

**PM Formalisation of
Micro Food Processing Enterprises (PM-FME) Scheme**

**HANDBOOK OF
PROCESSING OF RED CHILLI POWDER**



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CHAPTER 1

INTRODUCTION

1.1. Status and Market Size

Chilli is one of the most important commercial crops of India. It is grown almost throughout the country. There are more than 400 different varieties of chillies found all over the world. It is also called as hot pepper, cayenne pepper, sweet pepper, bell pepper, etc. Its botanical name is “*Capsicum annuum*”. The world’s hottest chilli “Naga Jolokia” is cultivated in hilly terrain of Assam in a small town Tezpur, India. Different varieties are grown for vegetables, spices, condiments, sauces and pickles. Chilli occupies an important place in Indian diet. It is an indispensable item in the

kitchen, as it is consumed daily as a condiment in one form or the other. Among the spices consumed per head, dried chilli fruits constitute a major share. Currently, chillies are used throughout the world as a spice and also in the making of beverages and medicines. If some varieties of chillies are famous for red colour because of the pigment ‘capsanthin,’ others are known for biting pungency attributed to ‘capsaicin.’ India is the only country which is rich in many varieties with different quality factors. Chillies are rich in vitamins, especially in vitamin A and C. They are also packed with potassium, magnesium and iron. Chillies have long been used for pain relief as they are known to inhibit pain messengers, extracts of chilli peppers are used for alleviating the pain of arthritis, headaches, burns and neuralgia. It is also claimed that they have the power to boost immune system and lower cholesterol. They are also helpful in getting rid of parasites of gut.

The fruit of chilli or *Capsicum* plants have a variety of names depending on place and type. It is commonly called chilli pepper, red or green pepper, or sweet pepper in Britain, and typically just capsicum in Australian and Indian English. The large mild form is called bell pepper in the US and Canada. It is called paprika in some other countries (although paprika can also refer to the powdered spice made from various capsicum fruit). The original Mexican term, chilli (now chile in Mexico) came from the Nahuatl word chilli or xilli, referring to a larger *Capsicum* variety cultivated since 3000 BC, as evidenced by remains found in pottery from Puebla and Oaxaca. It is universally called by different names such as Pimenton, Puvre de Guinee, Filfil

Ahmar, Paprika, Spaanse Peper, Peperone, Pimento, Struchkovy pyeret, Togarashi, Hesiung Yali chiao, Lal-mirch, etc.

In Indian subcontinent, chillies are produced throughout the year. Two crops are produced in kharif and rabi seasons in the country. Chilli grows best at 20–30°C. Growth and yields suffer when temperatures exceed 30°C or drops below 15°C for extended periods. The crop can be grown over a wide range of altitudes from sea level upto nearly 2100 meter.

Chillies are known from pre-historic times in Peru. They are believed to have originated in the tropical America. It is also said that chillies have originated in the Latin American regions of the New Mexico and Guatemala as a wild crop around 7500BC, as per the remains of the pre-historic Peru. The people native to these places domesticated this crop in and around 5000 BC,. Chilli is said to be the first ever domesticated crop in America. The three species *C. annuum*, *C. frutescens* and *C. chinense* evolved from a common ancestor located in the North of the Amazon basin (NW-Brazil, Columbia). Further evolution brought *C. annuum* and *C. frutescens* to Central America, where they were finally domesticated (in México and Panamá, respectively), whereas *C. chinense* moved to the West and was first put to cultivation in Perú. Two other species were first cultivated in Western South America: *C. baccatum* in the Peruvian lowlands and *C. pubescens* at higher elevations, in the Andes (Perú, Bolivia, Ecuador). at that time, chillies were cultivated by the farmers together with a primary crop to protect the primary crop from any damage from birds. Columbus carried chilli seed to Spain in 1493. The cultivation of chilli and *Capsicum* spread rapidly from Spain to Europe. The Portuguese brought capsicum from Brazil to India during the year 1584. Chillies became popular in the whole of Asia rapidly and native Asians started cultivating this crop as well. The south Asian climate suited this crop, and since its introduction in the 16 century has been increasingly cultivated in south Asia. Chillies are the cheapest spices available in India and are eaten across all groups of people. The most important chilli growing states in India are Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu, which together constitute nearly 75 per cent of the total area. Andhra Pradesh tops the list in dry chilli production followed by Tamil Nadu, Maharashtra, Orissa and Karnataka.

Chilli is a fruit of the plants '*Capsicum annuum*' and '*Capsicum frutescens*' that come from the genus '*Capsicum*,' belonging to the family of '*Solanaceae*,' which also includes tomato and potato. *Capsicum* is derived from the Greek word "Kapsimo"

meaning "to bite." Genus *Capsicum* is divided into three sections by Hunziker - Monotypic *Tubocapsicum* , *Pseudoacnistus* and *Capsicum*. All the species in the genus have $n=12$ except *C. ciliatum* and *C. scolnikianum* which have $n=13$. genus *Capsicum* includes 22 wild species and three varieties as well as five domesticated species and their wild relatives. In general domesticated species have larger but fewer fruits than its wild counterparts though seed per plant is about the same.

