Ministry of Food Processing Industries
Government of India

NIFTEM
KNOWLEDGE • INNOVATION • OUTREACH

PALM PRODUCTS - PROCESSING

AATMANIRBHAR BHARAT

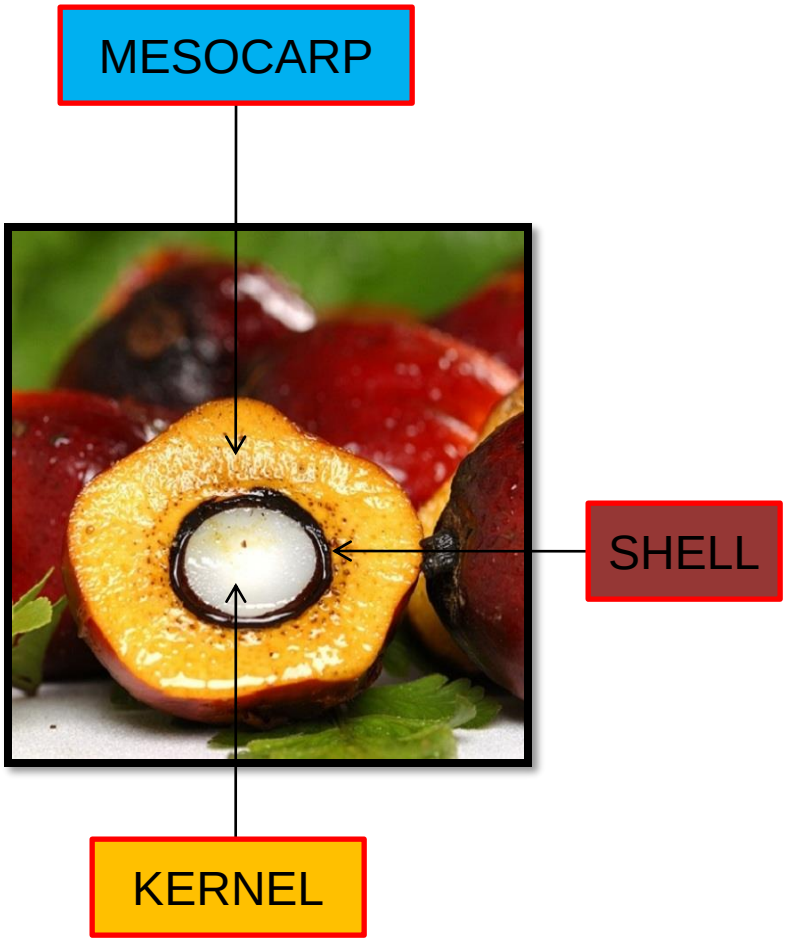
PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)

INTRODUCTION

- **Scientific Name :** *Elaeis guineensis*
- **Family**: Arecaceae
- **Common name:** Oil Palm, macaw-fat
- **Origin :** West Africa

INTRODUCTION

- 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 fleshy pulp or mesocarp of the fruitlet contains approximately 50% palm oil by weight and the kernel between 46 and 57% palm kernel oil.



INTRODUCTION

- 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.

