MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

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KNOWLEDGE • INNOVATION • OUTREACH

PM Formalization of

Micro Food Processing Enterprises (PMFME) Scheme

HANDBOOK

OF

PALM PRODUCTS

AATMANIRBHAR BHARAT

National Institute of Food Technology Entrepreneurship and Management
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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

1.1 INTRODUCTION

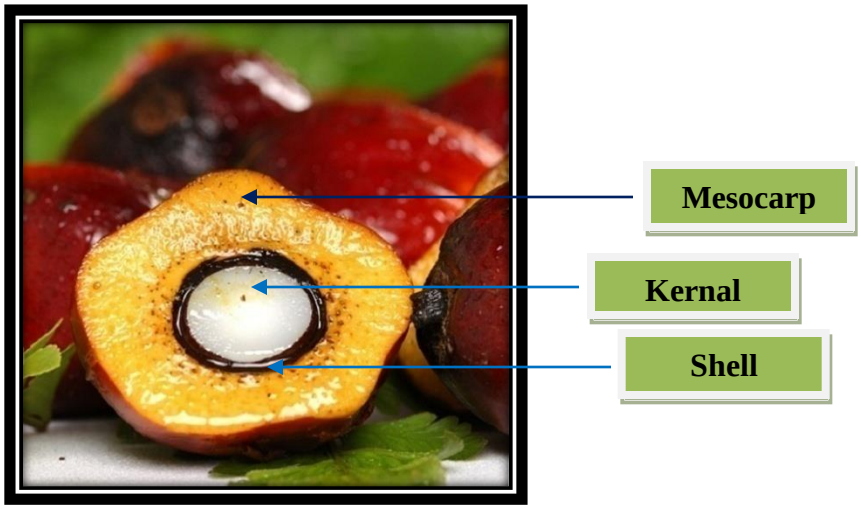
Scientific Name : *Elaeis guineensis*

Family: Arecaceae

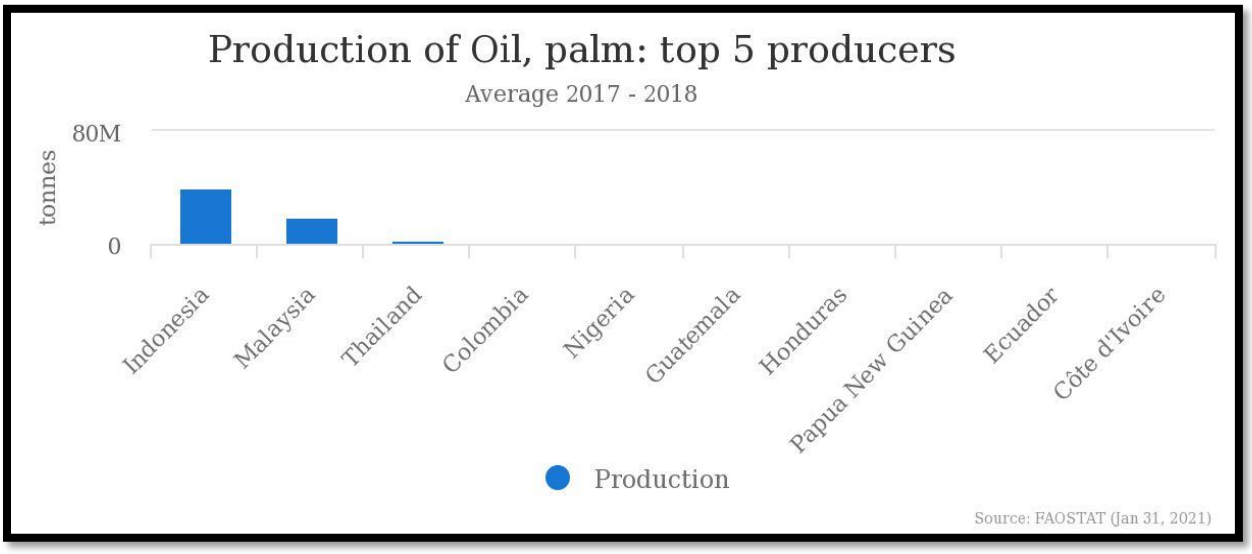