Chilli Plant is an annual sub-herb and the fruits vary in shape, size, colour and degree of pungency. *Capsicum* plants are herbaceous or semi-woody annuals or perennials. The leaves are ovate, tapering to a sharp point, measuring up to 15 cm, dark green on the upper surface and pale green on the lower surface. The flowers are small, white and borne singly or in clusters of 2 or 3 in the axils of the leaves. The fruits are of diverse shapes and sizes depending upon the variety.

1.1.1. Socioeconomic importance

Pungency in chilli is due to the alkaloid "capsaicin" contained in the pericarp and placenta of fruits, it produces mild to intense spice when eaten. Capsaicin is a potent inhibitor of substance P, a neuropeptide associated with inflammatory processes. The hotter the chili pepper, the more capsaicin it contains. The hottest varieties include Naga Jalokia, habañero and Scotch bonnet peppers. Jalapeños are next in their heat and capsaicin content, followed by the milder varieties, including Spanish pimientos, and Anaheim and Hungarian cherry peppers. Capsaicin is being studied as an effective treatment for sensory nerve fiber disorders, including pain associated with arthritis, psoriasis, and diabetic neuropathy. When animals injected with a substance that causes inflammatory arthritis were fed a diet that contained capsaicin, they had delayed onset of arthritis, and also significantly reduced paw inflammation.

1.1.2. Commercially grown varieties

Sl. No.	State	Variety
I	<u>SOUTH ZONE</u>	
1	Andhra Pradesh	Jwala, X-235, G-1, G-2, G-3, G-4, G-5, LCA-205, 206, 235, Karakulu, Sannalu, Dippayerupu, Punasa, Maduru, Pottibudaga, Hybrid, Bharat, Aparna, Pottikayalu, Cullakayalu, Barak, Mota, Chapta, Desi Sindu, Kiran, Chikkaballapur (Lavangi), Sapota.
2.	Karnataka	Jwala, Bayadgi, G-1, G-2, G-3, G-4, G-5, Pusa Jwala
3.	Kerala	Jwala, Sadabahar, Champa, CO-1, Nandan, K-1
4.	Pondicherry	K-1, K-2, CO-1, CO-2
5.	Tamil Nadu	K-1, K-2, CO-1, CO-2, CO-3, PMK-1, PMK-2, Borma Wonder, Sannam, Palam
II	<u>NORTH ZONE</u>	
6.	Bihar	Rori, Moti Mirchi, Chittee
7.	Haryana	NP-46-A, Pusa Jwala, Pusa Summer
8.	Himachal Pradesh	Solan Yellow, Hot Portugal, Pachad Yellow, Sweet Banana, Hungarian Wax, Punjab Lal
9.	Jammu & Kashmir	NP-46-A, Ratna Red, California Wonder
10.	Punjab	CH-1, Sanauri
11.	Uttar Pradesh	NP-46, Jwala Pant C-1, Desh, Pahadi, Kalyanpur, Chaman and Chanchal.
III	<u>EAST ZONE</u>	
12.	Assam	NP64-Am Pusa Jwala, Surya Mukhi, Krishna, Balijuri
13.	Tripura	Jwala, Suryamukhi, Krisha, Baliwai
14.	West Bengal	Siti and Suti, Akashi, Kajari, Bow, Dhani, Bullet, Dhala.
IV	<u>WESTERN ZONE</u>	
15.	Goa	Cacana, harmal, Tanvati, Lavangi
16.	Gujarat	K-2, Pant C-1, Jawahar-218, NP-46-A, Jwala.
17.	Rajasthan	CH-1, NP-46-A, Jwala, Pant C-1, G-3, G-5
IV	<u>CENTRAL ZONE</u>	
18.	Madhya Pradesh	Pusa Jwala, Sona-21, Jawahar, Sadabahar, Agni.
19.	Maharashtra	Pathori, Bugayati, Dhobri, Black seed, Chaski, Bhiwapuri
20.	Orissa	Jwala, Deshi, Sadabahar.

1.1.3. Cultivation Scenario

Harvesting is done when the pods are well ripened and partially withered in the plant itself. The harvested pods are kept in heaps either indoor or in shade away from direct sun light for 2 or 3 days so as to develop uniform red colour and then dried in the sun by spreading them on clean dry polythene sheets, cemented / concrete drying yards etc. Pods are spread out in thin layers for uniform drying with frequent

stirring to prevent mold growth and discolouration. The dried pods are heaped and covered by clean gunny bags / polythene sheets. The moisture content of dry pods are kept at 8- 10 %. Improved drying system could be used to ensure cleanliness and uniform colour of the product.

1.1.4. Production status red chilli powder

Chilli is raised over an area of 1832 thousand hectares in the World, with a production of 2959 thousand tons. Major chilli growing countries are – India, China, Indonesia, Korea, Pakistan, Turkey and Sri Lanka in Asia; Nigeria, Ghana, Tunisia and Egypt in Africa; Mexico, United States of America in North – Central America; Yugoslavia, Spain, Romania, Bulgaria, Italy and Hungary in Europe and Argentina and Peru in South America. India is the world (Source: FAO) leader in chilli production followed by China and Pakistan. This shows that the bulk share of chilli production is in Asian countries, though it is Countrywise production. produced throughout the world. The top 10 chilli producing countries, India, China, Ethiopia, Myanmar, Mexico, Vietnam, Peru, Pakistan, Ghana and Bangladesh. Accounted for more than 85% of the world production in 2009, the lion's share is taken by India with 36% share in global production, followed by China (11%), Bangladesh (8%), Peru (8%) and Pakistan (6%). India, the largest producer of chillies, is having annual (Source: FAO) chilli production of around 14 lakh tonne, China with a production of around 4.5 lakh tons, Mexico with the production of around 4 lakh tons and Pakistan producing 3.5 lakh tons of chilli are other major producer of chillies.

