PM Formalization of

Micro Food Processing Enterprises (PMFME) Scheme

HANDBOOK

OF

LEMON GRASS

AATMANIRBHAR BHARAT

National Institute of Food Technology Entrepreneurship and Management
Deemed to be University (De-novo Category) under Section 3 of the UGC Act, 1956
An Autonomous Institution under Ministry of Food Processing Industries, Government of India,
Sonepat, Haryana, India
Website: www.niftem.ac.in
Email: pmfmecell@niiftem.ac.in
Call: 0130-2281089

TABLE OF CONTENTS

PAGE NO.

ABBREVIATIONS

1	PET	Polyethylene terephthalate
2	LDPE	Low-density polyethylene
3	BIS	Bureau of Indian Standards
4	FSSAI	Food Safety and Standards Authority of India

CHAPTER 1

1.1INTRODUCTION:

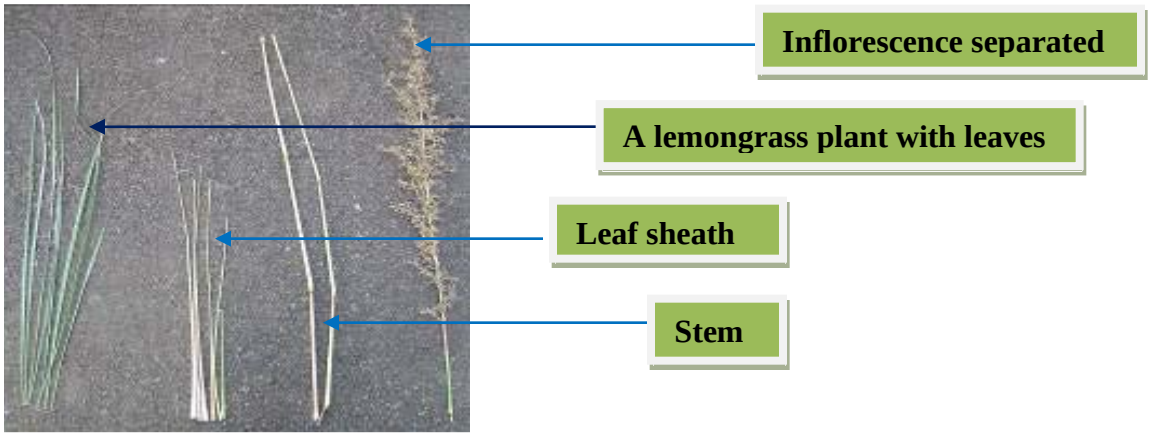
Scientific Name : ***Cymbopogon citrates / Cymbopogon flexuosus***

Family: *Graminae* (Poaceae) and the genus *Cymbopogon*

Common name: Lemongrass

Origin : South Asia, South-east Asia, Australia

Lemongrass is a generally fast growing tropical and sub tropical grass .The name of the lemongrass derives from lemon like fragrance of the oil present in shoot of the plant. Lemongrass has numerous therapeutic and medicinal uses and widely used as herbs in many countries. This plant is full of citrus flavor and can be dried, powdered or used fresh. Lemongrass whole plant or essential oil is commonly used in herbal teas, infusions, soups, fish, and seafood and curry preparation.