Common name: Oil Palm, macaw-fat

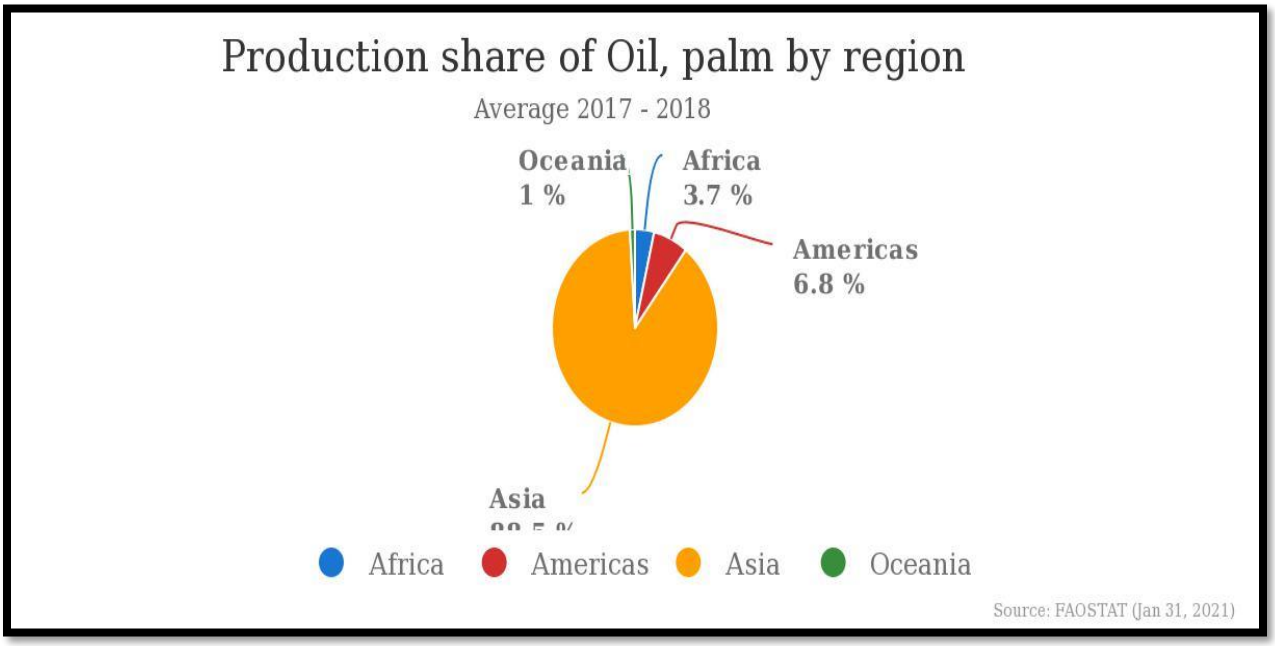
Origin : West Africa

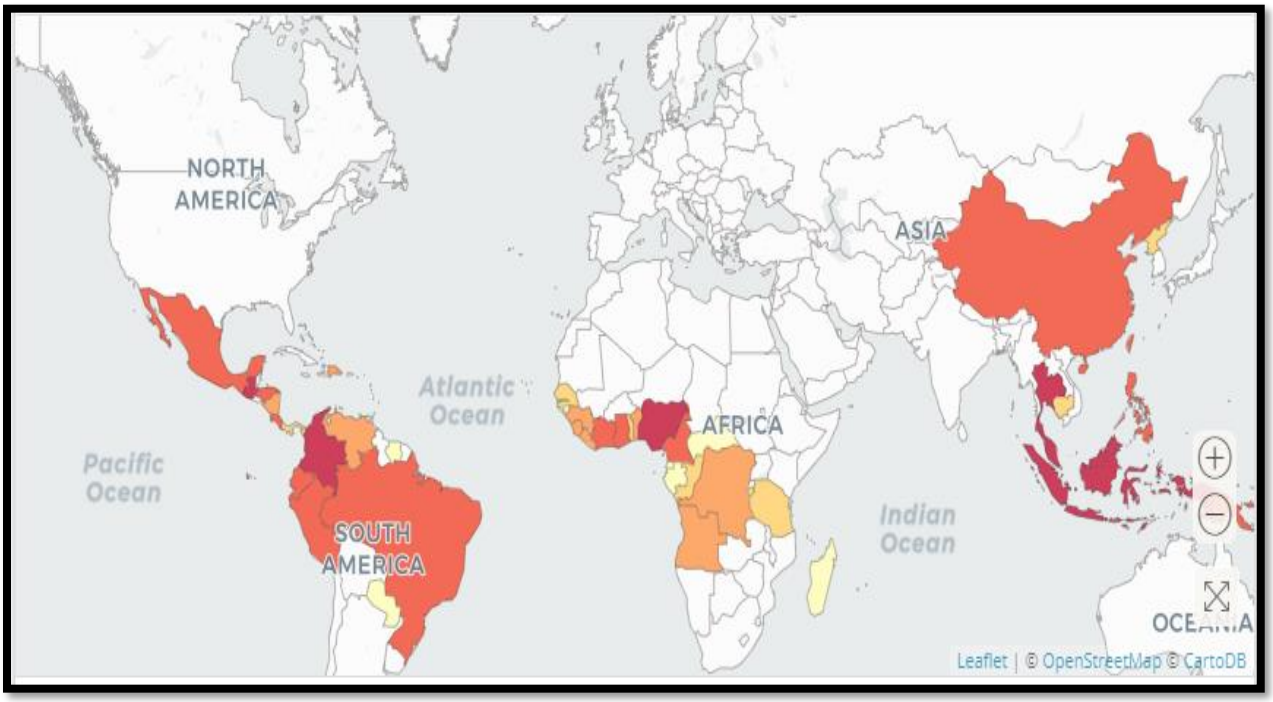
The oil palm (Elaeis guineensis) is grown throughout the humid tropics of West and Central Africa, the Far East, and Central and South America. Oil is obtained from both the fleshy mesocarp of the fruit and the central kernel. The oil palm produces bunches of fruit referred to as fresh fruit bunches. The fleshy pulp or mesocarp of the fruitlet contains approximately 50% palm oil by weight and the kernel between 46 and 57% palm kernel oil.