1.1.5. Production and yield of red chilli powder in major states in India

India is not only the largest producer but also the largest consumer of chilli in the world. Chillies are the most common spice cultivated in India. Chilli is a universal spice of India. It is cultivated in all the States and Union Territories of the country. India contributes about 36% to the total world production. In India, Chillies are grown in almost all the state throughout the country. Andhra Pradesh is the largest producer of Chilli in India and contributes about 26% to the total area under Chilli, followed by Maharashtra (15%), Karnataka (11%), Orissa (11%), Madhya Pradesh (7%) and other states contributing nearly 22% to the total area under Chilli. The production of Chilli in India is dominated by Andhra Pradesh which contributes nearly 57% to the total production. Karnataka is the second largest producer

contributing 12% to the total production followed by Orissa (5%), West Bengal (5%), Maharashtra (4%), Madhya Pradesh (3%) and others about 14% during 2006-07. The major chilly growing districts in Andhra Pradesh are Guntur, Warangal, Khammam, Krishna and Prakasham. Guntur is the biggest chilli producing region, contributing 30% to the total production of AP with annual Source (Spice Board, India) turnover of around Rs.600 crore. Area and Production of Chilli in this area decides the prices at National level. Chilli production in India is moving northwards on increasing demand from diversified sectors and changing consumption patterns. Dry chilli production rose by nearly 43% from 8.7 lakh tonnes in 1997 - 98 to 12.5 lakh tonnes in 2007 - 08. India harvested a bumper crop from 1998 to 2001, with an average yield of 1174.25 kg/ha. Crop damage due to floods in major producing regions of South India, particularly in 2005 - 06, resulted in a sharp decline in production to 10.14 lakh tonnes. In 2007 - 08, the total acreage brought under chilli cultivation is around 7.2 lakh ha, an increase from last year's 7 lakh ha. Rising export demand coupled with higher price realization in the domestic market have motivated farmers to bring more area under chilli cultivation.

1.1.6. Composition & Nutritive Value of red chilli powder

Fresh Chilli peppers are very rich in vitamin C: i.e. 111.0 mg. per 74 grams in comparison to only 37 mg. in oranges, which makes them very effective as immune system stimulants and healing agents especially for cellular damage. Many folk remedies recommend Chilli pepper in wound cleaning preparations for gangrene and open sores and even as a styptic, though more modern sources generally advise against using Chilli on broken skin. While drying, Chilli loses most of its vitamin C, it increases the vitamin A content by 100 times. Vitamin A is a powerful anti-oxidant and anti-inflammatory agent. Chilli preparations have been used as a gargle to treat sore throat and laryngitis. Surprisingly, it has been shown that Chillies do not aggravate or cause stomach ulcers. In fact, they have a preventative effect, as stomach ulcers are mostly caused by bacteria and it's antibacterial action kills such bacteria. In folk-medicine they have also long been used to treat worms. Chilli has a very beneficial effect on the circulatory system. Studies have shown that it counteract on cholesterol build up and reduces platelet aggregation, thus reducing the risk of heart attacks and strokes. It also lowers high

blood pressure and increase peripheral circulation.

Parameters	Value {Per 100 gms}	
	<u>CHILLIES DRY</u>	<u>CHILLIES (GREEN)</u>
Moisture	10.000 gm	85.700 gm
Protein	15.000 gm	2.900 gm
Fat	6.200 gm	0.600 gm
Minerals	6.100 gm	1.000 gm
Fibre	30.200 gm	6.800 gm
Carbohydrates	31.600 gm	3.000 gm
Energy	246.000 K cal	29.000 K gm
Calcium	160.000 mg	30.000 mg
Phosphorus	370.000 mg	80.000 mg
Iron	2.300 mg	4.400 mg
Vitamins		
Carotene	345.000 µg	175.000 µg
Thiamine	0.930 mg	0.190 mg
Riboflavin	0.430 mg	0.390 mg
Niacin	9.500 mg	0.900 mg
Vitamin C	50.000 mg	111.000 mg
Minerals & Trace Elements		
Sodium	14.000 mg	--
Potassium	530.000 mg	--
Phytin Phosphorus	71.000 mg	7.000 mg
Magnesium	--	272.000 mg
Copper	--	1.400 mg
Manganese	--	1.380 mg
Molybdenum	--	0.070 mg
Zinc	--	1.780 mg

Chromium	--	0.040 mg
Oxalic Acid	--	67.000 mg
<u>Caloric values</u>		
Chilli (Dry)	297	
Chilli (Green)	229	

Source : The National Institute of Nutrition, Hyderabad.

