



PM Formalisation of Micro Food Processing Enterprises Scheme

Processing of Large Cardamom Powder



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CHAPTER 1

INTRODUCTION

1.1 Introduction

Large cardamom commonly known as 'badi elachi' in Hindi is indigenous. Grows in evergreen forests of sub Himalayan tracts. Large cardamom, a shade loving plant, grows well in the altitudes of 600-2000m receiving annual rainfall of 2000-3500 mm apportioned over 200 days. Cloudy conditions prevail for most of the monsoon period. The flowering season begins early in the lower altitudes with peak flowering during March-April, while it is late in the higher altitudes with a peak period during June-July. The fruit is a trilocular, many seeded capsule. The capsule wall is echinated having reddish-brown to dark-pinkish to maroon colour. The seeds are di-angular, whitish when immature and become dark greyish towards maturity. Usually the capsules which are formed at the basal portion of the spike are bigger and bolder than others. The seeds contain about 2-3 per cent essential oil, a powerful flavouring agent and are used mainly as spice and for food flavourings.

Large cardamom dried fruit is a high-value, low-volume spice crop grown only in the three eastern Himalayan countries. It is widely used in foods, beverages, perfumes, and medicines. Production is currently declining, and improved post-harvest management would be one way to help ensure the sustainability of this niche crop. The value chain for large cardamom consists largely of traditional practices which should be scientifically refined during a number of post-harvest steps including marketing. The primary processing steps required by the present market are curing, tail cutting, and grading.

1.2 Present Status of National and Global Cardamom Market

The global cardamom market is projected to register a CAGR of 5.7% during the forecast period (2020-2025). The price of cardamom is unstable due to the irregular demand from the major importers such as Saudi Arabia and UAE amid COVID-19 pandemic and the decrease in the global supply of cardamom due to poor weather conditions.

India is the largest producer of large cardamom with 54% share in world production. The districts of Sikkim and the districts of Kalimpong and Darjeeling in West Bengal are among the leading producers of large cardamom in India. Furthermore, Uttarakhand, the North Eastern Hill states- Arunachal Pradesh, Nagaland, Mizoram, Manipur, Meghalaya and Assam too produce large cardamom. Other Himalayan countries in the sub-continent such as Bhutan and Nepal are also major cultivators of this spice and have recently witnessed a spike in the production and export of large cardamom

1.3 Readymade spice powder

Powdered spice in air tight packaging material is of enormous demand. Increasing urbanization paired with a rise in number of working women has reduced the time of cooking. Consequently, homemakers have started demanding readymade spice powder that includes chilli powder, cumin powder, fennel powder, black pepper powder, turmeric powder. Also popular are ready made paste of onion, garlic, ginger in packet form. An official report from Everest Spices Ltd. Reveals their exports about 10 per cent of its products to the US, West Asia, Singapore, Australia, New Zealand and East Africa, said: “The total market size of branded spices is estimated at 6,600 crore, and is growing at 14 per cent annually