The tope leading producer of palm oil are Indonesia, Malaysia, Thailand, Colombia and Nigeria.




Production share of Oil, palm by region
Average 2017 - 2018
Oceania
1 %
Africa
3.7 %
Americas
6.8 %
Asia
Africa
Americas
Asia
Oceania
Source: FAOSTAT (Jan 31, 2021)


NORTH AMERICA
ASIA
Atlantic Ocean
AFRICA
Pacific Ocean
Indian Ocean
SOUTH AMERICA
Leaflet | © OpenStreetMap © CartoDB

1.2 On the basis of internal characteristics of oil palm can be divided into :

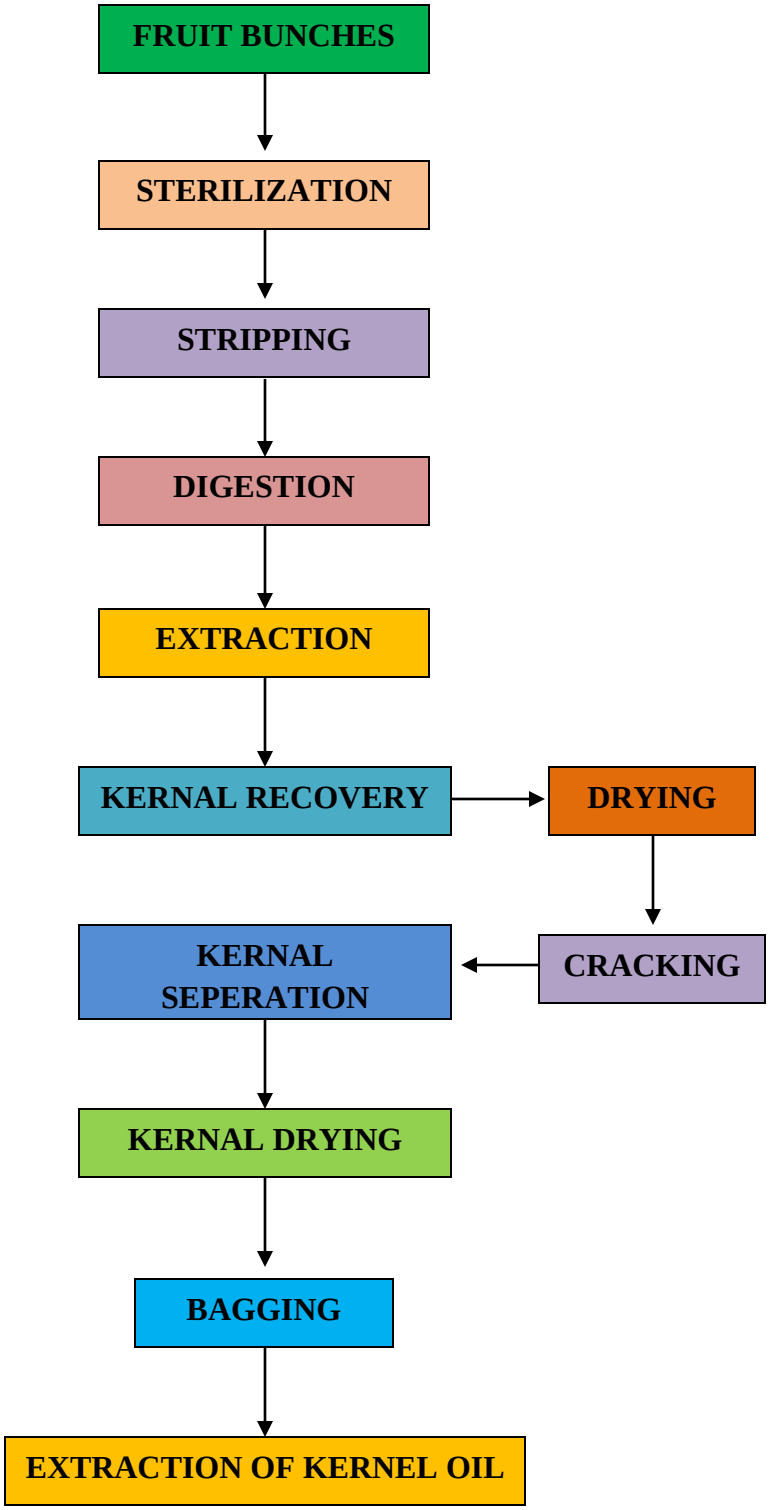
- **Dura:** have fruits which contain a thick shell between the mesocarp and the kernel. The fruit comprise of mesocarp from 45 - 65% and shell 25 -35%. the content of mesocarp and shell varies according to region and the mesocarp have been found in lesser quantities in mesocarp.
- **Pisifera :** have fruits which do not contain shell.
- **Tenera :** is a cross between the other forms. Tenera fruit contain 75-80% mesocarp and and 17% shell. Extraction efficiency reduces upon mixing of dura and tenera because of difference in size and fruits composition. Normally 15-20% of minority types are prescribed to mixed.