Phytochemical composition

Capsaicin:

Molecular formula - C₁₈H₂₇NO₃

Chemical formula: 8-methyl-N- Vanillyl-6-nonenamide

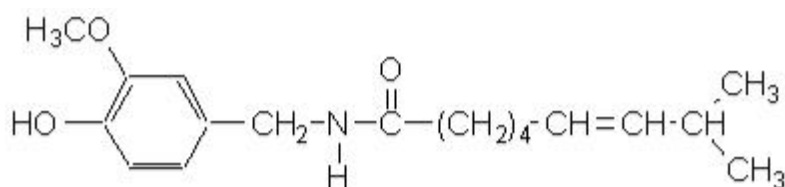


Fig: Chemical Structure of Capsaicin

The amount of capsaicin in hot peppers varies very significantly between varieties, and is measured in Scoville Heat Units (SHU). Colour is the first notable characteristic of food and often predetermines or “colours” our expectation. We use colour as a way to identify food and a way to judge the quality of food. Studies demonstrate that colour predetermines our expectations of flavor and taste. The colour of chillies is no guide to the intensity of their flavour. All chillies begin life green and turn yellow or red as they ripen, although there is no rule that green or red is hotter.

1.2. Indian Market Outlook

Indian states like Andhra Pradesh, Gujarat, Rajasthan, Orissa and Madhya Pradesh are the five leading states for the production of spices. The new age urban population around the world is extremely health conscious which is causing rise in demands for organic spices. The three biggest clients of spice manufacturers include retail, industrial and catering sector.

Andhra Pradesh leads the country in the production of chilli, with 49%.

Spices are generally sold at premium prices and also in greater demand which can further enhance export revenues in major spice producing countries. Spices farming mechanism starts at grass root level conserving the generative and renewing capacity of the soil, plant nutrition, and soil management, yields nutritious food rich in vitality which has resistance to diseases. Increasing demand of natural flavoring and coloring agents in food, medicinal properties and health benefits are driving the spices market. There is high demand for spices from regions like Asia Pacific, Middle East and Europe.

CHAPTER 2

Processing of Red Chilli Powder

2.1. Process Flow chart for Production of Red chilli Powder

Harvesting

Drying

Shorting/ Grading

Dry Cleaning

Stem Cutting

Crushing/ Milling

Sieving

Vacuum Conveyor

Powdered Red Chilli

Packing

2.2. Harvesting

Harvesting is done when the pods are well ripened and partially withered in the plant itself. The harvested pods are kept in heaps either indoor or in shade away from direct sun light for 2 or 3 days so as to develop uniform red colour.

- i) Harvesting should be done during early mornings, It should be avoided during rains or just after rains.
- ii) While harvesting fruits, care should be taken to hold stalks firmly and fruit should be pulled upward gently, breaking the base of the stalk.

- iii) For dry chillies, care should be taken that the fruit should not be ripened or over ripened.
- iv) The harvesting should not be delayed as delayed harvesting gives
- v) The harvested fruits should be heaped indoor for 2-3 days, so that the partially ripe fruits, allows the whole produce to develop a uniform red colour.
- vi) The best temperature for ripening is 22-25o C and direct sunlight is to be avoided since this can result in development of white patches.

2.3. Drying

Drying in the sun by spreading them on clean dry polythene sheets, cemented / concrete drying yards etc. Pods are spread out in thin layers for uniform drying with frequent stirring to prevent mold growth and discolouration. The dried pods are heaped and covered by clean gunny bags / polythene sheets. The moisture content of dry pods are kept at 8- 10 %. Improved drying system could be used to ensure cleanliness and uniform colour of the product.

After removing the extraneous matters like plant parts, etc well dried pods should be packed in clean, dry gunny bags and stored ensuring protection from dampness. Dunnage should be provided to stack the packed bags to prevent moisture ingress from the floor. Care should be taken to stack the bags at 50 –60 cm away from the wall. Storing chillies for longer period may lead to deterioration. However, if cold storage facilities are used, the product may be stored for 8-10 months. Insects, rodents and other animals should be effectively prevented from getting access to the premises where chilli is stored

Traditional Sun drying

- Chillies on harvesting have a moisture content of 65-80% depending on whether partially dried on the plant or harvested while still succulent, this must be reduced to 10% to prepare dried spice.
- Traditionally, this has been achieved by sun - drying of fruits immediately after harvesting without any special form of treatment.
- Sun drying even to day is the most widely used method in the world.

- Immediately after harvesting of fresh fruits, they are heaped indoors for 2 or 3 days, so that the partially ripe fruits if any are ripen fully and whole produce develops a uniform red colour.
- The best temperature for ripening is 22-25°C and direct sun light should be avoided which can cause development of white patches
- Heaped fruits then spread out in the sun on hard dry ground or on concrete floors or even on the flat roofs of houses. Frequent stirrings are given during day time in order to get uniform drying and thereby no discolouration or mould growth.
- The drying fruits are heaped and covered by tarpaulins or gunny bags during nights and spread during day time.

After 2 or 3 days, the larger pods are flattened by trampling or rolling to facilitate subsequent packing into bags for storage and transport.

- Drying by this procedure takes 5-15 days depending on prevailing weather.
- Out of 100 kg of fresh fruits, 25-35kg of dried fruits may be obtained.
- Fresh produce dried on open spaces like roadsides and remain exposed to weather for the entire drying period (5-15 days) may cause contamination with dust and dirt, damaged by rainfall animals, birds and insects. The losses may range 70-80% of total quantity due to this method.
- Traditional method of harvesting and sun drying involved poor handling of fruits results in bruising and splitting.
- Bruising causes discoloured spots on pods, splitting leads to an excessive amount of loose seeds in a consignment, and there is a considerable loss in weight and then in price.
- If the harvested fruits are not properly dried and protected from rain and pests, it will loose the colour, glossiness and pungency.