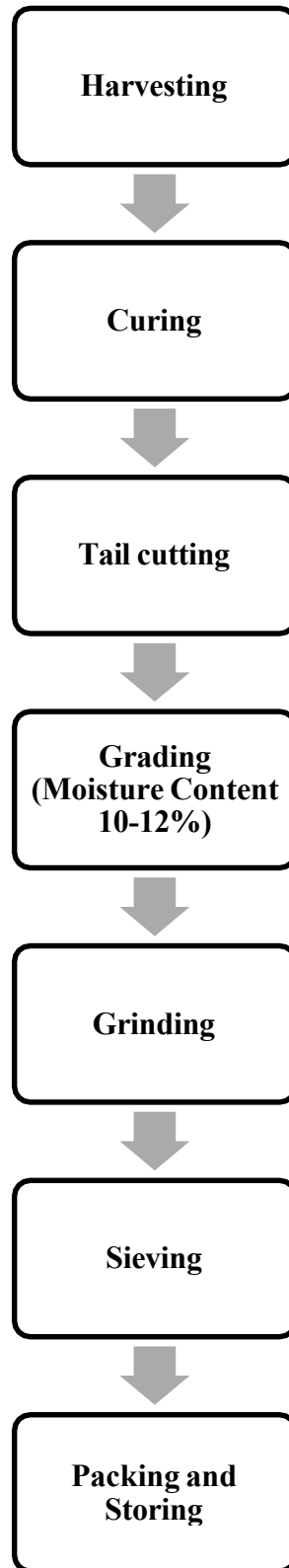
CHAPTER 2

PREPARATION OF LARGE CARDAMOM POWDER

2.1. Large Cardamom Powder

Large cardamom (*Amomum subulatum Roxb.*) is one of the popular spices that comes under the family Zingiberaceae. Eastern Himalayas region as its origin where wild species are still located. Cardamom is the world's third-most expensive spice, exceeded in price per weight only by vanilla and saffron. It is an ancient spice cum medicinal herb. India is the largest producer and exporter of large-cardamom (*Amomum subulatum Roxb.*). The other major producers of large-cardamom are Nepal and Bhutan. Its cultivation is confined in Eastern Himalaya covering Sikkim, West Bengal (Darjeeling hills) and Arunachal Pradesh. Large cardamom seeds are considered as an antidote to either snake venom or scorpion venom. It is also reported that large cardamom seeds are used as preventive as well as a medicinal measure for throat. The seeds of large cardamom have been used to flavor food, confections, beverages and liquids Furthermore, it has been used as an insecticide as well. Its usage in Ayurvedic is well known from prehistoric time. It is used as flavoring and preservative to different types of coffee, liquors, confections, beverages and tobacco. Volatile oil (2-4%) is the principal aroma-giving compound in large cardamom and 1,8- cineole is the major active compound after compound, in an extent 60 to 80% of the total volatile oil. Large Cardamom powder is produced by grinding of dried seeds with moisture content 10% to fine powder followed by sieving.

2.2 Flowchart for Processing of Large Cardamom Powder



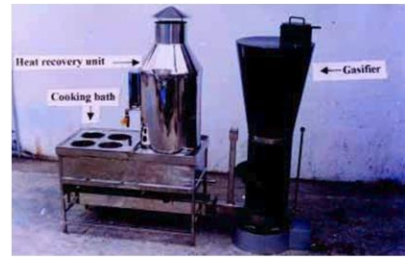
2.3. Equipment used in for processing of Large Cardamom Powder



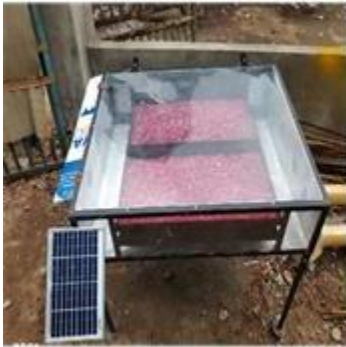
Traditional Bhatti



Modified Bhatti



Gasifier system



Solar drier



dryer



Pulversier



Vertical filling machine



Labelling machine

2.4. Large Cardamom Powder processing

Harvesting

- ✓ Fully matured capsules are harvested during September to November.
- ✓ The top most capsule in a spike ripens first and then in the bottom, so harvesting is assessed by opening the topmost capsule on a spike. However brown color of seeds indicates full maturity.
- ✓ When the topmost capsule is fully matured, the spike bearing shoots are cut at 45 cm height and left for another 10-15 days to ensure maturity of all the capsules.
- ✓ The spikes are harvested using a special knife known as an elaichi chhuri.
- ✓ The harvested spikes are stored for 2–3 days after harvesting, which makes it easier to separate the capsules.
- ✓ Separation is done by hand, and no device is available for this operation so far.
- ✓ The separated capsules are manually cleaned from other plant materials before curing.

Curing

- ✓ Curing operation will determine the quality of dried capsule so it is the most important step for large cardamom processing
- ✓ Freshly harvested capsule contains 80-85 per cent moisture.
- ✓ Curing is done to lower the moisture content to 10-12 per cent which is safe for storage.
- ✓ The weight ratio from fresh to cured capsule is 4:1 to 5:1.
- ✓ Some of the evaporable substances which are the part of essential oil are lost during curing
- ✓ Curing at too high temperature causes charring of capsules and loss of volatile oil, while too less temperature leads to mould growth.