Today all the commercial plant are grown from tenera seed which are produce with the help of dura as the female parent and pisifera as the male. The ratio of oil to bunch in mature commercial teneras is about 22-24%. With the help efficient equipments extraction rate can be achieved between 19-22%, where as extraction of oil from immature palm is about 12%.

The presence of fatty acids and triacylglycerol makes palm oil suitable for number of food applications. The composition of saturated fatty acids and unsaturated fatty acids in palm oil is 50:50. There are two types of oil are produced from the palm oil i.e, crude palm oil which produced from the mesocarp and kernel palm oil from the inside kernel. Crude palm oil contain high percentage of carotenoids thus it is also called as red palm oil.

CHAPTER 2

2.1 PALM OIL EXTRACTION:



2.1.1 FRUIT BUNCHES :

Bunches are cut down with the help of cutter and transported to mill for further processing.

2.1.2 STERILIZATION :

Sterilization of palm fruits is done for heat treatment and for the absorption of moisture. It prohibits the growth of fungus especially on damaged fruits. During sterilization an enzyme called lipolytic becomes inactive as well it also prevent the forming other free fatty acids. The process of sterilization further softening the palm fruits for next processing operations. The time of sterilization depends upon size of fruits while the standard time and temperature is 50 minutes at 135ºC.

2.1.3 STRIPPING :

Striping is done to separate the fruits from bunches after sterilization. In modern milling, stripping are of two types namely the beater arm type and the rotary drum type. For small mill which have capacity of 5 ton bunches per hour, beat arm stripper is used while rotary drum can handle quantity up to 20 tons per hour. Rotary drum stripper run more smoothly and efficiently than beat arm type. Fruits losses should not be more than 6% while stripping.

2.1.4 DIGESTION :

Digestion is preliminary pressing before final extraction where slowly rotating oil bearing cells are ruptured by rotating beater and thus produces mash of mesocarp and nuts. The process of digestion is carried out at 95ºC.

2.1.5 EXTRACTION :

Extraction of oil from the mash is done with the help of screw, hydraulic, or centrifugal presses, this method is known as dry method. Since centrifugal presses are not so much efficient thus screw and hydraulic presses are more used by modern mill. The factors which determine the extraction are temperature, pressure applied, duration of pressure and the ratio of fiber and kernel. Extraction of palm oil can also be done through wet method, where hot water as a liquid is used to extract oil from ruptured cell of palm fruits. Treatment with hot water also helps in

protein coagulation and hydrolyze gums, resins and starch thus preventing the palm oil from foaming during frying. After removal moisture, oil is extracted.