Improved CFTRI method of sun - drying:

- CFTRI has developed a four - tier system of wire - mesh trays or a single tray of perforated Aluminium. It took 14 days in sun to dry fruits having a moisture content of

72 to 74% reducing it to about 6%, the traditional method of sun drying takes about 3 weeks to achieve a moisture level of 15-20%.

2.4. Shorting and grading

Sorting is the process of grouping according to size, shape, weight, image and color. Grading is pre-requisite for development of the modern marketing, trade and economy of any commodity. The Indian chillies are graded mostly by farmers on the basis of colour and size, before they are brought in the market. The damaged discoloured and immature pods are removed depending on market demand. However, at traders level the other important quality parameter are moisture and stalks. Excess moisture add weight to the pods but give room to various fungi to grow. Similarly, if the stalk of the pods is broken, exposing the seeds entirely, the seeds may fall out. On the other hand in absence of optimum moisture the pods may break and let off the seeds. Thus the seed and pod ratio in a lot is also a valuable parameter of grade.

Apart from the apparent characters of colour, size, moisture and stalk of the pods, the following features also have weightage in grading chillies.

- a) Seed and fruit (pod) ratio
- b) Seed size and hardness
- c) Thickness of the skin of the pod and
- d) Pungency.

For different purposes, the varieties of chillies are chosen by the end user. End users are mainly of two types. Such as domestic retail users and industrial wholesale users. Industrial users who prepares Chilli powder gives preference for colour-pungency, fleshy skin and less seeds. Whereas, the domestic users prefer all varieties for different occasions. There are several local and conventional grades followed by the farmers, village merchants and itinerant merchants. The visual assessment of grades by seeing the lots/heaps and by picking hand full of pods and analyzing them to enable the traders to adequate and assess the prices both in open and closed auction.

2.5. Dry Cleaning

Cleaning the spice prior to packaging and sale, is to ensure that the spice is of the highest quality and will obtain the highest price. Cleaning should remove all the foreign matter that lowers the quality and endangers the sale.

The first step majorly is of de-stoning & leaf removing. Vibratory sieves are used to remove sand, small stones, seeds & dust particles & air blower is used to remove leafs.

2.6. Steam Cutting

Chillies stem cutting machine is generally used to cut the stem of the red chillies in bulk amount saving the time and labour costs. By using this machine the red chillies stems are easily cut. This machines are generally used in mirchi powder making companies.

2.7. Crushing/ Milling

Process of milling is commonly also known as grinding process. Under this process the crushed parts are milled & grinded to powder form. After 2-3 rounds of proper grinding fine chili powder is obtained.

2.8. Sieving

Centrifugal sifter with fine mesh can be used & replaced with traditional sifters. The internal shaft with rubber blades rotate to break the lumps along with it passing through desired size of fine mesh to get smooth fine chili powder.

2.9. Vacuum Conveyor

Used to convey the powder form of chilli to one place from another within the premises

2.10. Powder chilli packing

Red Chilli Powder Should having 8% moisture content for safe storage.

Mostly packed in plastic pouches.

CHAPTER 3

Packaging of Red Chilli Powder

3.1. Deteriorating factors

In order to select a suitable packaging material/ type of package for Red chilli powders, it is essential to know the factors which affect the quality of Red chilli powder.

3.1.1. Moisture Content

Red chilli powder is hygroscopic in nature and picks-up moisture from the atmosphere resulting in sogginess and caking/ lumping of the powder. Pick-up of moisture also results in loss of free-flowing nature of the Red chilli powder.

3.1.2. Loss of Aroma / Flavour

Red chilli powder contains volatile oils, which impart the characteristic aroma/flavour to the product. Losses in the volatile oil content or oxidation of some aromatic compounds result in aroma and flavour loss.

3.1.3. Discolouration

Red chilli powders contain natural pigments. Light can affect the pigments resulting in loss or fading of colour and deterioration.

3.1.4. Insect Infestation

Red chilli powder is prone to spoilage due to insect infestation, which can be further accelerated due to high humidity, heat and oxygen.

3.1.5. Microbial Contamination

In high humidity condition of 65% and above, moisture absorption occurs. Beyond a certain level of moisture content, spoilage due to microbial growth sets in.

3.2. Packaging requirements of Red Chilli powder

In order to maintain the quality of the Red chilli powder during handling, transportation, storage and distribution, the packaging material to be used is to be selected with care, keeping in mind the functional as well as the marketing requirements.

The packaging requirements for Red chilli powder, in general, are listed below:

- To protect the product from spillage and spoilage.
- To provide protection against atmospheric factors such as light, heat, humidity and oxygen. The selected packaging materials should have high water vapour and oxygen barriers.
- The packaging material should have a high barrier property to prevent aroma/flavour losses and ingress of external odour.
- The volatile oil present in the spice product has a tendency to react with the inner/ contact layer of the packaging material, at times leading to a greasy and messy package with smudging of the printed matter. The packaging material should therefore be grease and oil resistant and compatible with the product.
- Besides the above functional requirements, the packaging material should have good machinability, printability and it should be easily available and disposable.