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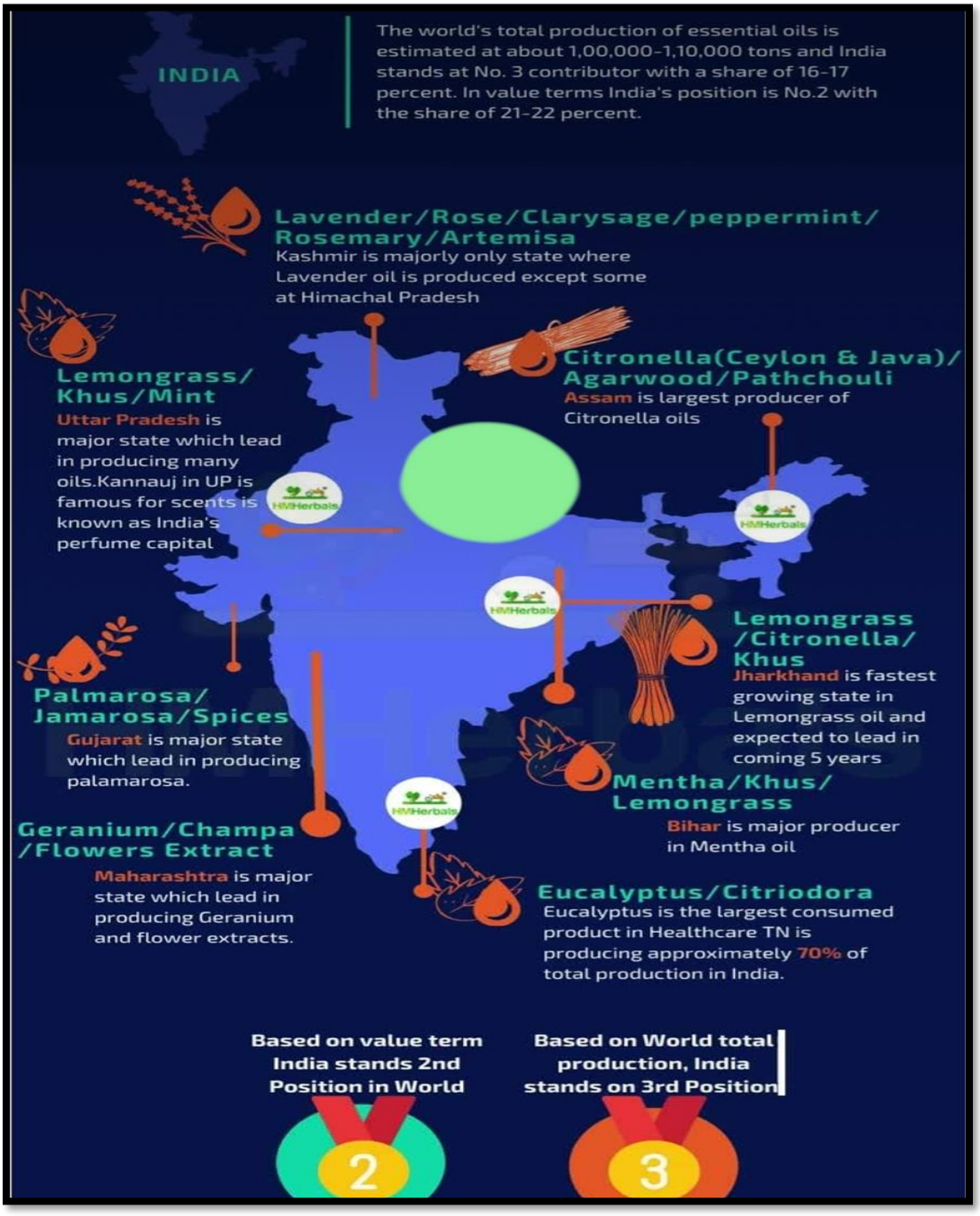
LEMONGRASS PLANT

Lemongrass seed

Lemongrass in full bloom

1.2 WORLDWIDE PRODUCTION OF LEMONGRASS:

Lemongrass is a popular crop in countries like China, India, Sri-Lanka, Guatemala, Madagascar and Zambia. Trends in imports and exports reflect India to be a largest producer of lemongrass worldwide and exports 80% of its total production. Trends also show US as the largest importer of essential oil as per 2008 JEA market brief of essential oil.



1.3 SPECIES AND VARIETIES:

Lemongrass broadly has three types of varieties mentioned below.

