td>
<td>Bhoothai HFPCL</td>
<td>Ginger</td>
</tr>
<tr>
<td>2</td>
<td>Haveri</td>
<td>Hangel</td>
<td>Shrikumareshwara HFPCL</td>
<td>Ginger</td>
</tr>
<tr>
<td>3</td>
<td>Kodagu</td>
<td>Madikeri</td>
<td>Bhagandeshwara HFPCL</td>
<td>Cardamom, Blackpepper</td>
</tr>
<tr>
<td>4</td>
<td>Gadag</td>
<td>Gadag</td>
<td>PuttarajaGawayi HFPCL</td>
<td>Garlic, Red Chilli</td>
</tr>
<tr>
<td>5</td>
<td>Dhakshina Kannada</td>
<td>Bantvala</td>
<td>Pingara HFPCL</td>
<td>Pepper</td>
</tr>
<tr>
<td>6</td>
<td>Dhakshina Kannada</td>
<td>Belthangadi</td>
<td>Navachetana HFPCL</td>
<td>Pepper</td>
</tr>
<tr>
<td>7</td>
<td>Udupi</td>
<td>Karkala</td>
<td>Karkala HFPCL</td>
<td>Pepper</td>
</tr>
<tr>
<td>8</td>
<td>Uttar Kannada</td>
<td>Sirsi</td>
<td>Srimadhukeshwara HFPCL</td>
<td>Pepper</td>
</tr>
<tr>
<td>9</td>
<td>Chamrajnagar</td>
<td>Chamrajnagar</td>
<td>Udiraga HFPCL</td>
<td>Turmeric</td>
</tr>
<tr>
<td>10</td>
<td>Bagalkot</td>
<td>Jamkandi</td>
<td>Jamkhandi HFPCL</td>
<td>Turmeric</td>
</tr>
<tr>
<td>11</td>
<td>Bidar</td>
<td>Humnabad</td>
<td>Kayakalpa HFPCL</td>
<td>Ginger</td>
</tr>
<tr>
<td>12</td>
<td>Hubali-Dharwad</td>
<td>Hubali</td>
<td>uluvayogi HFPCL</td>
<td>Dry Chilli</td>
</tr>
<tr>
<td>13</td>
<td>Hubali-Dharwad</td>
<td>Dharwad</td>
<td>kayakayogi HFPCL</td>
<td>Dry Chilli</td>
</tr>
</tbody>
</table>

In Karnataka state, ITC-ILTD, a major chilli exporter cum processor, has already started dry chilli production under Public Private Partnership for Integrated Horticulture Development (PPP-IHD) programme in the Bellary district.

Another two spices giants (Dry Chilli) will start the PPPIHD activity during the next financial year. Two more proposal are under consideration for the similar programme on Turmeric and Back Pepper.

Globally it has been felt that, to maximize the benefits and link the value chain, integration of stakeholders is inevitable. Participatory approach has proved to be an asset for production of critical commodities like spices where success lies on the close coordination between producer and buyer/processor/exporter.

Foretell Business Solutions Pvt Ltd, a leading agribusiness market research and consulting firm, is a consultant to Project Monitoring Unit (PMU), Depart of Horticulture, Govt. of Karnataka, for monitoring, business developing of Farmer Producer Organisation (FPO). Also, assisting in promotion, implementing and development supporting to Public Private Partnership for Integrated Horticulture Development (PPP-IHD) programme. For further detail contact TAS@commodityindia.com or bc@commodityindia.com.
Spent Pepper – A New Entry to Spices Market

Binu Roy

Spent pepper is the byproduct obtained from black pepper after oil and resin extraction. First, the oil has been extracted out from the pepper using steam distillation. Then the de-oiled pepper is again distilled using solvent (the process is called solvent extraction) to get the resin. The left over is called spent pepper. During the process of spent pepper, we can get around 20 per cent of oleoresin, out of that around 6 per cent is oil and about 75 per cent is resin, then the remaining is spent.

Spent pepper was considered as a scrap or was used in boilers till few years back. In recent years, spent pepper has found major demand especially from the European markets. It is mainly used as pepper powder, which will have less hotness, in Spain, Russia, Netherlands, Ukraine, Canada, Germany etc. It is also used for making cattle feeds.