3.3. Packaging materials for Red Chilli powder

3.3.1. Bulk packaging

In bulk packaging, the current trend is to use Flexible Intermediate Bulk Containers (FIBCs) commonly known as Jumbo bags. These bags have a capacity of up to 1 tonne. In general these bags are made from cloth, but at present mainly from plastic (PP) fabric, which can be laminated or provided with an inner plastic liner bag. The PP fabric is stabilized against UV degradation. The bags are provided with filling and discharge spouts and slings for hanging during loading/ unloading operations.

The FIBCs offer various advantages such as:

- 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 mechanised, less labour is required
- Saving in time for loading and unloading

- Bags are light in weight and, therefore, freight costs are reduced

3.3.2. Institutional packages

Institutional packs of capacities ranging from 2kg to 10kg are also used. The traditional materials that were used such as tinplate containers and jute bags are currently being replaced by materials such as laminated flexible pouches and plastic woven sacks. The sacks are usually BOPP multicolor Printed laminated PP Woven bags. These bags may be gusseted and have window and micro perforation.

3.3.3. Consumer Packages

The options available to the traders/exporters of Red chilli powder in the selection of a consumer pack for domestic and export market are quite wide. However, the selection/choice of the packaging material/ system depends upon a number of factors, which are broadly listed below:

- Shelf-life period i.e. the degree of protection required by the product against moisture pick-up, aroma retention, discolouration etc. (this is more critical in case of powdered Red chilli powder)
- Climatic conditions during storage, transportation and distribution
- Type/ sector of market
- Consumer preferences
- Printability and aesthetic appeal

The package types generally used as consumer packs are:

- 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, grinding etc.
- Printed tinplate container with/without dispensing systems
- Composite containers with dispensers

- Plastic containers with plugs and caps with dispensing and tamper evidence features
- Printed flexible pouches – pillow pouch, gusseted pouch, stand-up pouch.
- Lined cartons

The printed flexible pouches have recently become very popular due to their easy availability, excellent printability, light weight, machinability and cost-effectiveness. Also, depending upon the functional and marketing requirements, the laminate/film can be tailor made to serve a specific need.

The printed flexible pouches are generally laminates of various compositions. Some of the commonly used laminates are:

- Polyester/ metallised polyester/LDPE
- BOPP/LDPE
- BOPP/ metallised polyester/LDPE
- Polyester/Al foil/LDPE

3 ply laminates such as 12 μ PET/ Print/ 12 μ Met. PET/ PE can avoid delamination and prevents smudging and de-figuring of the print.

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 12 μ thick. The film is highly transparent with excellent clarity, gloss and printability thus enhancing the sales appeal. The film has very low moisture and gas permeability and, therefore, ensures prolonged shelf life of the contents with aroma, flavour and taste retention. The very high mechanical strength (tear, puncture, burst and flex) minimises damage to the contents during handling and transportation. The film has good machinability as well as printability. The latest printing technologies help in improving sales promotions. 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, crystal clear and has high mechanical strength and non-contamination property for food contact applications.

The following table shows the packaging specifications for flexible packs of ground consumer spices, framed by the Indian Institute of Packaging.

Laminates/Co-extruded films (up to 500 grams capacity)	Laminates/Co-extruded films (up to 1000 grams capacity)
12 μ PET / 37.5 μ LD-HD (30% HD)	12 μ PET/50 μ LD-HD (30% HD)
12 μ MET PET / 37.5 μ LD-HD (30% HD)	12 μ MET PET / 50 μ LD-HD (30% HD)
12 μ PET / 50 μ PP	12 μ PET / 62.5 μ PP
12 μ MET PET / 50 μ PP	12 μ MET PET / 62.5 μ PP
10 μ PET / 9 μ Al. foil / 37.5 μ LD-HD (30% HD)	10 μ PET / 9 μ Al. foil / 50 μ LD-HD (30% HD)
12 μ Al. foil / 37.5 μ LD-HD (30% HD)	12 μ Al. foil / 50 μ LD-HD (30% HD)
25 μ BOPP / 37.5 μ LD-HD (30% HD)	25 μ BOPP / 50 μ LD-HD (30% HD)
25 μ MET BOPP / 37.5 μ LD-HD (30% HD)	25 μ MET BOPP / 50 μ LD-HD (30% HD)
35 μ BOPP / 25 μ BOPP	35 μ BOPP / 35 μ BOPP
30 μ LD – 7.5 μ Tie - 25 μ PA – 7.5 μ Tie - 30 μ LD-HD (30% HD)	30 μ LD – 7.5 μ Tie - 30 μ PA – 7.5 μ Tie - 40 μ LD-HD (30% HD)
The LD or LD-HD layer could also be LLD (outer) or LLD-HD (inner or outer) or EAA layer (outer)	The LD or LD-HD layer could also be LLD (outer) or LLD-HD (inner or outer) or EAA layer (outer)

The types of sealing of pouches from flexible plastic based materials could be variable:

- Centre seal formation
- Three sides seal formation

- Four sides seal formation
- Strip pack formation

The vital link in the performance of the pouch is the seal integrity. The performance of the heat seal layer is very important. Even if the film structure has been designed with exceptional properties, with excellence in interlayer lamination, if the sealing of the pouch fails, the product may get contaminated and in some cases become unfit for consumption.