INTRODUCTION

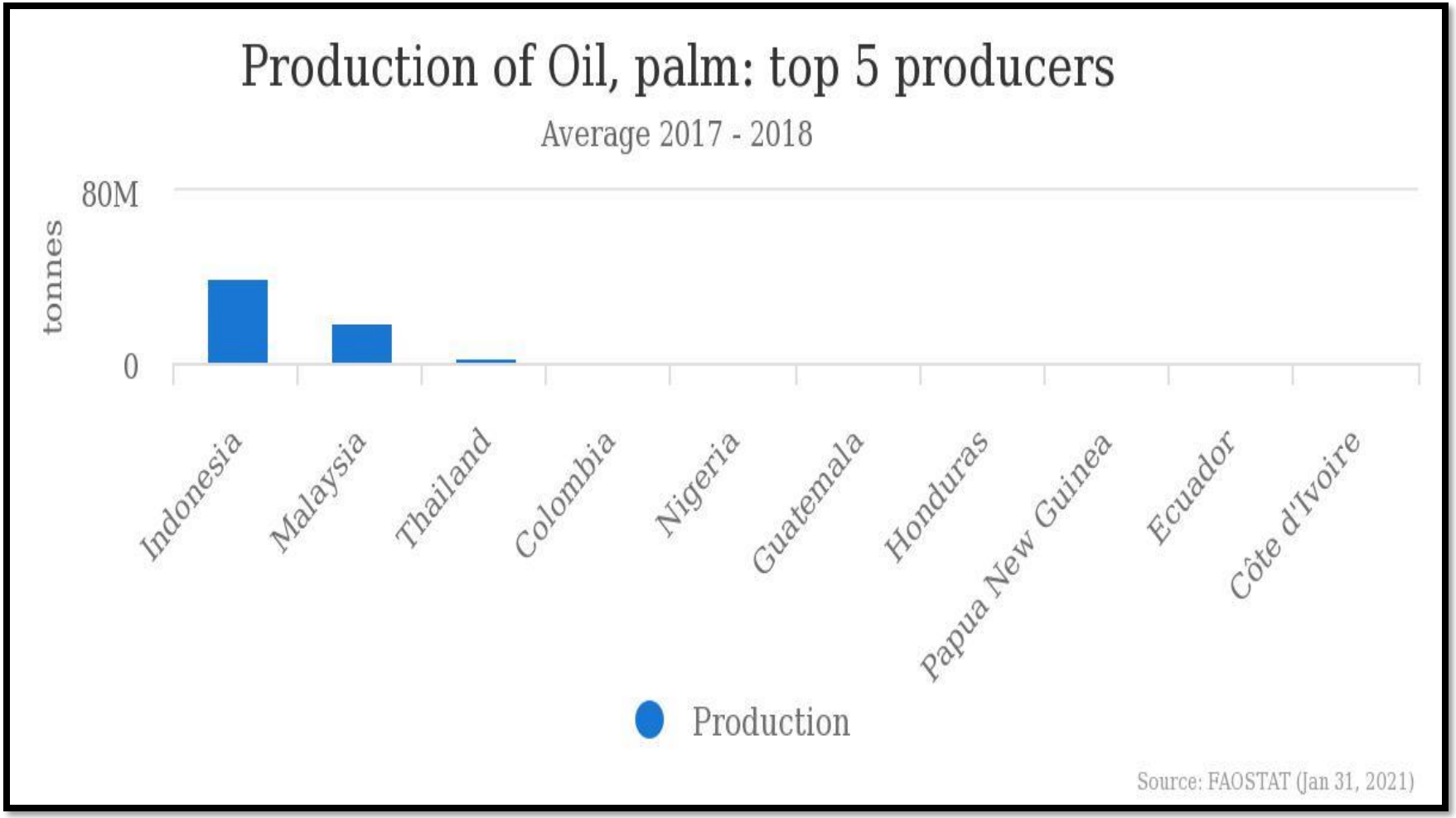
On the basis of internal characteristics of oil palm can be divided into :

- **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.