- ✓ The ideal curing temperature must be 45-55°C.

Traditional curing (Bhatti)

- ✓ This curing system is constructed using mud and bricks.
- ✓ Raw cardamom capsules are spread over the drying platforms.
- ✓ Hot smokes from firewood are passed through the capsules.
- ✓ The process takes 35-40 hrs for complete drying.
- ✓ The bhatti operates with very poor operating thermal efficiency of the order of 5-15 per cent resulting in wastage of huge quantities of fuel wood.
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Modified bhatti (Flue pipe curing house)

- ✓ This is an indirect system of drying and smoke does not come in contact with the produce at any stage.
- ✓ Flue pipe is connected to a fire place with an exit provided outside the building.
- ✓ The capsules are spread over the floor/shelves as 17-24 hours, volatile oil content of 2-2.4 per cent.
- ✓ When the firewood is burnt, hot air passes through flue pipes and capsules gets dried by the heat generated.

- ✓ Proper ventilation is provided to control temperature inside the room. Since smoke does not come in contact with capsules, its original maroon colour is retained fetching better price in the market.
- ✓ The capacity of this system varies from 200 to 400 kg of fresh capsules.
- ✓ Drying time is reported as 17-24 hours, volatile oil content of 2-2.4 per cent.

Natural convection dryer

- ✓ This dryer with a thermal efficiency of about 5.6 is better than the conventional flue curing kilns.
- ✓ It can dry 300 kg large cardamom capsules at a time and for drying to a level of 10 per cent moisture the time required is 24 hrs

Gasifier curing system

- ✓ The solid fuel i.e., firewood through biomass gasification and thermo chemical reaction is converted into gaseous fuel by partial combustion.
- ✓ A mixture of producer gas consisting of carbon monoxide, hydrogen, methane, carbon dioxide and nitrogen is obtained, which is combustible and is used to burn.
- ✓ Through updraft type of biomass gasifier, air enters the gasifier from bottom and producer gas is taken out from top for curing cardamom.
- ✓ The quality of dried capsules is better in color and volatile oil content than traditional system.

Portable curing chamber

- ✓ Unit is made of a furnace curing chamber and an air heating system.
- ✓ All the four sides of the air-heating chamber are enclosed by asbestos sheets leaving the top for drying.

- ✓ Freshly harvested capsules are placed in wire mesh platform of 3-5 mm to a thickness of about 15-20 cm.
- ✓ Air around the furnace gets heated by burning firewood inside the furnace cylinder.
- ✓ Temperature inside heating chamber can be adjusted by regulating chimney valves and adjusting rate of burning firewood. 50 kg of raw capsules will get cured in 20 hours

Solar drier

- ✓ On an average 55.7 per cent of higher temperature was obtained in the solar dryer over the ambient temperature.
- ✓ It takes 24 hours (3 sunny days) for curing of capsules than open sun drying which takes 48 hours to obtain the same level of moisture contents resulting in a net saving of about 50 per cent of drying time for the solar dryer in comparison to the open sun drying.

Calyx cutting

- ✓ Calyx or tail is either removed by rubbing against wire mesh just after curing or removed manually with scissors. So far no devise is developed for this purpose.
- ✓ Capsules with the tail removed are graded as kainchicut and those with the tail intact as non-kainchi-cut.
- ✓ This operation is labor-intensive because extra labor is hired with extra cost.



With Calyx



Without Calyx

Grading

- ✓ There are four commercial grades of dried capsules

- badadana (big capsule),
 - chotadana (small capsule),
 - kainchi-cut (capsule tail removed) and
 - non-kainchi-cut (capsule tail intact).
- ✓ Manually operated sieves for grading are reported, but so far no mechanical grading machines have been developed.

Grinding

Large cardamom capsules are usually sold whole.