CHAPTER 4

Food Safety Regulations & Standards

4.1 Definition and Standards: According to the FSSAI standards, Chillies and Capsicum (Lal Mirchi) powder means the powder obtained by grinding clean ripe fruits or pods of *Capsicum annum* L and *Capsicum frutescens* L. It shall be free from mould, living and dead insects, insect fragments, rodent contamination. The powder shall be dry, free from dirt, extraneous colouring matter, flavouring matter, mineral oil and other harmful substances. The chilli powder may contain any edible vegetable oil to a maximum limit of 2.0 percent by weight under a label declaration for the amount and nature of oil used.

The standards of Red Chilli powder:

Parameters	Limits
Moisture	Not More than 11.0% by weight
Total ash on dry basis	Not more than 8.0 percent by weight
Ash insoluble in dilute HCl on dry basis	Not more than 1.3 percent by weight
Crude fibre	Not more than 30.0 percent by weight
Non-volatile ether extract on dry basis	Not less than 12.0 percent by weight

The Microbial standards for Red Chilli powder are as follows:

Sl. No	Requirements	Standards
1	Salmonella	Absent in 25 gm

The Microbial standards for Red Chilli powder are as follows:

Sl. No	Name of Residues	Tolerance limit mg/kg.ppm)
1	Carbaryl	5.00
2	Dicofol	1.00
3	Dimethoate (residue to be determined as dimethoate and expressed as dimethoate)	0.5
4	Endosulfan	1.0
5	Monocrotophos	0.2
6	Dithiocarbamates	1.0
7	Quinolpos	0.2

4.2 Food Safety

Part I - General Hygienic and Sanitary practices to be followed by Petty Food Business Operators applying for Registration (See Regulation 2.1.1(2))

SANITARY AND HYGIENIC REQUIREMENTS FOR FOOD MANUFACTURER/PROCESSOR/HANDLER

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.
2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.
3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.
4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.
6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.
7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.
8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).
9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.
10. All equipments shall be placed well away from the walls to allow proper inspection.
11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.
13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.
14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time

after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.

15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.

16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.

17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.

18. The vehicles used to transport foods must be maintained in good repair and kept clean.

19. Foods while in transport in packaged form or in containers shall maintain the required temperature.

20. Insecticides / disinfectants shall be kept and stored separately and away from food manufacturing / storing/ handling areas.

4.3 LABELLING

Labeling Requirements

All food products sold in India that are prepackaged are required to comply with the Food Safety and Standards (Packaging and labelling) Regulations, 2011. The Food Safety and Standards Regulation, 2011 is a notification issued by the Food Safety and Standards Authority of India under the Ministry of Health and Family Welfare. In this article, we look at the regulations pertaining to food labelling in India.

Applicability of Food Labelling Regulations

The food labelling regulations require all “Prepackaged” or “Pre-packed food” to comply with the labelling regulations in India. As per the rules, prepackaged food means food, which is placed in a package of any nature, in such a manner that the contents cannot be changed without tampering it and which is ready for sale to the consumer.

General Labelling Requirements

The following labelling requirements must be complied with by all prepackaged food sold in India:

- The label must be in English or Hindi or Devnagri language. In addition to the above, the label can contain information in any other language, as required.
- The label must not contain information about the food that could be deemed to be false, misleading, deceptive or otherwise create an erroneous impression regarding the product.
- The label must be affixed to the container in such a manner that it would not easily be separated from the container.
- The contents or information presented in the label should be clear, prominent, indelible and readily legible by the consumer.
- If the container is covered by a wrapper, then the wrapper must contain necessary information or make the label of the product inside readily legible by not obscuring.
- The name of the food must be mentioned along with the trade name and description of the food contained. In case the food contains more than one ingredient, then a list of ingredients must be presented in descending order of their composition by weight or volume, as the case may be, at the time of its manufacture;

4.4 Nutritional Information

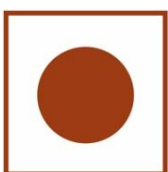
Nutritional Information or nutritional facts per 100 gm or 100ml or per serving of the product must be given on the label along with the following information:

- energy value in kcal;
- the amounts of protein, carbohydrate (specify the quantity of sugar) and fat in gram (g) or ml;
- the amount of any other nutrient for which a nutrition or health claim is made:

- It is important to note that any “health claim” or “nutrition claim” or “risk reduction” claim made in the label will be thoroughly scrutinized by the FSSAI authorities. Hence, any such claim must be validated by test data. As per the rules, the following is the definition for “health claim”, “nutrition claim” and “risk reduction” claim:
- “Health claims” means any representation that states, suggests or implies that a relationship exists between a food or a constituent of that food and health and include nutrition claims which describe the physiological role of the nutrient in growth, development and normal functions of the body, other functional claims concerning specific beneficial effect of the consumption of food or its constituents, in the context of the total diet, on normal functions or biological activities of the body and such claims relate to a positive contribution to health or to the improvement of function or to modifying or preserving health, or disease, risk reduction claim relating to the consumption of a food or food constituents, in the context of the total diet, to the reduced risk of developing a disease or health-related condition;
- “Nutrition claim” means any representation which states, suggests or implies that a food has particular nutritional properties which are not limited to the energy value but include protein, fat carbohydrates, vitamins and minerals;
- “Risk reduction” in the context of health claims means significantly altering a major risk factor for a disease or health-related condition;

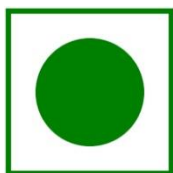
Veg or Non-Veg Symbol

All packaged food that is “Non-Vegetarian” must have a symbol that is a brown colour filled circle inside a square with a brown outline. If a food contains only egg as a non-vegetarian ingredient, then the manufacturer may provide a declaration that the product contains only egg and add the non-vegetarian symbol.