2.2 PALM KERNEL PROCESSING :

Oil is not extracted from the palm fruit only but it can also extracted from the palm kernel by crushing and the cake is used as animal feed. After digestion, crushing of mass produces palm oil as well as nuts and fiber. The process of kernel extraction includes nuts separation from fiber, followed by drying, cracking, kernel separation, drying and bagging of kernel.

2.2.1 NUT SEPARATION :

Earlier for the process of nut separation was carried out with the help of hydraulic and mechanical separation but now a day pneumatic system is used for carry out this process.

2.2.2 NUT DRYING AND CRACKING :

The process of drying is carried out before grading and cracking. It mainly done to shrink the kernel within their shell which will facilitate cracking. Those nuts which are small in size like tenera are difficult to crack thus drying process becomes very much important. It is important to monitored the time of drying otherwise prolonged drying results into discolors or break the kernel.

2.2.3 KERNEL SEPARATION :

Separation of the heavier shells from the kernels is accomplished either by clay baths or hydrocyclone units. The shells can then be used for boiler fuel or road surfacing.

2.2.4 DRYING AND BAGGING :

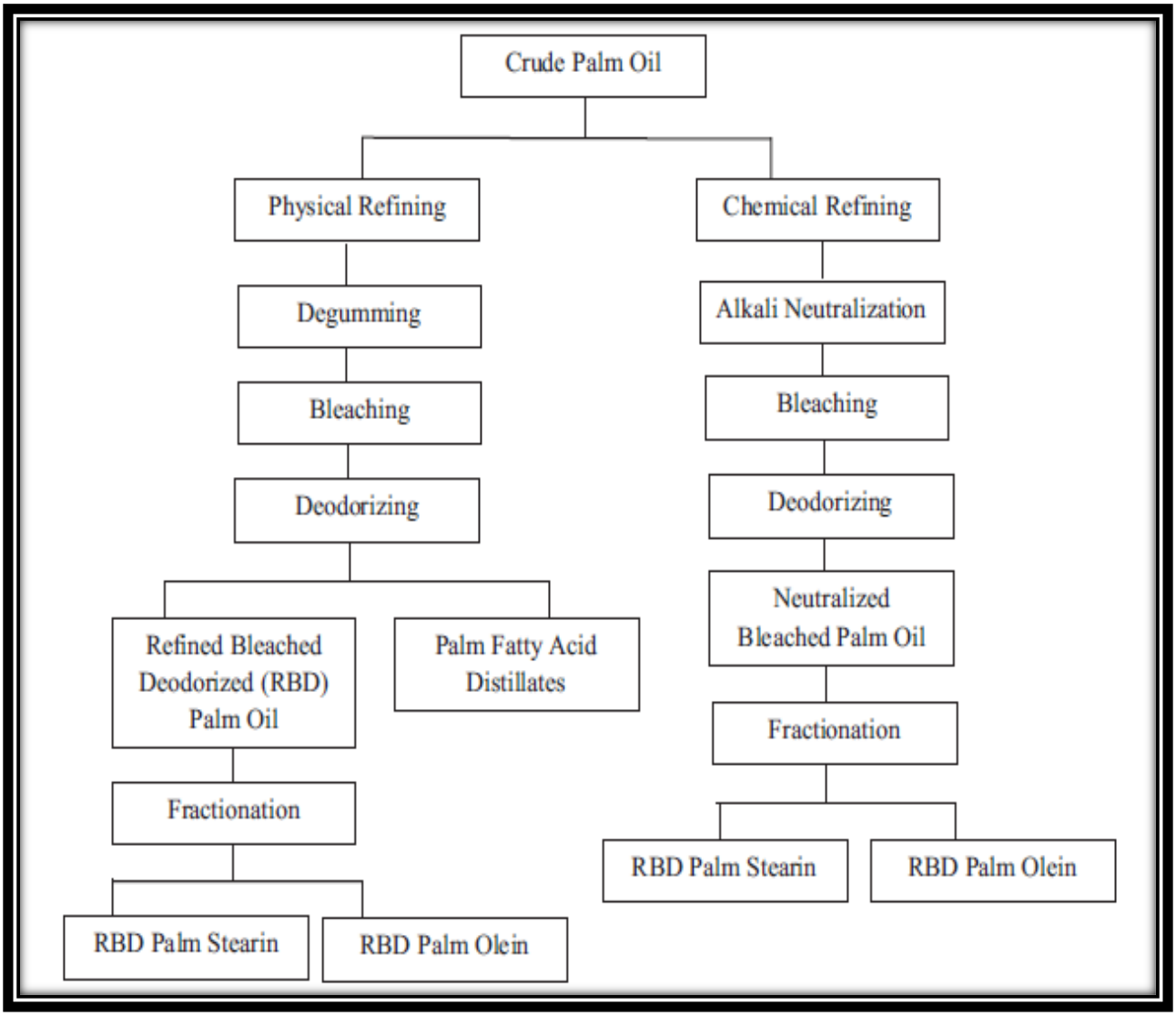
Drying of kernel is done to reduce the moisture content up to 6-7.5% followed by bagging for storage and shipment.