1.3.1 Cymbopogon flexuosus :

This verity is commonly known as East Indian, Cochin or Malabar grass based on the colour of the stem this lemongrass Varity is sub grouped into two groups:

(a) C. flexuosus* var. *flexuosus *:*

It is red grass and has reddish or purple in colour stem and leaf sheath. This variety is superior in quality as its essential oil has more than75-80% citral compound.

(b) C. flexuosus* var. *albescens:

This lemongrass Varity is white and has white colour of the stem.this plant is inferior in quality as it shows poor alcohol solubility The essential oil obtained from it contains less than 65-70% citral compound.

1.3.2 Cymbopogon citratus :

This verity is commonly known as West Indian or American lemongrass. It is a stem less Varity. The essential oil obtained from it contains 74-76% citral and gives poor alcohol solubility.

1.3. 3 Cymbopogon pendulus :

This verity of lemongrass is commonly known as Jammu lemongrass and is white stemmed and dwarf . The essential oil of this lemongrass contains around 75-80% citral and gives medium solubility in alcohol.

CHAPTER 2

2.1 CULTIVATION :

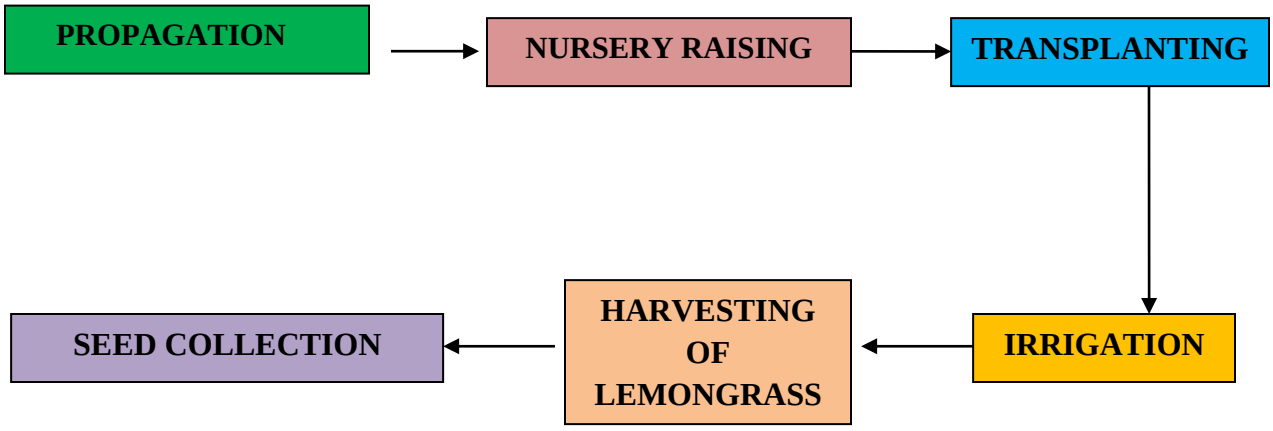
2.1.1 Climate *:*

Lemongrass grows in tropical and sub tropical environments having sunny, warm, humid conditions. Additional irrigation is alternative for growth of lemongrass in environments where rainfall is scanty. 25-30°C temperature during daytime is considered ideal for maximum production of lemongrass essential oil, with very less extreme lower night temperature.

2.1.2 Soil:

Lemongrass grows on various soil types ranging from loam to laterite soil. Calcareous and water-logged soils are not considered good for cultivation of lemongrass varieties. Good drainage is one of the most essential components for lemongrass cultivation.

2.2 Production:



2.2.1 Propagation:

Propagation of lemongrass takes place from seeds. Seeds are generally mixed with dry sand in the ratio of 1:3 and later sown in the field. Alternative to this method, seedlings first can be raised in a controlled environment of nursery in one-tenth of the area of the main field and than transplanted in field after 45 days.

2.2.2 Nursery raising:

The seeds are uniformly distributed over the beds and thin layer of soil are spread over seeds, for raising healthy seedlings bed has to be irrigated timely.