- ✓ Grinding can be a method of adding value to a product. However, it is not advisable to grind spices.
- ✓ After grinding, spices are more vulnerable to spoilage.
- ✓ The flavour and aroma compounds are not stable and will quickly disappear from ground products.
- ✓ The storage life of ground spices is much less than for the whole spices.
- ✓ Pulverizer is used to grind cardamom into powder followed by sieving to give uniformity to the product

Packaging and Storage

- ✓ Cardamom powder is packed in inert and rigid containers.
- ✓ Stored at dry and warm places to prevent reabsorption of moisture from the atmosphere

2.5. Impact of Processing of Large Cardamom Powder

- ✓ Large Cardamom Powder would loss flavour and aroma during grinding process.
- ✓ Curing of cardamom should be done below 50 °C as it will lead to loss of color which will impact the value of the product.

CHAPTER 3

PACKAGING OF LARGE CARDAMOM POWDER

3.1. Packaging

Packaging ensures safe delivery of the product to the ultimate consumer in good condition at minimal overall cost. Packaging can be defined as a method to protect and contain foods with the aim of minimizing the environmental impact of our consumption.

3.2. Functions of packaging

It is important to understand the functions of Large Cardamom Powder packaging to effectively select, design, and utilize noodle packaging systems. The functions of noodle packaging can generally be described as

1. Promoting and Selling the Product
2. Defining Product Identity
3. Providing Information
4. Expressing Customer Needs
5. Ensure Safe Use
6. Protecting the Product

3.2.1. Components of Large Cardamom Powder packaging

Like most food packages, cardamom packaging is usually composed of three components:



A primary package is defined as a package that is directly in contact with the Large Cardamom Powder product. It is mainly used to form a sealed microenvironment to protect and isolate the Large Cardamom Powder content from an unwanted environment (e.g., high humidity, oxygen, microbial) and other contamination from dust and undesired human contact.

Secondary package is the package that contains one or more primary packages. A secondary package can also be used to provide convenience in handling.

A tertiary package incorporates the secondary package in the final shipping and distribution. The purpose is to consolidate secondary packages and to assist in storage and handling and to provide an additional layer of protection. Examples are corrugated boxes, pallets, and stretch plastic films.

3.3. Requirements for effective food packaging

1. Be nontoxic
2. Protect against contamination from microorganisms
3. Act as a barrier to moisture loss or gain and oxygen ingress
4. Protect against ingress of odors or environmental toxicants
5. Filter out harmful UV light
6. Provide resistance to physical damage
7. Be transparent - be tamper – resistant or tamper – evident
8. Be easy to open
9. Have dispensing and resealing features
10. Be disposed of easily
11. Meet size, shape and weight requirements
12. Have appearance, printability features
13. Be low cost
14. Be compatible with food
15. Have special features such as utilizing groups of product together.

3.4. Characteristics of Large Cardamom Powder

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

Moisture Content: Spices, specifically spices in powder form, are hygroscopic in nature and pick-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 spice powder.

Loss of Aroma / Flavour Spices contain volatile oils, which impart the characteristic aroma/flavour to the product. Loss in the volatile oil content or oxidation of some aromatic compounds result in aroma and flavour loss.

Discolouration Some of the spices like green cardamom, red chillies, turmeric, saffron contain natural pigments. Light can affect the pigments resulting in loss or fading of colour and deterioration.

Insect Infestation Spices are prone to spoilage due to insect infestation, which can be further accelerated due to high humidity, heat and oxygen.

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.

3.5. Different packaging materials for packaging of Large cardamom powder Packaging

Bulk Packaging

- ✓ Bulk packing is the process or act of placing larger quantities of similar items into a larger single box/container to aid in the movement of product, create less refuse, and to prevent damage or pilferage to the smaller cartons or boxes.
- ✓ The jute bags may be provided with a loose liner bag of polyethylene or may be without a liner.
- ✓ The double gunny bag is provided with an inner polyethylene liner.

Jumbo bags (Flexible Intermediate Bulk Containers) (FIBCs) for export of spices. These bags have a capacity of **up to 1 tonne**

Why FIBC bags are used??