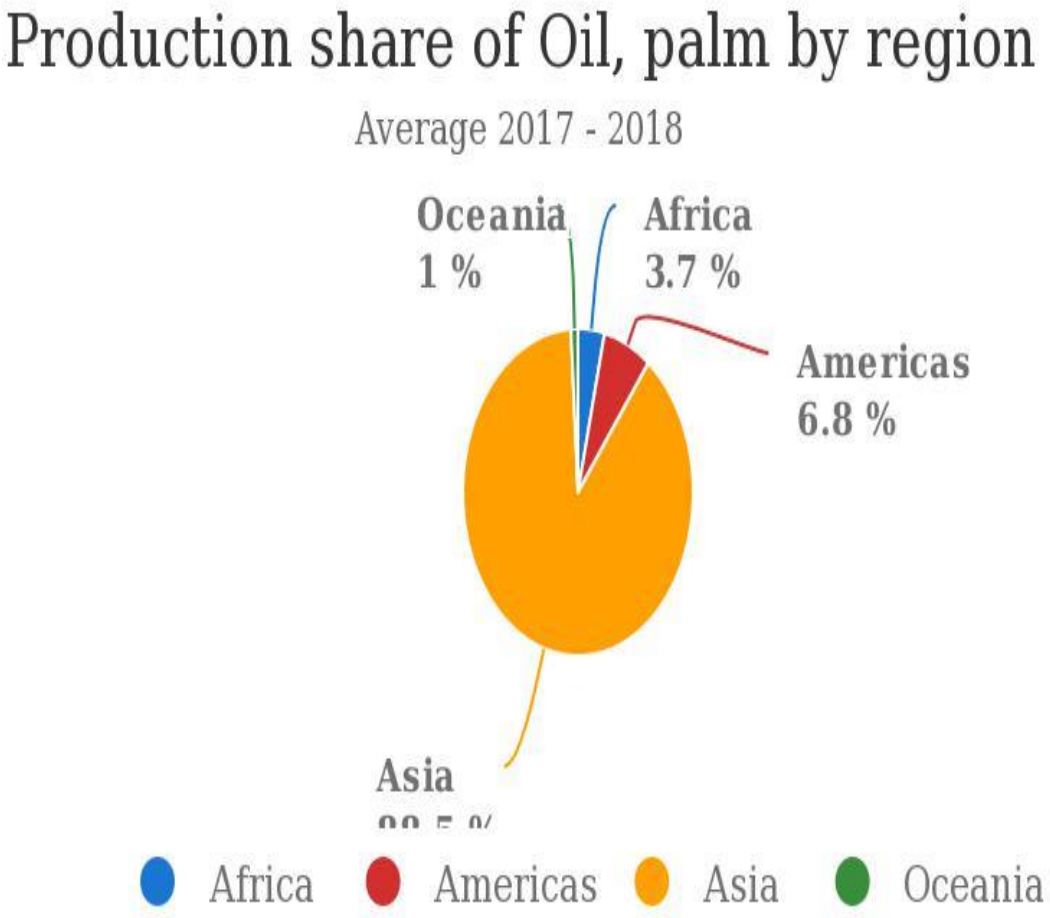
INTRODUCTION

- **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.