The major constraint of spent pepper is Preservation. Since it is a by-product after oil extraction, the spent pepper powder is coated with high oil content. Hence, we need to dry it with much vigilant and make sure the spent pepper powder is free of moisture content. A little bit of moisture may attract the fungus in short span of time and once the spent pepper is affected with fungus, then that is of no use. Usually, spent pepper is dried in the sunlight and that is most economical way of drying. Spent pepper powder has a shelf life of around 1 year. Approx price for spent pepper is about Rs.130-145/kg.

As per the data available from Zauba Technologies & Data Services Private Limited, India exported black pepper spent of about 3.76 million kgs in 2015 which is 2 per cent lower than the previous year. Till November 2016 the export was about 2.96 million kg which shows a decline of 15 per cent compared to the same period previous year. In value terms India exported worth USD 375 million in 2016 (till November) preceding by USD 434 million in 2015 and USD 269 million in 2014.

Spain is the largest buyer of black pepper spent with 42 per cent (1.54 million kgs worth USD 179 million) of Indian exports in 2015 followed by Russia with 17 per cent (0.63 million kgs worth USD 81 million), Netherlands with 8 per cent (0.29 million kgs worth USD 41 million), Germany with 7 per cent (0.25 million kgs worth USD 29 million), Ukraine with 5 per cent (0.17 million kgs worth USD 20 million) and Canada with 4 per cent (0.15 million kgs worth USD 20 million). Cochin Sea accounted for 95 per cent of total spent pepper exports.

Overall, spent pepper found space in the list of Indian spices trade, but market sustainability is a question mark. India produces a large quantity of spent black pepper but both export and domestic market opportunity is very less.
Spices Outlook

Debajit Saha, Foretell Business Solutions Pvt Ltd

Small Cardamom Fundamentals

India
Indian small cardamom production for the crop year 2016-17 is expected to be around 16,500 tonnes against the 2015-16 production of 25,000 tonnes. Decline in small cardamom production in India is mainly due to failure of pre-monsoon (Mar-May) rainfall and southwest monsoon (Jun-Sep) and higher temperature during flowering season across the major growing regions of Kerala, Karnataka and Tamilnadu. Scanty rainfall has affected crop yield during the current season. Small cardamom yield for the current crop year is expected to be around 220kg/ha compared to last year yield of 340kg/ha (5-year average yield is around 230kg/ha). Though small cardamom production for 2016-17 is expected to decline, the total supply is estimated to be normal, thanks to higher opening stocks of 4800 tons.

Guatemala
Guatemala is expected to produce around 28,000-30,000 tonnes of cardamom for the crop year 2016-17 against the last year production of 32,000-35,000 tonnes. Production for the crop year 2016-17 declined mainly because of higher temperature across the cardamom growing belt of Guatemala, also the rainfall across the growing regions were 30% less compared to last year. Carry forward stocks for the crop year 2016-17 is expected to be around 4,000 tonnes. So, total supply for the year 2016-17 would be around 36,000 tonnes against the last year supply of 40,000-42,000 tonnes.

Price Outlook: Chart is showing extremely bullish outlook for Indian cardamom going forward. Price had broken out important resistance of 17.94 and set to touch next strong resistance of $22.06/kg. Above this level, price will touch $25.00/kg. RSI is also showing bullish movement in price.

In short, we believe price will continue to remain bullish and one can expect prices to touch 25.00 and above.

Current price: USD 23.57/Kg.

Expected direction: Bullish

Expected price: USD25.00/Kg.

Factors to watch: Currency Movement, Weather and crop condition.
Black Pepper
Fundamentals

India
Indian black pepper production for the crop year 2016-17 is expected to be less than the last year production of 53,000 tonnes. Indian production for the crop year 2016-17 declined mainly because of less rainfall during the flowering season across the major growing regions of India. Currently harvesting across Kerala have started and expected to pickup in the coming days.

Vietnam
Pepper growing regions of Vietnam has received a good rainfall during flowering and fruit set and also weather was favorable throughout the crop season, production for the crop year 2016-17 is expected to be better than the last year production of 170,000 tonnes.

Taking India and Vietnam crop condition in to consideration we expect price to trade in a range.

Price Outlook:
India: Black pepper is in corrective wave after it hit high of $11.33/kg. Price has corrected 50% of last major move and we are expecting price to bounce from the current level. If price drop below $9.02/kg level, then it will enter the bearish territory and new bear market may start. On the higher side we are expecting prices to touch earlier high of $11.33/kg and above that level, it will hit $12.50/kg level.

Considering the expected low production, we believe price will continue to remain high and we may see the price to hit new high in the current season.