2.2.5 OIL EXTRACTION :

Oil extraction is done either by wet method or dry method which have been discussed above.

2.3 PALM OIL REFINING PROCESS :

Although crude palm oil is directly used, but it has been refined for used as more sophisticated edible oil. Refining of crude oil involves either physical refining or chemical refining. The process of physical refining involves steps like degumming, bleaching, deodorizing and fractionation while chemical withering process involves alkali neutralization, bleaching, deodorizing and fractionation.



2.3.1 ALKALI NEUTRALIZATIO :

To reduce free fatty acids and polar lipids in crude palm oil, it is treated with solution called sodium hydroxide or sodium carbonate and the process is called as alkali neutralization or alkali refining.

2.3.2 DEGUMMING :

Alkali neutralization is not alone sufficient for removal of all the impurities thus the process of degumming is performed in both i.e. physical refining and chemical refining. Degumming is mainly done to target impurities like phospholipids and other polar lipids (gums). Removal of gums are done with the help of centrifugation.

2.3.3 BLEACHING :

Like degumming, bleaching also an important steps of physical refining and chemical refining. The process of bleaching is performed for the removal of pigment especially carotenoids (which gives darker color) by using charcoal or clay.

2.3.4 DEODORIZING :

Deodorizing is done by steam distillation and used for removing those products which are volatile in nature. The process of deodorizing is carried out at 230ºC for 2 hours followed by cooling of oil and passing it through filter.

2.3.5 FRACTIONATION :

Fractionation is cooling or winterization of refined or crude oil into liquid (olein) or solid (stearine) fraction. The liquid one is mainly used as cooking or salad oil while sloid one is used for margarine and shortening. There are three main process of fractionation :

I. Dry fractionation : It is also called as winterization which involves simple cooling method and produces olein and stearine 65% and 35% respectively.
II. Detergent fractionation : This process involves cooling of oil and mixing with detergent and magnesium sulphate and followed by centrifugation which results in to olein and stearine 70% and 30% respectively.

III. Solvent fractionation : This process involves continuous crystallization in hexane and followed by cooling and separation of olein and stearine 70-75% and 25-30% respectively.

2.3.6 ADVANTAGES AND DISADVANTAGES OF DIFFERENT REFINING METHOD

REFINING	ADVANTAGES	DISADVANTAGES
Chemical	Functional process. Large amount Free fatty acids reduces.	Expensive. Time consuming. Produce polluting effluent.
Physical	Less energy requirement. Less expensive. Produce less effluent.	Loss of vitamins. Loss of deep red color. Oxidative damage is more.