2.2.3 Transplanting:

The best season for transplanting seedlings is monsoon season. Seedlings raised in nursery beds are transplanted in the field at 6-7 leaf stage when they are 50-70 days old.

2.2.4 Irrigation:

Proper irrigation is essential for cultivation of lemongrass in situation of drought, the crop should be irrigated timely on alternate days for approximately a month after plantation of seedlings.

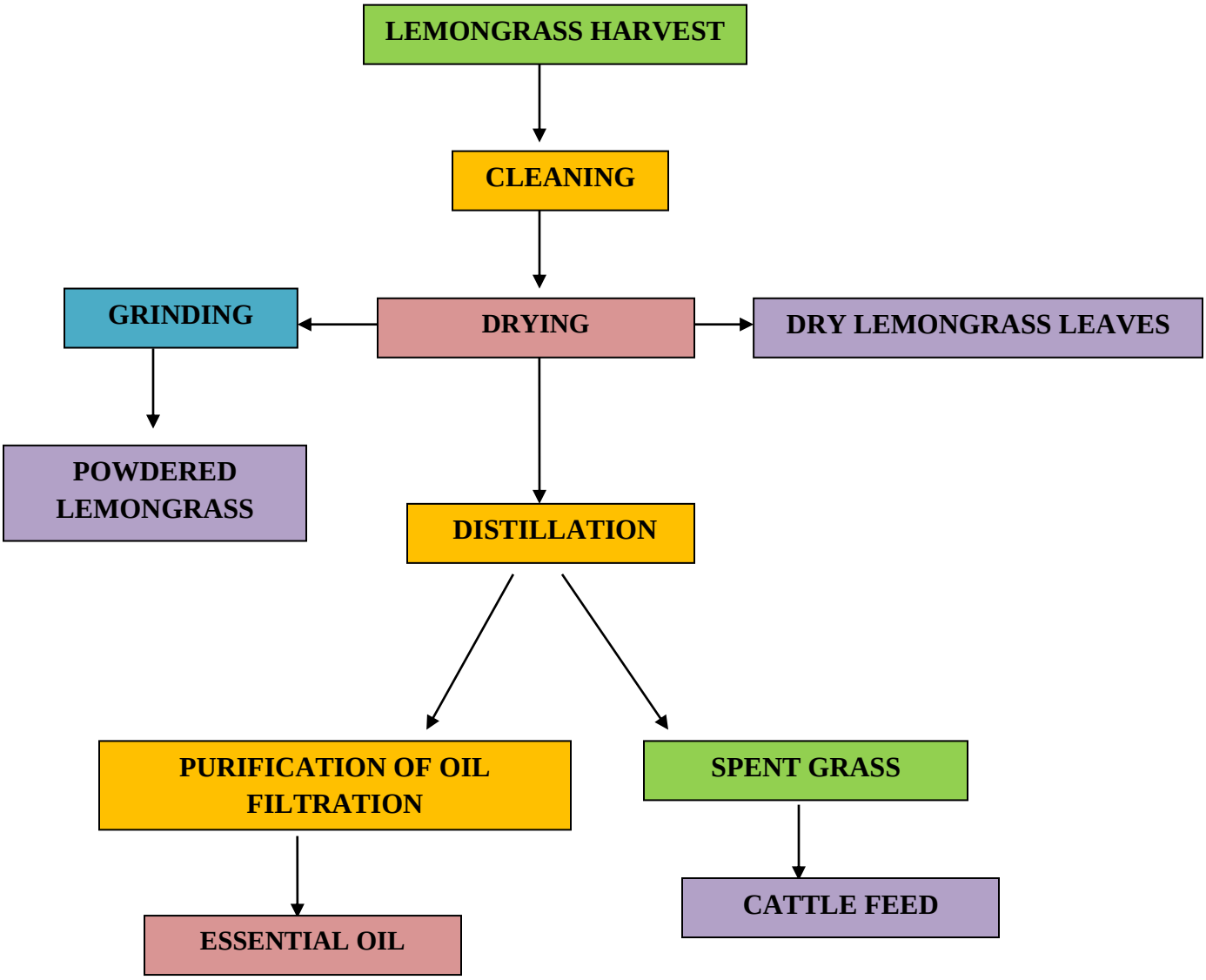
2.2.5 Harvesting of the herb:

Sickles are used for cutting grass once the harvesting time approaches. Crop is ideally cut 10 cm above the ground level. Total numbers of harvests in a year depends on the climate conditions of the area.