- ✓ Adaptability is its Forte.
- ✓ Swifter Packing of Materials.
- ✓ Non- Hazardous to Environment.
- ✓ Resourceful in Nature.
- ✓ Faster Speed in Transportation.

Institutional Packages

- ✓ **Institutional packaging** means the **institutional** consumer like transportation, Airways, Railways, Hotels, Hospitals or any other service **institutions** who buy **packaged** commodities directly from the manufacturer for use by that **institution**
- ✓ The traders also use institutional packs of capacities ranging from **2kg to 10kg**.
- ✓ The variety of packages used include **laminated flexible pouches and plastic woven sacks** which replace traditional material like tinsplate containers and jute bags

Consumer Packages

The options available to the traders/exporters of spices 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, discoloration etc. (this is more critical in case of powdered spices)
- 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

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, flavor and taste retention. The very high mechanical strength (tear, puncture, burst and flex) minimizes 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.

CHAPTER 4

FOOD SAFETY REGULATIONS AND STANDARDS OF LARGE CARDAMOM POWDER

4.1. FSSAI

FSSAI stands for Food Safety and Standards Authority of India which is an organization that monitors and governs the food business in India. It is an autonomous body which is established under the Ministry of Health & Family Welfare, Government of India. The FSSAI has been established under the Food Safety and Standards Act, 2006 (FSS Act) which is a consolidating statute related to food safety and regulation in India.

4.1.1. Functions of FSSAI

1. Framing of regulations to lay down food safety standards
2. Laying down guidelines for accreditation of laboratories for food testing
3. Providing scientific advice and technical support to the Central Government
4. Contributing to the development of international technical standards in food
5. Collecting and collating data regarding food consumption, contamination, emerging risks etc.
6. Disseminating information and promoting awareness about food safety and nutrition in India

4.2. Food Standards

FOOD SAFETY AND STANDARDS (FOOD PRODUCTS STANDARDS AND FOOD ADDITIVES) REGULATIONS, 2011

Regulation 2.9: SALT, SPICES, CONDIMENTS AND RELATED PRODUCTS

2.9.2: Cardamom (Elaichi)

2.9.2.6. Large Cardamom (Badi Elaichi) powder

Large Cardamom (Badi Elaichi) powder means the powder obtained by grinding seeds of *Amomum subulatum* Roxb, without the addition of any other substance. It may be in the form of small pieces

of seeds or in finely ground form. The powder shall have characteristic flavour free from off flavour, mustiness and rancidity. It shall be free from mould, living and dead insects, insect fragments, rodent contamination. The powder shall be free from added colouring matter and any harmful substance.

Parameters	Limits
Moisture	Not more than 11.0 percent 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 2.0 percent by weight
Volatile oil content on dry basis	Not less than 1.0 percent by weight

4.2.1. List of Microbial requirement in Large Cardamom Powder

Requirements	Standards
Salmonella	Absent in 25 gm

4.2.2. List of Contaminant/Toxin in Large Cardamom Powder

Contaminants/toxins	Tolerance limit mg/kg
Endosulfan	1.0
Monocrotophos	0.5
Quinolphos	0.01
Fosetyl-A1	0.2

4.3. Labelling Standards

Labeling requirements for packaged food products as laid down in the Part VII of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name or description
2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colours and Flavours
6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number or volume of contents
9. Distinctive batch, lot or code number
10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Wherever applicable, the product label also must contain the following:

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of coloring material. Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown color- filled circle inside a brown square outline prominently displayed on the package, contrasting against the

background on the display label in close proximity to the name or brand name of the food.

Vegetarian food must have a similar symbol of green color-filled circle inside a square with a green outline prominently displayed.

All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or May be made on a card or tape affixed firmly to the package and bearing the required information prior to customs clearance.

Exporters should review the Chapter 2 of the “FSS (Packaging and Labeling) Regulation 2011” and the Compendium of Food Safety and Standards (Packaging and Labeling) Regulation before designing labels for products to be exported to India.

According to the FSS Packaging and Labeling Regulation 2011, “prepackaged” or “pre packed food” including multi-piece packages, should carry mandatory information on the label.

4.4. 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 equipment's 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 equipment's 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.



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