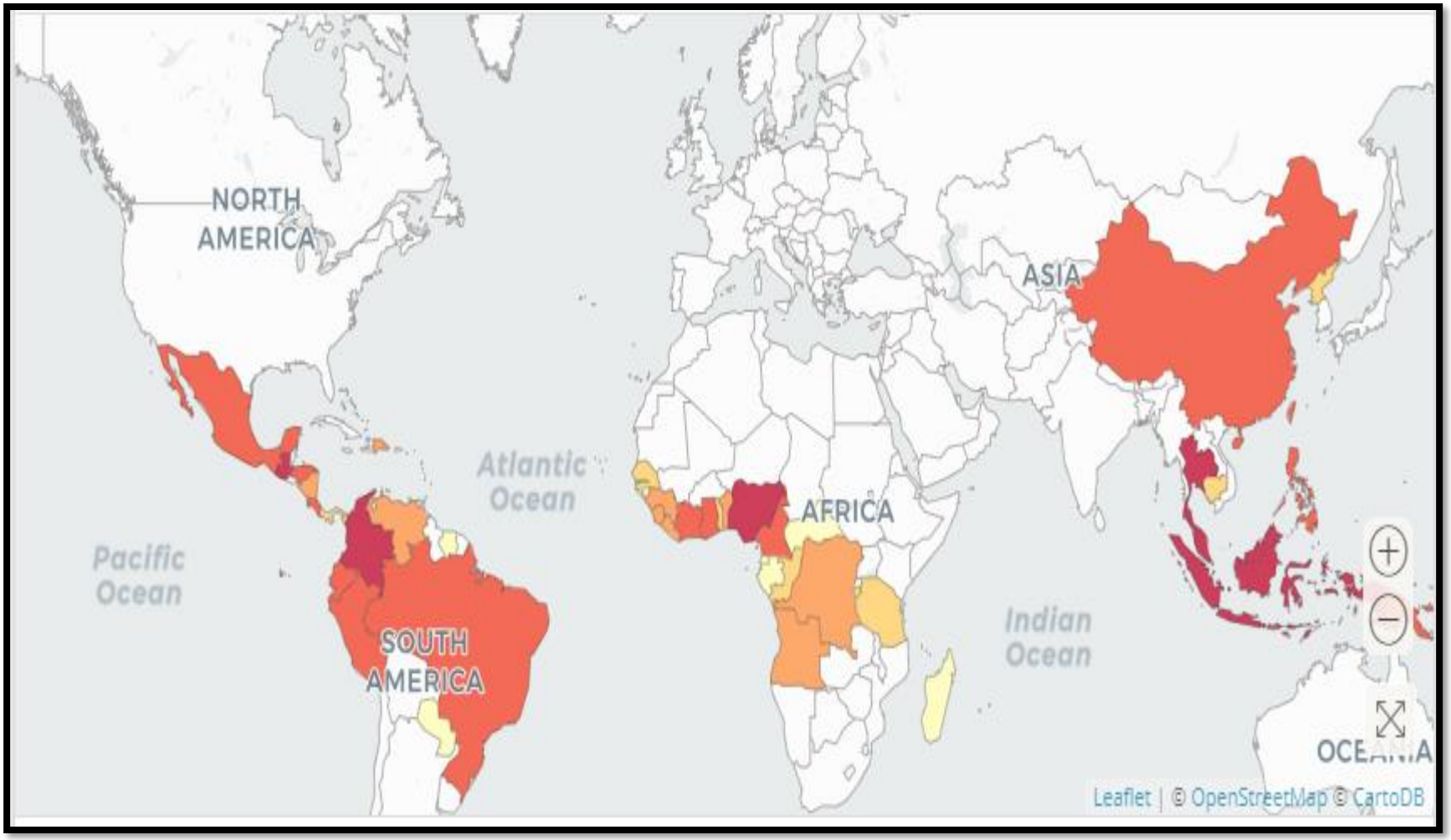
PRODUCTION OF PALM OIL



PRODUCTION OF PALM OIL



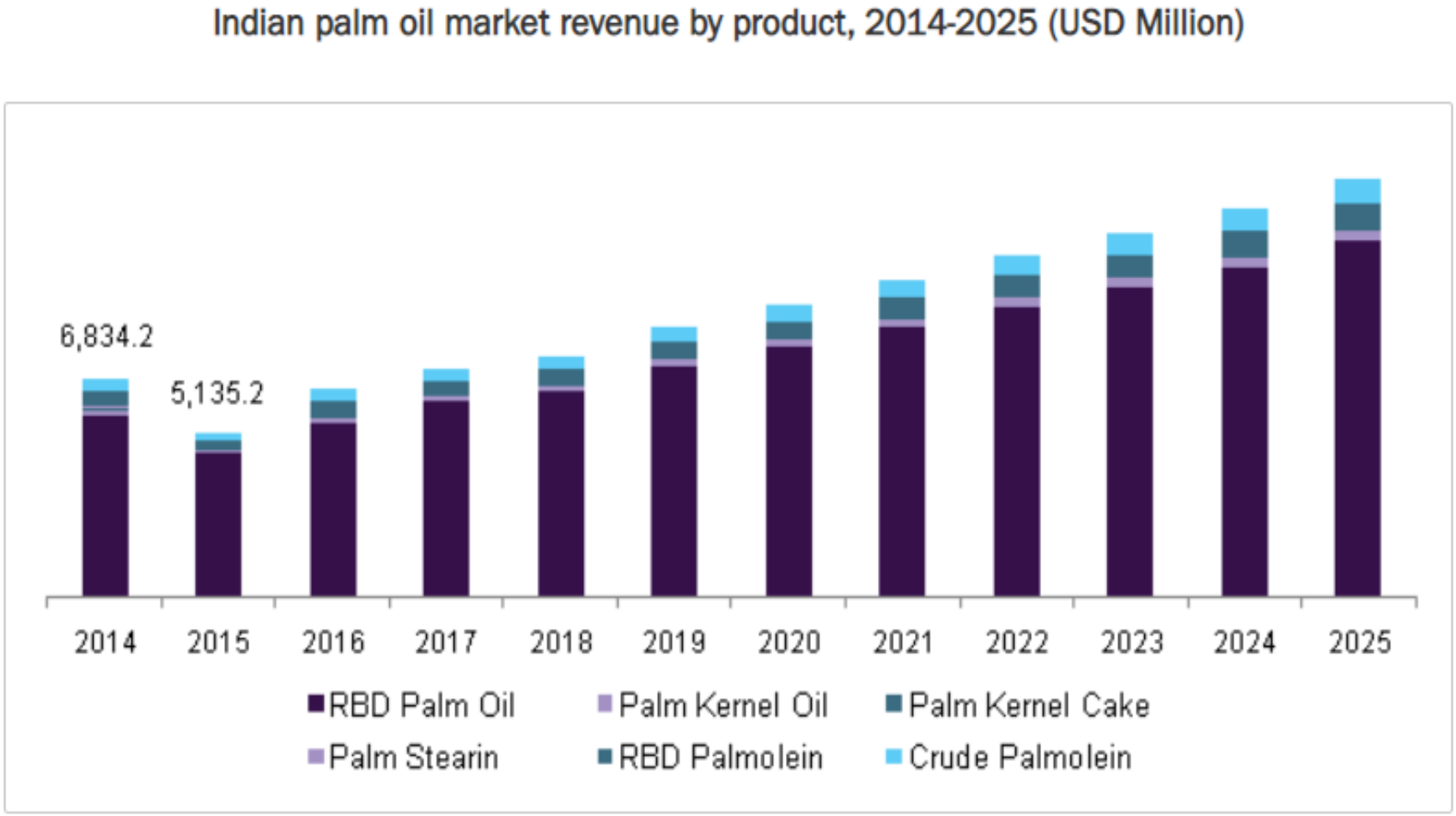
PRODUCTION OF PALM OIL



MARKET POTENTIAL

- The global palm oil market size was estimated at USD 61.1 billion in 2019 and is expected to reach USD 61.7 billion in 2020.
- The global palm oil market is expected to grow at a compound annual growth rate of 3.1% from 2019 to 2027 to reach USD 78.0 billion by 2027.
- Crude palm oil (CPO) dominated the palm oil market with a share of 58.3% in 2019. This is attributable to Increasing consumption in oleochemicals production of agrochemicals and cleaning products.
- Key factors that are driving the market growth include increasing demand for palm oil derivatives and oleochemicals from different end-use industries.