Vietnam: Black pepper is in downward wave and we are expecting price to continue its downward move. The trend line is showing price could fall to $4.6/kg. $5.56/kg will remain the major support point. $6.40 will remain the major resistance level for any price rebound. If price stays above this level, then trend will change.

Considering the expected high production, we believe price will continue to remain weak.

Current price: India: USD9.6/Kg; Vietnam: $5.68/Kg.

Expected direction: India: Bullish; Vietnam: Sideways;

Expected price: India: USD11.33/Kg
Vietnam: USD 5.5/kg

Factors to watch: Currency movement, crop from Vietnam.
Turmeric
Fundamentals
Area under turmeric for the current season 2016-17 has increased across Telangana, Andhra Pradesh, Telangana and Sangli; however area across Tamilnadu and Karnataka has declined because of less availability of water.

Price Outlook: Turmeric at present is showing neither bullish nor bearish trend. Price is in sideways trend which implies that traders are comfortable to approach market cautiously. Considering the higher expectation of production this year, and the kind of indication we are getting from the chart, it seems price will continue to remain sideways and with all possibility may come down when the new crop hits the market.

Current price: USD 3.31/Kg.

Expected direction: Sideways to down

Factors to watch: Quality of the crop, stockiest demand.

Overall turmeric production for the crop year 2016-17 is expected to be 20% higher compared to last year production of 291,000 tonnes. Stocks across the markets are comparatively less than the last year stocks of 186,000 tonnes.

Cumin
Fundamentals
India
Sowing of cumin across India is completed. There was anticipation of

Price Outlook: Cumin is showing bullish trend as it formed higher low formation in long term chart. Price is currently above 20 months EMA which itself is significant to consider the bullish trend. Price may spend some time at the current level before next big move kicks off. We are expecting price to hit $3.90/kg and then $4.20/kg. RSI is also supporting the trend. Strong support will be observed around $3.42/kg.

Current price: USD 3.64/Kg.

Expected direction: Bullish

Expected price: USD 4.20/Kg

Factors to watch: Crop condition, weather and currency.
increase in acreage for the current crop season but finally area under cumin for the crop year has come down across Gujarat and Rajasthan.

So far weather condition across the cumin growing regions is good. Stocks across the markets are expected to be round 70,000 tonnes against the last year stocks position of 95,000 tonnes.

**Syria**

Cumin production for the crop year 2016-17 is expected to be less than the last year production of 32,000 tonnes. Production for the current crop year declined mainly because of decline in acreage and unfavorable weather conditions across the growing regions of Syria.

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**Coriander**

**Fundamentals**

Sowing of coriander across the major growing regions like MP and Rajasthan has come down by 15% during the current crop season 2016-17. However, sowing across Gujarat and Andhra Pradesh has increased by 50%. Currently crop condition across Gujarat and Andhra Pradesh is good, however, in MP and Rajasthan the standing crop has got affected by cold wave. Stocks across the markets for the current crop year is expected to be little higher than the last year stocks of 54,000 tonnes.

**Price Outlook:** Coriander at present is showing weakness. Price is currently below 2014 low of $1.43/kg. It is difficult to predict the price movement at present. The broader trend is still weak, however, since it has corrected more than the last broader move, we believe price will struggle to recover. We may see sideways movement for extended period of time and even coming down.

**Current price:** USD1.37/Kg.

**Expected direction:** Sideways to down

**Factors to watch:** Crop condition, weather and currency.

---

**Chilli**

**Fundamentals**

During the current crop year area under cultivation across Andhra Pradesh and Telangana has increased by 30-35% however in Karnataka area has increased by 10-15%. Though area across Karnataka has increased, production is expected to remain more or less similar to last year because of scarcity of water across the growing regions of the state. However weather and rainfall across Andhra and Telangana was good during the current season. So production for the current year is estimated to be higher than the last year. In MP increased acreage and good weather throughout
the season have helped the current year production. MP production for the current crop year is expected to be higher than the last year production of 1,30,000 tonnes.

Harvesting of Chilli across China is completed production for the crop year 2016-17 is estimated be 5-10% less compared to last year production.

**Price Outlook:** - Chilli is showing extreme bullishness at present. However, there is possibility of correction as price has advanced a lot. Price may correct up to $3.40/kg before starting a new move. If price remains bullish, we may see the price to cross the current high of $3.88/kg.