2.2.6 Seed collection:

The whole inflorescence is cut and dried in the sun and seeds are collected by thrashing against the floor or beating with sticks. After six months seeds lose viability thus fresh seeds are recommended for plantation.

2.3 PROCESSING:



2.3.1 Drying:

The crop is cut in small pieces and filled into the stills. Prior to distillation process grass is set to wilt for 24 hours , wilting process improves the overall yield of essential oils. Drying of crop also decreases moisture content by 30% which further helps in distillation process.

For some products like herbal tea or infusions where the dry leaves or powdered lemongrass is final product, dried and powdered lemongrass packaging takes place after drying step in appropriate packaging material.

2.3.2 Grinding:

Pulverizer machines are used to grind dry lemongrass into smooth fine powder or coarse material as per the requirement. Dry lemongrass crop enter the grinding chamber though the feed inlet and then grinded by the high speed rotating tool.

2.3.3 Distillation:

Lemongrass essential oil is collected by steam distillation. There are commonly three types of distillation.

2.3.3.1 Hydro distillation:

This method is most suitable for dried plant material where less possibility of plant damage from boiling water exist. The dried lemongrass to be distilled is kept in a vessel half filled with water. The vessel is then heated by direct fire, steam jacket, or closed steam coil, *etc*.

2.3.3.2 Hydro and Steam distillation:

This method is suitable for both fresh and dried crop .in this method steam kept at low pressure which maintains lower temperature in comparison to other methods of distillation process. In this method, the plant material is in contact with steam not boiling water. Steam used in this method is always fully saturated, wet and never superheated.

2.3.3.3 Steam distillation:

In this method saturated or superheated steam is incorporated through open or perforated steam coils**.** The two separate layers form in this process having one layer of oil another layer of water.
The increase the shelf life of essential oil, following points should be taken into consideration:

1. Pre- treatment of essential oil to eliminate metallic impurities.
2. Clarification of essential oil by NaCl .
3. Oil should be stored in hard or dark colored glass bottles, while large quantities should be stored in heavily tinned metal containers.
4. The oil should be stored at a dark places.

2.3.4 Purification of oil (Filtration) :

Anhydrous sodium sulphate is mixed with oil and generally kept for 4-5 hours or overnight than the mixture is flittered to eliminate insoluble component present in the essential oil. Steam rectification process should be incorporated in purification step where due to rusting colour of the oil changes.

2.3.5 Spent grass

The remaining residue obtained after extraction of the oil is called spent grass. It can be used for cattle feed or manuring crops.

CHAPTER 3

3.0 EQUIPMENT FOR LEMON GRASS OIL PROCESSING.

3.1 WEIGHING MACHINE:

For getting good quality of product, all the ingredients should be properly weighed with the help of digital weighing machine.

3.2 GRINDING MACHINE:

Pulverizer machines are used to grind dry lemongrass into smooth fine powder or coarse material as per the requirement. Dry lemongrass crop enter the grinding chamber though the feed inlet and then grinded by the high speed rotating tool.

3.3 SIEVE :

It used for sieving powder so that only fine powder can be utilized for manufacturing purpose. Without sieving coarse powder will be mixed up.

3.4 DISTILLATION UNIT:

Steam distillation unit is used to extract essential oil from lemongrass. This equipment uses indirect heat to extract lemongrass oil from fresh or dry lemongrass plant.

3.5 FOOD GRADE CONVEYOR:

These are conveyors with food grade belt to maintain food safety standards set by monitoring authorities.