CHAPTER 3

3.0 EQUIPMENT FOR PALM OIL PROCESSING.

3.1 STERILIZATION EQUIPMENT :

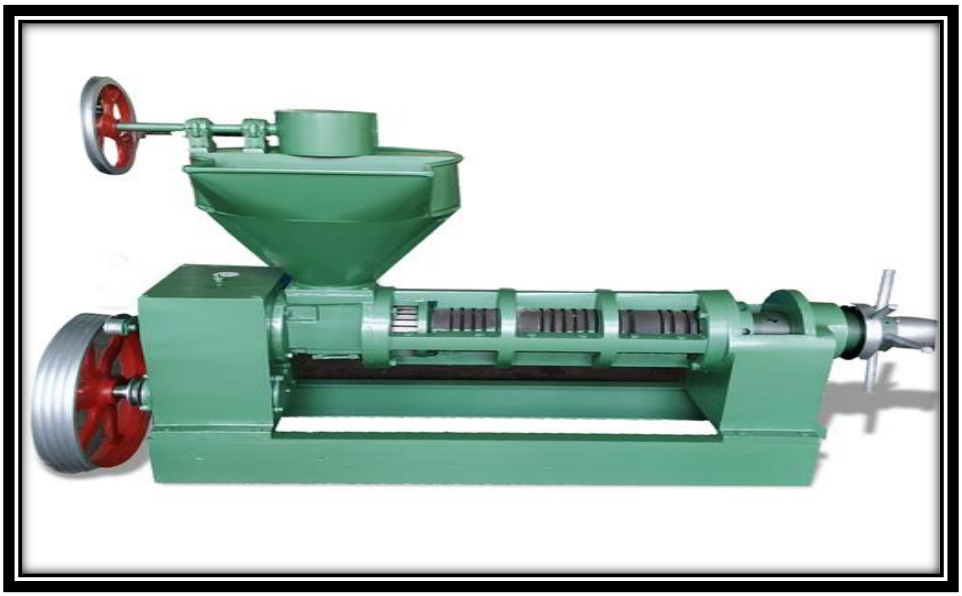
This equipment is used for heat treatment of palm fruits thus preventing the growth of fungus and inhibiting lipolytic enzyme.

3.2 PALM FRUIT THRESHER :

The fruits received at mill are in bunches and they are detached with the help of thresher or stripper. There are two types of thresher one is rotating drum and other is fixed drum which are used for stripping palm oil fruits.

3.3 OIL EXTRACTOR :

Extraction of palm oil is done either by wet method or dry method. Dry method includes use of screw pressure for extraction oil from palm fruits.



3.4 CLARIFICATION MACHINE:

Clarification of palm oil is done to remove non oily solids dirt by passing palm oil through hot water at 95ºC. Oil and dirt separated from each other where dirt settled down at the lower part while clear oil presents at upper part.

CHAPTER 4

4.1 PHYSIOCHEMICAL CHARACTERISTICS OF PALM OIL:

Characteristic	Range
Apparent densityat50°C (g/ml)	0.892 - 0.899
Melting point (°C)	33 - 45
Smoke Point (°C)	230 - 235
Solidification point (°C)	35 - 42
Refractive index at 50°C	1.449 -1.456
Specific gravity at 50°C	0.888 0.889
Viscosity (cP)	45 - 49
Iodine value (g/100)	46 - 56
Free Fatty Acids (% FFA as Palmitic)	3.17 - 5
Peroxide value (meq O_2/kg)	0.1 - 10
Saponification value (mg KOH/g)	190 - 209
Total polar compound (%)	9.47 - 19.50
Saturated fatty acids (SFA %)	49.9 - 54.7
MUFA (%)	37.1 - 39.2
PUFA (%)	8.1 - 10.5

Source : Čmolík and Pokorný (2000), Dumont and Narine (2007),

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 PALM OIL:

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

5.3.1 Hydrolytic rancidity :

As the temperature increases, water holding capacity of oil increase. Hydrolytic rancidity occurs due to presence of moisture, mainly due to hydrolysis of oil to glycerol and free fatty acids results in to off odor. Thus proper packaging prevents the hydrolytic rancidity.

5.3.2 Oxidative Rancidity :

Oxidative rancidity in oil caused due to oxidation of unsaturated fatty acids chain. Aldehydes and ketones are the final products of oxidation responsible for the rancid odor of oils. Due to presence of natural antioxidant and pigments, unrefined oil are less prone to oxidation than refined oil.

5.3.3 Microbial growth due to increase in water activity:

Microbial growth in oil occurs when moisture content is more than 65%.

5.3.4 Packaging protect oil from degradation of color and vitamins by protecting it from direct exposure of UV light. Thus oil are protected by using opaque and pigmented packaging materials

5.4 PACKAGING MATERIAL FOR PALM OIL:

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 LDPE :

Low-density polyethylene is heat sealable, inert, odour free and shrinks when heated. It act as a barrier to moisture and has high gas permeability, sensitivity to oils and poor odour resistance. It is less expensive, therefore widely used. One of the great attributes of LDPE is its ability to be fusion welded to itself to give good, tough, liquid-tight seals.

5.4.4 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 .