**Current price:** USD3.64/Kg.

**Expected direction:** correction

**Expected price:** USD 3.40/Kg.

**Factors to watch:** Crop condition, weather and currency.
Observations on Chilli Exports from India

Binu Roy

India is the largest producer, consumer and exporter of Chilli in the world. India produces around 11.7 lakh tons of chilli and exports around 30 per cent of the total production i.e. around 3.52 lakh tons in 2015-16 as per the data from Spices Board of India.

Indian Chilli exports are growing at a CAGR of 9 per cent in volume terms from 2.41 lakh tons to 3.51 lakh tons during 2011-12 to 2015-16. Value realization too showed a growth from Rs.88.97 to Rs.98.80 per kg.

China is the second largest producer and exporter of Chilli next to India. Even though India is having a major market share in majority of chilli importing countries, China is getting a better value realization compared to Indian chilli.

% share of Indian and Chinese chilli in major markets

<table>
<thead>
<tr>
<th></th>
<th>Thailand</th>
<th>Sri Lanka</th>
<th>Malaysia</th>
<th>Indonesia</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>80.77 %</td>
<td>98.23 %</td>
<td>71.49 %</td>
<td>81.49 %</td>
<td>19.73 %</td>
</tr>
<tr>
<td>China</td>
<td>16.96 %</td>
<td>1.48 %</td>
<td>21.81 %</td>
<td>11.98 %</td>
<td>33.13 %</td>
</tr>
</tbody>
</table>

For Indian chilli, in value realization terms, Saudi Arabia is the big market for Indian Chilli followed by UK and USA.
Thailand and Vietnam showed a huge jump in their quantity exported from 2011-12 to become the first two largest markets for Indian chillis. Malaysia, till then the largest market, started showing a decline in chilli imports from India and became the 5th largest importer of chillis from India in 2015-16.

Sri Lanka, USA, Mexico, Singapore, UK and Saudi Arabia are showing a steady growth over the years and proved as a sustainable market.

### Health Benefits of Chilli

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heart Attack</strong></td>
<td>Chilli due to presence of capsaicin lowers blood pressure and reduces the level of cholesterol. It also prevent arteriolosclerosis.</td>
</tr>
<tr>
<td><strong>Sound Sleep</strong></td>
<td>Eating a chilli per day is helpful to stay sleep longer.</td>
</tr>
<tr>
<td><strong>Detoxicants</strong></td>
<td>Chillies acts as detoxifiers as they removes waste products from our body and increases supply nutrients to the tissues. It also acts as gastrointestinal detoxicants helping in digestion of food.</td>
</tr>
<tr>
<td><strong>Brain</strong></td>
<td>Capsaicin stimulates brain to excrete endorphin and gives a sense of pleasure when ingested</td>
</tr>
<tr>
<td><strong>Lung disease</strong></td>
<td>Chillies gives relief from nasal congestion by increasing the metabolism. It also dilates airway of lungs which reduces asthma and wheezing.</td>
</tr>
</tbody>
</table>
Indian Spice Exports Trend

![Graphs showing the trend of Indian spice exports in terms of volume and value over the years.](image-url)
UNBIASED INFORMATION AND INSIGHTS ADD IMMENSE VALUE TO YOUR BUSINESS

Information on spices related to - crop, production, inventory and movement of goods, market and prices- are often incomplete, irregular or biased. Decisions based on unreliable information could lead to huge financial loss and reputation damage to your business. Hence, you need a reliable partner, who is not a part of the transaction, to provide information and insight that is reliable, timely and actionable.

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Crop surveys and seasonal reports- We bring out crop survey based seasonal reports on Cardamom (Small), Chilli, Coriander, Cumin Pepper, Turmeric and Minor Spices after extensive primary surveys. This provides insights on acreage, expected yields, production estimation and besides a prediction on possible range of prices during arrival season. The seasonal report is released at the beginning of the season and is updated on completion of arrival season. It is a must have for every spices industry player with sizeable procurement exposure.

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Coverage
Cardamom (Small), Chilli, Coriander, Cumin Pepper, Turmeric and Minor Spices
For more details and sample reports,

Please talk to Swapna +91 9342840609 or email us at swapna@fbspl.com

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**Mobile:** (62).267.8610220, (62).8.1510054288

International Spice Conference, Organising Secretary  
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**Ph:** +91 8547523237/ +91 9895146966  
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**Email id:** marketing@nichrome.com  
**Mobile:** 8308811655

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**Contact Person:** Mr. Viren  
**Address:** V.P.O. Khosa Pando, Zira Road, Moga-142001, Punjab, India.  
**Email:** virender.singh@parasspices.com  
**Mobile:** 98148 59823