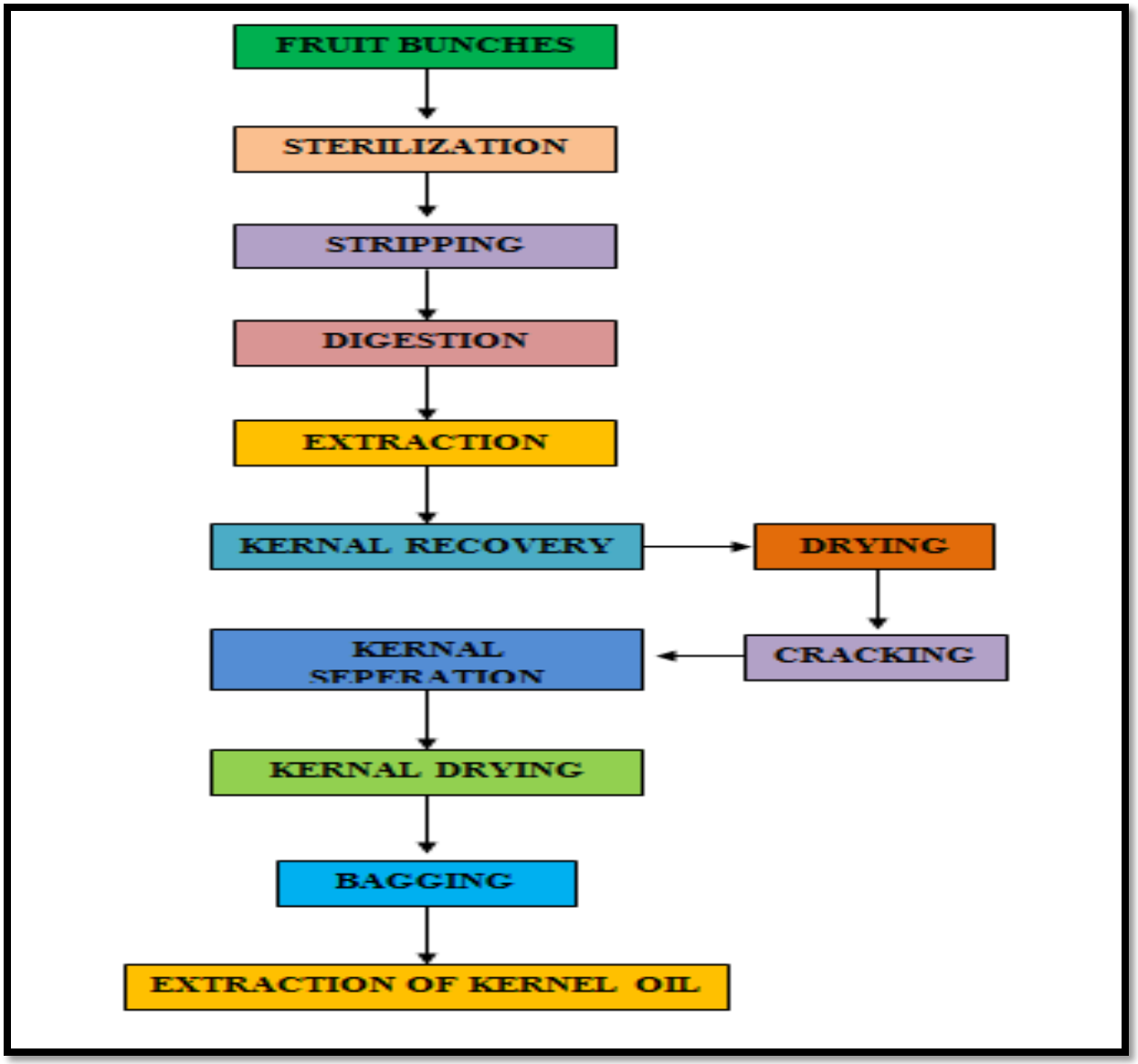
MARKET POTENTIAL



MARKET POTENTIAL

- Palm oil market size in India was valued at USD 5.16 billion in 2015.
- The industry in India presents massive potential for growth since the government has allowed 100% FDI in plantation and has also pledged huge financial aid to farmers in upcoming years.
- Key industry participants include Ruchi Soya Industries Ltd., Cofco Agri Ltd., Cargill India, Edible Group, 3F Industries Ltd., Godrej Agrovet, Adani Wilmar Ltd., Troika India, Aditya Engineers, Sundex Process Engineers Pvt. Ltd., Brissun Technology Pvt. Ltd., Tinytech Udyog, Chempro Technovation Pvt. Ltd. and GlamTech Agro Process Pvt. Ltd.

PALM OIL PROCESSING



PALM OIL PROCESSING

- **FRUIT BUNCHES :** Bunches are cut down with the help of cutter and transported to mill for further processing.