CHAPTER 6

6.0 STANDARDS AND REGULATIONS

6.1 BIS STANDARDS/ REGULATIONS :

- Oil is a commodity consumed by every person. It may become health hazardous unless protected properly.
- Therefore, different standards like PFA, Agmark, and BIS are formulated which give specifications on the quality parameters of oil at the time of sale, the shelf life of the oil in different plastic packaging materials, and specifications on safety and performance of packaging materials.
- The shelf life required for oil in PET/PVC bottles is 60 and 180 days under normal and accelerated storage conditions, respectively.
- The vinyl chloride (VC) monomer content in PVC should be < 1 ppm and VC migration into oil < 10 ppb.

6.2 BIS SPECIFICATIONS FOR PLASTIC PACKAGING MATERIALS FOR PACKING EDIBLE OILS/FATS:

IS No- Year	Specification
12724-1989	Flexible packaging materials for packaging of refined edible oil
12883-1989	Polyvinyl chloride (PVC) bottle for edible oils.
12887-1989	Polyethylene terephthalate (PET) bottles for packaging of edible oils. 11352-1985 Specification for flexible packs for packaging vanaspati.
10840-1994	Blow molded HDPE container for packaging of vanaspati.

6.3 FSSAI REGULATIONS FOR PALM OIL:

- Refined vegetable oil means any vegetable oil which is obtained by expression or solvent extraction of vegetable oil bearing materials, deacidified with alkali and/or physical refining and/or by miscella refining using permitted food grade solvents followed by bleaching with absorbent earth and/or carbon and deodorized with steam. No other chemical agent shall be used. The name of the vegetable oil from which the refined oil has been manufactured shall be clearly specified on the label of the container. In addition to the under-mentioned standards to which refined vegetable oils shall conform to the standards prescribed in these regulations for the specified edible oils shall also apply except for acid value which shall be not more than 0.5. Moisture shall not exceed 0.10 percent by weight.
- Test for argemone oil shall be negative.
- Palm oil means the oil obtained from fleshy mesocarp of fruits of the oil palm (Elaeis Guinensis) tree by the method of expression or solvent extraction. It shall be clear, free from rancidity, suspended or other foreign matter, separated water, added colouring and flavouring substances or mineral oil. It shall conform to the following standards, namely:-

Butyro-refractometer reading at 50 °C	35.5 - 44.0
Or	
Refractive Index at 50 °C	1.4491-1.4552
Melting point (capillary slip method)	Not more than 37 °C
Iodine value(Wij's method)	45-56
Saponification value	195-205
Unsaponifiable matter	Not more than 1.2 per cent
Acid value	Not more than 10.0

- Indigenously produced raw Palm Oil obtained by method of expression may be supplied for human consumption as such provided acid value is not more than 6.0 But palm oil imported into the country or produced by solvent extraction shall be refined before it is supplied for human consumption and it shall conform to the standards laid down under regulation 2.2.1 (16). Additionally, it shall have Flash Point (Pensky-Marten closed method) - Not less than 250° C.
- Test for argemone oil shall be negative.
- The oil so refined shall not contain Hexane more than 5.00 ppm.
- Palmolein means the liquid fraction obtained by fractionation of palm oil obtained from the fleshy mesocarp of fruits of oil palm (Elaeis Guineensis) tree by the method of expression or solvent extraction. It shall be clear, free from rancidity, suspended or other foreign matter separated water, added colouring and flavouring substances or mineral oils. It shall conform to the following standards, namely:-

Butyro-refractometer reading at 40 °C	43.7 - 52.5
Or	
Refractive Index at 40 °C	1.4550 - 1.4610
Iodine value (Wij's method)	54-62
Saponification value	195-205
Cloud Point	Not more than 18°C
Unsaponifiable matter	Not more than 1.2 per cent
Acid value	Not more than 6.0

- Test for argemone oil shall be negative.
- The oil so refined shall not contain Hexane more than 5.00 ppm

- Palm kernel oil means the oil obtained from sound kernel of the fruits of oil palm (Elaeis guinensis) tree by the method of expression or solvent extraction. It shall be clear, free from rancidity suspended, or other foreign matter, separated water, added colouring and flavouring substances or mineral oil. It shall conform to the following standards, namely:-

Butyro-refractometer reading at 40 °C	35.3 - 39.5
Or	
Refractive Index at 40 °C	1.4490 - 1.4520
Iodine value (Wij's method)	10 - 23
Saponification value	237-255
Unsaponifiable matter	Not more than 1.2 per cent
Acid value	Not more than 6.0

6.4 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.

6.5 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.