**Company Name:** Rsons group  
**Contact Person:** Mr. Sarang Somaiya  
**Address:** Natraj Chambers, Bardan Gali, Danapith, Rajkot - 360001, Gujarat, India  
**Email:** rsonsgroup@gmail.com  
**Mobile:** 00971 562177584/ 7778000036

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**Mobile:** 9920117264

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**Address:** OS49, IV Floor, GCDA Complex, Marine Drive, Kochi-682 031  
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**Mobile:** 9895054410

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**Email:** sunilkumarp@synthite.com  
**Telephone:** 0484 3051261
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Phone No: +91-79-40084812  
Mobile: +91 9825033002  
Email: tanactive@gmail.com, mpshah70@gmail.com

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Contact Person: Mr. Lukas  
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Mobile: +31 6 31784732

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Email: chandrasekhar@vidyaherbs.com  
Mobile: 9945277842

INTERNATIONAL SPICES MACHINERY MANUFACTURERS LIST

Company Name: AC Horn  
Manufacturing (spices)  
Address: AC Horn Manufacturing  
1269 Majesty Dallas, Texas 75247 USA  
Phone: 1 800 657 6155  
Fax: 1 214 630 0130  
Website: www.achornmfg.com  
Machinery: Spices Roasters, Packing

Company Name: Adasen Machinery Co., Ltd.  
Address: No.112, Qijia Industrial Park, Licheng District China  
Mobile: 86 531 88975500  
Phone: 86 531 88976080  
Fax: 86 18668965557  
Email: jn.adasen@yahoo.com  
Website: www.dryersterilizer.com  
Machinery: Tunnel Continuous Microwave Sterilizer

Company Name: Alamo Food Equipment & Supplies, Inc. (spices)  
Address: 6600 Guada Coma Drive Schertz, Texas 78154 USA  
Phone: 1 210 651 4343  
Fax: 1 210 651 5111  
Email: Fran@alamofoodequipment.com  
Website: http://alamofoodequipment.com  
Machinery: Grinders & Blenders

Company Name: Alvan Blanch  
Address: Chelworth, Malmesbury Wiltshire Sn16 9sg United Kingdom  
Phone: 44 0 1666 577333  
Fax: 44 0 1666 577339  
Email: info@alvanblanch.co.uk  
Website: www.alvanblanchgroup.com  
Machinery: Herbs And Spices Processing

Company Name: AVA  
Address: Ava- Huep Gmbh U. Co. Kg Heinestraße 5 82211 Herrsching Germany  
Phone: 49 8152 9392 0  
Fax: 49 8152 9392 91  
Email: info@ava-huep.com  
Website: www.ava-huep.com  
Machinery: Spices Mixers, Driers & Sterilizers

Company Name: Ban Hing Enterprise Sdn Bhd  
Address: No. 13-3, Jalan Raja Laut, Postal Code-50350 City-Kuala Lumpur State-Wilayah Persekutuan, Malaysia  
Phone: 603 4042 5970  
Fax: 603 4042 0868  
Email: enquiry@mdex.my  
Website: www.mdex.my  
Machinery: Electric Grinding Machine Pmja Series Bean & Spices Processing Machine

Company Name: Bauermeister - Food Grinding Equipment  
Address: Bauermeister Zerkleinerungstechnik GmbH Oststr. 40 22844 Norderstedt Germany  
Phone: 49 40 52608 0  
Fax: 49 40 52608 199  
Email: info@bauermeister.de  
Website: www.bauermeister.de  
Machinery: Spices Food Processing Equipments
Company Name: Beijing Bidragon Machinery Co., Ltd.
Address: No.2-1803 Soubao Business Center, No.16 South-West Third Ring Road, Beijing, China
Phone: 86 13213263322
Fax: 86 13592608076
Email: sales2013@bidragon.com
Website: www.bidragon.com
Machinery: Chilli Grinder, Spices Mprocessing Machine & Chili Stem Cutting Machine

Company Name: Beijing Double Dragon International Agricultural Machinery Co., Ltd. (Bidragon International)
Address: No.2-1803 Soubao Business Center, No.16 Nansanhuan Xilu, Beijing, China.
Phone: 86 372 2190222
Fax: 86 372 2190333
Email: info@bidragon.com
Website: www.bidragon.com
Machinery: Chili Powder Grinding Machi & Garlic Separator