- **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 time of sterilization depends upon size of fruits while the standard time and temperature is 50 minutes at 135^{o}C.

PALM OIL PROCESSING

- **STRIPPING :** Striping is done to separate the fruits from bunches. 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.
- **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.
- **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. 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.

PALM KERNEL PROCESSING

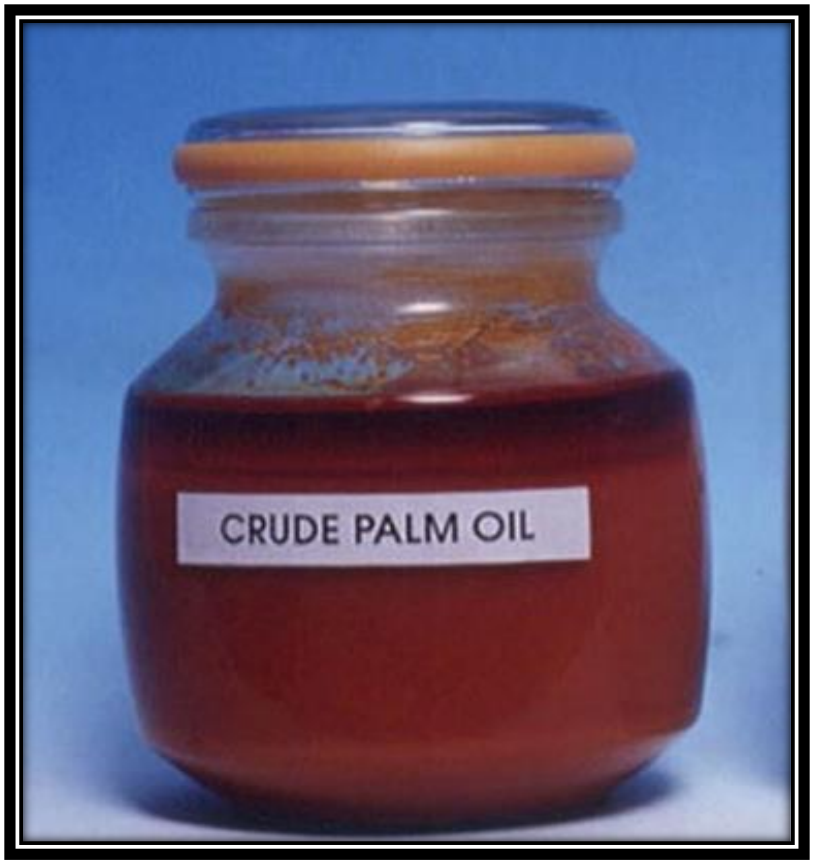
Oil is not extracted from the palm fruit only but it can also extracted from the palm kernel by crushing and the cake is used as animal feed. The process of kernel extraction includes following steps:

- **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.
- **NUT DRYING 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.