3.6 HPLC AND GLC SYSTEMS:

Quality of the essential oil is may be evaluated by HPLC and GLC systems, these highly sophisticated chromagraphic equipments helps to quantify chemical and bioactive components of the oil.

3.7 OTHER MATERIAL AND HYGIENE EQUIPMENT :

They are simply used to hold and transfer the given material efficiently.

3.8 POWER DISTRIBUTION EQUIPMENTS:

They are used to safely receive and distribute power.

CHAPTER 4

4.1 PHYSIOCHEMICAL CHARACTERISTICS:

The essential oil of *C. citratus* contains approximately:

Characteristic	Range
α-pinene	(0.13%)
β-pinene, delta-3-catrene	(0.16%)
Myrcene	(12.75%)
Dipentene	(0.23%)
β-phellandrene	(0.07%)
β-cymene	(0.2%)
Methyl heptanene	(2.62%)
Citronellal	(0.73%)
β-elemene	(1.33%)
β-caryophyllene	(0.18%)
Citronellyl acetate	(0.96%)
Geranyl acetate	(3.00%)
Citral b	(0.18%)
Citral a	(41.82%)
Geraniol	(1.85%)
Elemol	(1.2%)
β-caryophyllene oxide	(0.61%)

Source : (Saleem *et al*, 2003a, b)

Citral compound present in lemongrass has a citrus flavor. It is a component of fragrance formulations, the use of citral is less due to its characteristics to polymerize, oxidize and discoloration.

4.2 USES OF LEMONGRASS IN FOOD PROCESSING

4.2.1 Herbal teas

Dried lemongrass leaves are widely used as a lemon flavour ingredient in herbal teas, prepared either by decoction or infusion of 2-3 leaves in 250 or 500 ml of water. Lemongrass iced tea is prepared by steeping several stalks in a few quarts of boiling water. This can also be combined with green or black teas

4.2.2 Health food

Lemongrass is commonly used in Asian cooking. In Thailand and Indonesia, freshly ground lemongrass is added to spice pastes. The Vietnamese like to prepare their food at the dinner table, mixing meat with fresh herbs, and lemongrass is an essential herb at the table.

4.3.3 Uses of essential oil

Lemongrass is cultivated for its oil which is used in culinary flavouring. It is used in most major categories of food including alcoholic and non alcoholic beverages, frozen dairy desserts, candy baked foods, gelatins and puddings, meat and meat product and fat and oils.

CHAPTER 5

5.0 PACKAGING:

Packaging is an important part of food manufacturing process. It protect the food products from physical ,chemical, biological damages. Without packaging, food handling would be a messy, inefficient and costly exercise and modern consumer marketing would be virtually impossible. Thus food packaging lies at the very heart of the modern food industry.

Packaging Institute International defined packaging as the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container form to perform one or more of the following functions: containment, protection, preservation, communication, utility and performance. If the device or container performed one or more of these functions, it was considered a package.

5.1 NEED OF PACKAGING:

Packaging performs a series functions:

5.1.1 CONTAINMENT: The containment function of packaging makes a huge contribution to protecting the environment from the myriad of products that are moved from one place to another on numerous occasions each day in any modern society. Faulty packaging (or under-packaging) could result in major pollution of the environment.

5.1.2 PROTECTION: the primary function of the package: to protect its contents from outside Environmental influences such as water, water vapor, gases, odors, microorganisms, dust, shocks, vibrations and compressive forces.

5.1.3 CONVENIENCE: Products designed to increase convenience include ready to cook or ready to eat foods which can be reheated in a very short time, preferably without removing the primary package. Thus, packaging helps in convenience of consumer. Convenient packages promote sales.

5.1.4 COMMUNICATION: Packaging contains a lot of information such name of its manufacturer, product name, terms and uses, date of manufacturing, best before. nutritional information thus helping the consumer to be more informed.