Company Name: Bulk Process Equipment, Inc.
Address: 2702 Lighthouse Point East Suite 620 Baltimore, Md 21224 USA
Phone: 410 327 9242
Fax: 410 327 9212
Email: Sales@BulkProcessEquipment.com
Website: http://bulkprocessequipment.com
Machinery: Spices Drying & Blending, Mixing

Company Name: C S Bell Co
Address: 170 West Davis Street Po Box 291 Tiffin Ohio USA
Phone: 1 888 958 6381
Fax: 419 448 1203
Email: info@csbellco.com
Website: www.csbellco.com
Machinery: Spices Hammer Mills, Grinding Mills & Conveyers

Company Name: Chisholm Machinery Solutions (snack foods)
Address: 5760 Valley Way, P.O. Box 245 Niagara Falls, Ontario, Canada L2e 6t3
Phone: 1 905 356 1119
Fax: 1 905 356 9170
Email: info@chisholmMachinery.com
Website: www.chisholmMachinery.com
Machinery: Packaging, (Elevators & Conveyers)

Company Name: Christy Turner
Address: Knightsdale Road Ipswich Suffolk United Kingdom Ip1 4le
Phone: 44 0 1473 742325
Fax: 44 0 1473 462773
Email: info@christy-turner.com
Website: www.christy-turner.com
Machinery: Spices Flaking Mills, Pulverizers & Grinding Mills

Company Name: Dezintegrator Co
Address: 4 Ruski Street Bulgaria, Stará Zagora 6002 Bulgaria
Mobile: 359 889 40 10 20
Phone: 359 42 62 92 73
Fax: 359 42 62 62 30
Email: dezintegrator@abv.bg
Website: www.dezintegrator.com
Machinery: Equipment For Grnding Of Red Pepper Spices

Company Name: Donaldson Company Inc.
Address: Industrial Air Filtration P.O. Box 1299 1400 West 94 th St. Minneapolis, MN 55440 USA
Phone: 1 800 365 1331
Fax: 952 887 3054
Email: IAFaftermarketorders@donaldson.com
Website: www2.donaldson.com
Machinery: Spices Food Processing & Dust Collectors

Company Name: Etia
Address: Carrefour Jean Monnet, La Croix St Ouen, BP 20101, 60201 Compiègne Cedex France
Phone: 33 (0)3 44 86 44 20
Fax: 33 (0)3 44 86 27 86
Email: sales@etia.fr
Website: www.etia.fr
Machinery: Spices Drying, Heating & Heating

Company Name: Fitzpatrick
Address: 832 Industrial Drive Elmhurst, Il 60126, USA
Phone: 1 630 530 3333
Fax: 1 630 530 0832
Email: fitzinfo@idexcorp.com
Website: www.fitzmill.com
Machinery: Spice Size Reduction Machines
Company Name: Glen Mills Inc.  
Address: 220 Delawanna Ave. Clifton, NJ 07014 USA  
Phone: 1 973 777 0777  
Fax: 1 973 777 0070  
Email: staff@glenmills.com  
Website: www.glenmills.com  
Machinery: Spices Hammer Mills & Grinders

Company Name: Hela Spice Canada Inc.  
Address: Hela Spice Canada Inc. 119 Franklin Street Uxbridge, ON L9p 1J5 Canada  
Phone: 905 852 5100  
Fax: 905 852 1113  
Email: customerservice.ca@helaspice.com  
Website: www.helaspice.ca  
Machinery: Spicer-Food Processing Equipment

Company Name: Henan Machinery & Equipment Company Limited  
Address: Shuguang Road, Mazhai, Zhengzhou, Henan 450064, China  
Phone: 86 371 67199262  
Fax: 86 371 67199263  
Email: market@hnyigong.com  
Website: www.enyigong.com  
Machinery: Mini Spices Grinding Mill Factory

Company Name: Higao Tech Co., Ltd  
Address: HQ:No.35 Puzhuang Rd, European Industrial Zone, Zhuanghang Town, Fengxian District, Shanghai. 201415 China  
Phone: 86 527 8871 0396  
Fax: 86 185 0527 5611  
Website: www.pulverizermixermachines.com  
Machinery: Spices And Seasoning Grinding Pulverizer Machine

Company Name: Jiangyin Haixiang Machinery Co., Ltd.  
Address: Room508, No. 139, Pujiang Rood, Lingang New City, Jiangyin, Wuxi, Jiangsu 214442, China  
Phone: 86 510 66200158  
Fax: 86 510 66200168  
Email: jackie@haixiangjx.com  
Website: www.haixiangchina.com  
Machinery: Spice Grinding Machines