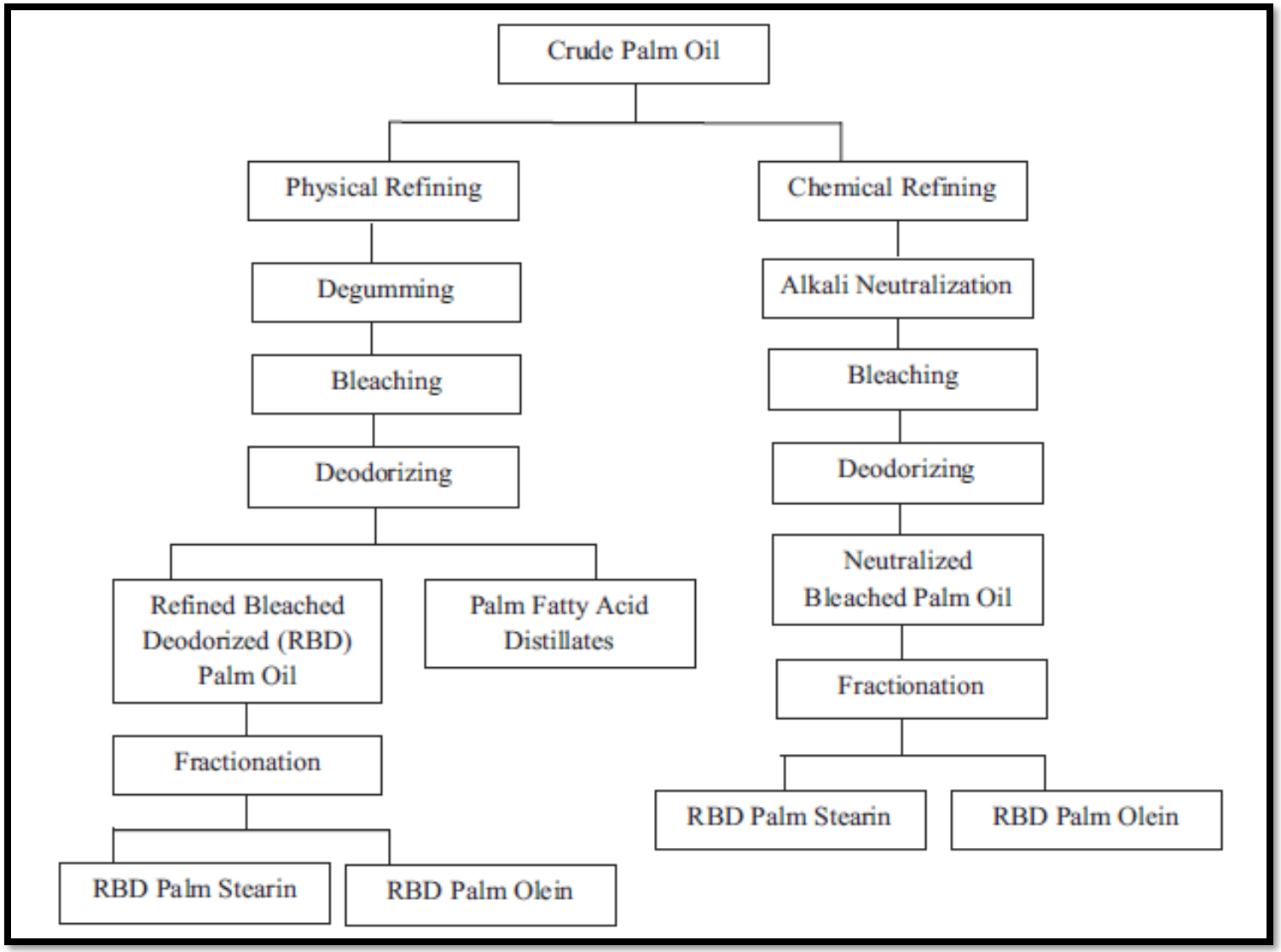
PALM KERNEL PROCESSING

- **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.
- **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.
- **OIL EXTRACTION :** Oil extraction is done either by wet method or dry method which have been discussed earlier.

PALM OIL



PALM OIL REFINING PROCESS



PALM OIL REFINING PROCESS

- **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.

- **DEGUMMING:** Degumming is mainly done to target impurities like phospholipids and other polar lipids (gums). Removal of gums are done with the help of centrifugation.

PALM OIL REFINING PROCESS

- **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.
- **DEODORIZING :** It 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.

PALM OIL REFINING PROCESS

- **FRACTIONATION :** Fractionation is cooling or winterization of refined or crude oil into liquid (olein) or solid (stearine) fraction. 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.

PALM OIL REFINING PROCESS

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.

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 : Čmolik andPokorný(2000), Dumont and Narine(2007),

EQUIPMENT FOR PALM OIL PROCESSING

- **STERILIZATION EQUIPMENT :**

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

EQUIPMENT FOR PALM OIL PROCESSING

- **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.

EQUIPMENT FOR PALM OIL PROCESSING

- **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.

EQUIPMENT FOR PALM OIL PROCESSING

- **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.

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