5.2 TYPES OF PACKAGING:

5.2.1 PRIMARY PACKAGING:

- Primary package are those package which directly came into contact with food products. It provides first or initial layer of protection to the food products.
- Examples of primary packaging includes Metal cans, tea bag, paperboard cartons, glass bottles and plastic pouches.

5.2.2 SECONDARY PACKAGE:

- Secondary package are those package which surrounds or contains the primary package.
- It further used to group primary packages together.
- Act as carriers and many a times also used for the display of primary package.
- Ex. Corrugated case, Boxes.

5.2.3 TERTIARY PACKAGE:

- It contains number of secondary package together.
- Mainly used for bulk handling of food products.
- Example : stretch-wrapped pallet.

5.2.4 QUATERNARY PACKAGE:

- Quaternary package is mainly used for handling the tertiary packages.
- It generally includes a metal container which can be transferred to or from ships, trains.

5.3 PACKAGING OF LEMON GRASS PRODUCTS:

Packaging of lemongrass products is mainly done to protect the products from outside environment especially after the completion of process so that essential oil can retain color, flavor and freshness for a longer period of time. Packaging of lemongrass products is also done to increase their shelf life:

5.4 PACKAGING MATERIAL FOR LEMONGRASSS PRODUCTS:

5.4.1 PET:

PET can be made into film by blowing or casting. It can be blow moulded, injection moulded, foamed, extrusion coated on paperboard and extruded as sheet for thermoforming. Melting point of PET is higher than PP which is around 260°C and due to the manufacturing conditions does not shrink below 180°C. Thus PET is ideal for high-temperature applications. PET is also flexible to low temperature (-100°C). It also act as good barrier of oxygen and water vapour.

5.4.2 FLEXIBLE POUCHES:

The high packaging cost of rigid/semi-rigid packs and lack of assurance on quality and quantity in buying loose oil has led to the introduction of flexible pouches as retail packs. Flexible packaging materials have the following advantages:

- Optimum balance between cost and benefits.
- Lower storage and handling costs.
- Amenable to high-speed FFS machines.

5.4.3 GLASS :

Now a day glass container has been also used for packaging. It has following advantages:

- act as strong barrier to moisture and gases.
- Prevent unwanted odors and microbial growth.
- do not react with food products.
- suitable for heat processing when hermetically sealed
- glass are re-useable and recyclable
- they are transparent to display the contents
- they are rigid, to allow stacking without container damage.

The disadvantages of glass include:

- glass have high weight which increases the transportation cost.
- very much fragile and low resistance to thermal shock as compare to other materials.
- potentially serious hazards from glass splinters or fragments .

5.4.4 PAPER BASED PACKAGING:

Rigid cardboard and paper based packaging materials are very common in market and have advantages like they are cheap, attractive, light weight, easy to cut and manipulated to create custom shapes and sizes but they are not as durable as glass or other packaging materials

available in market. Paperboard packaging materials comes in different grades each type is suitable for different packaging requirements.

CHAPTER 6

6.1 FSSAI REGULATION

Botanical name and part used	Official name in Sanskrit	Common name	Maximum usage levels per day for use as a health or food supplement (given in terms of raw herb/ material)
Cymbopogon citratus(DC.) Stapf / *C. coloratus*Stapf / *C. jwarankusa* (Jones) Schult / *C. martini* (Roxb.)Wats			
Whole plant	Lamajjaka / Harichaya / Rosha Ghas	lemon grass	Adult usage levels: 1-3 g 5-16 years: ½ adult usage levels 1-5 years: ¼ adult usage levels

6.2 LABELING STANDARDS (REGULATION 2.5 OF FSS)

Labeling requirements for packaged food products as laid down in the Part 2.4 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, Colors and Flavors
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

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre- packaged assorted vegetables, flours, vegetables and products that comprise of single ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

Wherever applicable, the product label also must contains 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. FSSAI revised the labeling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO

member countries and the comments received are under review and the publication date remains unknown.

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.

6.2 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.