Company Name: Kuko Packing Machinery Co., Ltd  
Address: No.658-E, Qiangye Road, Songjiang District 201602 Shanghai China (Mainland)  
Phone: 86 21 69746020  
Fax: 86 (0)21 6221 9769  
Email: info@goodpacking.com.cn  
Website: http://kukopacking.en.china.cn  

Company Name: LEM  
Address: “4440 Muhlhauser Rd. Suite 300 West Chester, Oh 45011-9767” USA  
Phone: 877 336 5895  
Email: contactus@lemproducts.com  
Website: www.lemproducts.com  
Machinery: Spices And Seasoning Machines(Grinders)

Company Name: Marel  
Address: Austurhraun 9 Gardabaer Is-210 Iceland  
Phone: 354 563 8000  
Fax: 354 563 8001  
Email: info@marel.is  
Website: http://marel.comce-dispenser-ct-1403.30/78?prdct=1  
Machinery: Spice And Salt Dispenser

Company Name: Mill Powder Tech Co., Ltd  
Address: 710,Tainan City, Yongkang District, Zhengbei 3rd Rd Taiwan  
Phone: 886 6 2545566  
Website: www.mill.com.tw  
Email: mill@mill.com.tw  
Machinery: spices Powder Grinder & Mixers / Blenders

Company Name: MMIS  
Country: Canada  
Address: 340 Industrial Parkway South, Aurora, Ontario L4g 3v7 Canada  
Phone: +1 905 841 1717  
Fax: 905 841 1733  
Email: inquiry@mmis.ca  
Website: www.mmis.ca  
Machinery: spices Grinders & Packaging

Company Name: Mushtaq’s Food Machinery  
Address: Ravenhurst House, Ravenhurst Street, Birmingham, B12 0hd United Kingdom  
Phone: 44 (0) 121 766 8536  
Email: sales@ mushtaqsfoodMachinery.com  
Website: www.mushtaqsfoodMachinery.com  
Machinery: Spices Region Wise Customised Bespoke Range Of Ethnic Food Machinery
Company Name: Napasol AG  
Address: Binningerstrasse 95 CH - 4123 Allschwil SWITZERLAND 503  
7th N. Suite 101 Fargo, ND 58102  
Phone: +41 (0)61 712 33 22  
Fax: +41 (0)61 712 33 23  
Email: safefood-ch@napasol.com  
Website: www.napasol.com  
Machinery: Spices Pasturization/ Sterilization Solution

Company Name: Prater Industries  
Address: 2 Sammons Court  
Bolingbrook, Il 60440 USA  
Phone: 1 877 247 5625  
Fax: 630 759 6099  
Email: info@praterindustries.com  
Website: www.praterindustries.com  
Machinery: Spices Hammer Mills, Grinding Mills

Company Name: Pro-Mlin  
Address: Surcinska 8/a, New  
Belgrade, Belgrade, Serbia  
(44.80206, 20.337222)  
Phone: 381 11/21 65 393  
Fax: 381 643128106  
Email: promlin@orion.rs  
Website: http://promlin.rs  
Machinery: Spices Mill

Company Name: Quadro Engineering Corp  
Address: 613 Colby Drive Waterloo, Ontario Canada N2v 1a1  
Phone: 1 519 884 9660  
Fax: 1 519 884 0253  
Website: www.quadro.com  
Machinery: Spices Dry Milling, Wet Milling, Etc

Company Name: Raphanel System  
Phone: 34 968 83 29 00  
Fax: 34 968 83 29 37  
Email: raphanel@raphanel.com  
Website: http://raphanel.com  
Machinery: Spices Sterilizer, Dryer & Oleoresin Extractor

Company Name: Revtech Process System  
Address: Pa Champgrand 50 Allée Des Abricotsiers 26270 Lorient Sur Drome France  
Phone: 33 4 75 60 16 33  
Fax: 33 4 75 60 16 27  
Email: revtech@revtech.fr  
Website: www.revtech-process-systems.com  
Machinery: Herbs And Spices Steam Sterilization

Company Name: Safe Spice Gida  
Address: Sterilizasyon San. Ve Dis. Tic. A.S  
Akcy Cad. Ayfer 144/1 Street. No: 20  
Gaziemir - Izmir / Turkey P. K. 35410  
Phone: 90 232 251 87 41  
Fax: 90 232 251 58 95  
Email: safespice@safespice.com.tr  
Website: http://safespice.com.tr  
Machinery: Spices Blender, Sterilization, Mill