Non-Veg Symbol

Packaged vegetarian food should have a symbol that consist of green colour filled circle inside a square with green.



Veg Symbol

Information Relating to Food Additives, Colours and Flavours

Food additives contained in the food product must be mentioned along with class titles along with the specific names or recognized international numerical identifications. Addition of colouring matter should be mentioned on the label along with certain statements like “CONTAINS PERMITTED NATURAL COLOUR(S)”, just beneath the list of the ingredients on the label. In case of addition of extraneous flavouring agent, then it should be mentioned in a statement like “CONTAINS ADDED FLAVOUR” just beneath the list of ingredients on the label.

Name and Complete Address of the Manufacturer

The name and complete address of the manufacturer must be mentioned on every package of food. In the case of imported food, the package must contain the name and complete address of the importer in India.

Net Quantity

All packaged food must carry the net quantity by weight or volume or number, as the case may be. The net quantity of the commodity contained in the package must exclude the weight of the wrappers and packaging materials.

Lot Number of Batch Identification

A lot number or batch number or code number must be mentioned on all packaged food so that it can be traced while manufacturing and distribution. Only bread and milk including sterilised milk are not required to comply with this regulation.

Date of Manufacture or Packing

The date, month and year in which the commodity is manufactured, packed or pre-packed must be mentioned on the label. In the case of food products having a shelf life of more than three months, then the month and the year of manufacture can be given with the “Best Before Date”. In case of products having a shelf life of fewer than three months, the date, month and year in which the commodity is manufactured or prepared or pre-packed must be mentioned on the label with best before date.

Country of Origin for Imported Food

For imported food, the country of origin of the food should be declared on the label of the food. In case a food product undergoes processing in a second country which changes its nature, the country in which the processing is performed should be considered to be the country of origin for the purposes of labelling.

Instructions for Use

Instructions for use, including reconstitution, should be included on the label, if necessary, to ensure correct utilization of the food.

Manufacturers List of Food Processing Machineries

S.no	Name of the company	Machineries
1.	MMM Buxabhoy & Co 140 Sarang Street 1st Floor, Near Crawford Market Mumbai India Tel: +91 22 2344 2902 Fax: +91 22 2345 2532 yusufs@vsnl.com; mmmb@vsnl.com; yusuf@mmmb.in	Packaging and labelling machines
2.	Acufil Machines S. F. No. 120/2, Kalapatty Post Office Coimbatore - 641 035 Tamil Nadu India Tel: +91 422 2666108/2669909 Fax: +91 422 2666255 Email : acufilmachines@yahoo.co.in	Dryer; Packaging and labelling machines
3.	Bombay Engineering Works,	Dryer

	1 Navyug Industrial Estate 185 Tokersey Jivraj Road Opposite Swan Mill, Sewree (W) Mumbai 400015 India Tel: +91 22 24137094/24135959 Fax: +91 22 24135828	
4.	Planters Energy network (PEN) No 5, Power House 3rd Street N R T Nagar Theni 625531 Tamil Nadu India Tel: +91 4546 255272 Fax: +91 4546 25527	Dryer
5.	Premium Engineers Pvt Ltd Plot No 2009, Phase IV, GIDC Vatva, Ahmedabad 382445 India Tel: +91 79 25830836 Fax: +91 79 25830965	Dryer; Milling & grinding machinery
6.	Central Institute of Agricultural Engineering, Nabi Bagh Berasia Road Bhopal 462 038 Madhya Pradesh India Tel: +91 755 2737191 Fax: +91 755 2734016	Slicing machinery; Cleaning machinery; Milling & grinding machinery
7.	Gardners Corporation 158 Golf Links New Delhi 110003 India Tel: +91 11 3344287/3363640 Fax: +91 11 3717179	Slicing machinery; Cleaning machinery; Milling & grinding machinery; Packaging and labelling machines
8.	Rajan Universal Exports Post Bag no 250 162 Linghi Chetty Street Chennai 600 001 India Tel: +91 44 25341711/25340731/25340751 Fax: +91 44 25342323	Cleaning machinery; Milling & grinding machinery
9.	Gurdeep Packaging Machines Harichand Mill compound LBS Marg, Vikhroli Mumbai 400 079 India Tel: +91 22 2578 3521/577 5846/579 5982 Fax: +91 22 2577 2846	Packaging and labelling machines

10.	Rank and Company A-p6/3, Wazirpur Industrial Estate Delhi – 110 052 India Tel: +91 11 7456101/ 27456102 Fax: +91 11 7234126/7433905 E-mail: Rank@poboxes.com	Dryers
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