Company Name: Sas Application Systems  
Address: Po Box 1190 Oxford Ox4  
4gh England, UK  
Phone: 44 0 18 65 74 76 34  
Fax: 44 (0)1235 81 84 43  
Email: info@spiceapplications.com  
Website: www.spiceapplications.com  
Machinery: Spices Coating Machine

Company Name: Schutte-Buffalo  
Address: 61 Depot Street Buffalo, Ny 14206 USA  
Phone: +1 716 855 1555  
Fax: 716 855 3417  
Email: info@hammermills.com  
Website: www.hammermills.com  
Machinery: Spices Custom Made Hammer Mills

Company Name: Sesotec Germany  
Address: Sesotec Gmbh Regener Straße 130 D-94513 Schönberg  
Germany  
Phone: 49 0 8554 3080  
Fax: 49 0 8554 2606  
Email: webcontact@sesotec.com  
Website: www.sesotec.com  
Machinery: Bulk goods (vacuum/ pressure)

Company Name: SMICO Manufacturing Company INC  
Address: 6101 Camille St. Valley Brook, Oklahoma 73149 USA  
Phone: 405 946 1461  
Fax: 405 946 1472  
Machinery: Vibratory Screens For Spice Cleaning

Company Name: Taizhou Liming Pharmaceutical Machinery Co., Ltd.  
Address: Jiangsu ,Taizhou, No.60-1, Jiefang West Road, Diaopu Town, Taizhou City, Jiangsu Province, 225321 China  
Phone: 86 523 82039777  
Fax: 86 523 86982704  
Email: jerry.ghu1204@foxmail.com  
Website: http://tzlmsj.ecl.xyz  
Machinery: Spices Powder Making
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Email</th>
<th>Website</th>
<th>Machinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Jet Pulverizer Co., Inc</td>
<td>1255 North Church Street, Moorestown, NJ 08057-1166 USA</td>
<td>1 800 670 9695</td>
<td>856 778 7712</td>
<td><a href="mailto:info@jetpulverizer.com">info@jetpulverizer.com</a></td>
<td><a href="http://www.jetpulverizer.com">www.jetpulverizer.com</a></td>
<td>Spices Milling Equip, Ent For Food</td>
</tr>
<tr>
<td>The Witte Company, Inc</td>
<td>P.O. Box 47, 507 Route 31 South Washington, NJ 07882-0047 USA</td>
<td>908 689 6500</td>
<td>908 537 6806</td>
<td><a href="mailto:info@witte.com">info@witte.com</a></td>
<td><a href="http://www.witte.com">www.witte.com</a></td>
<td>Drying, Cooling, Classification &amp; Inspect Flavouring And Spices</td>
</tr>
<tr>
<td>Thompson Equipment And Supply</td>
<td>3249 East Kemper Rd. Cincinnati, Oh 45241 USA</td>
<td>1 513 761 7784</td>
<td></td>
<td></td>
<td></td>
<td>Spices Packaging &amp; Grinders</td>
</tr>
<tr>
<td>Urschel</td>
<td>1200 Cutting Edge Drive, Chesterton, In 46304 USA</td>
<td>1 219 464 4811</td>
<td>1 219 462 3879</td>
<td><a href="mailto:info@urschel.com">info@urschel.com</a></td>
<td><a href="http://www.urschel.com">www.urschel.com</a></td>
<td>Chilli Pepper Processing Machine (Dried) &amp; Other Selected Spices</td>
</tr>
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<td>86 536 4187866</td>
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<td><a href="http://alpapowder.com">http://alpapowder.com</a></td>
<td>Superfine Powder Pulverizer &amp; CSM VH Classifier Mill Spice</td>
</tr>
<tr>
<td>Zhangjiagang Huibang Machinery Co., Ltd</td>
<td>No.60 Building, No.2 Hanhai East Road, Guancheng Dist Henan Zhengzhou 450000 China (Mainland)</td>
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<td>86 371 53392380</td>
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<td><a href="http://www.aslanMachinery.com.com">www.aslanMachinery.com.com</a></td>
<td>Supply Best Quality Chili Powder Processing Machine &amp; Chili Grinder</td>
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<td>86 371 86680328</td>
<td>86 371 86680328</td>
<td><a href="mailto:doraMachinery@188.com">doraMachinery@188.com</a></td>
<td><a href="http://megaplantyu.com">http://megaplantyu.com</a></td>
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