Oleochemistry

Palm oil processing

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The student should be able to understand and compare:

- The refining routes of the palm oil
- The fractionation routes of the palm oils

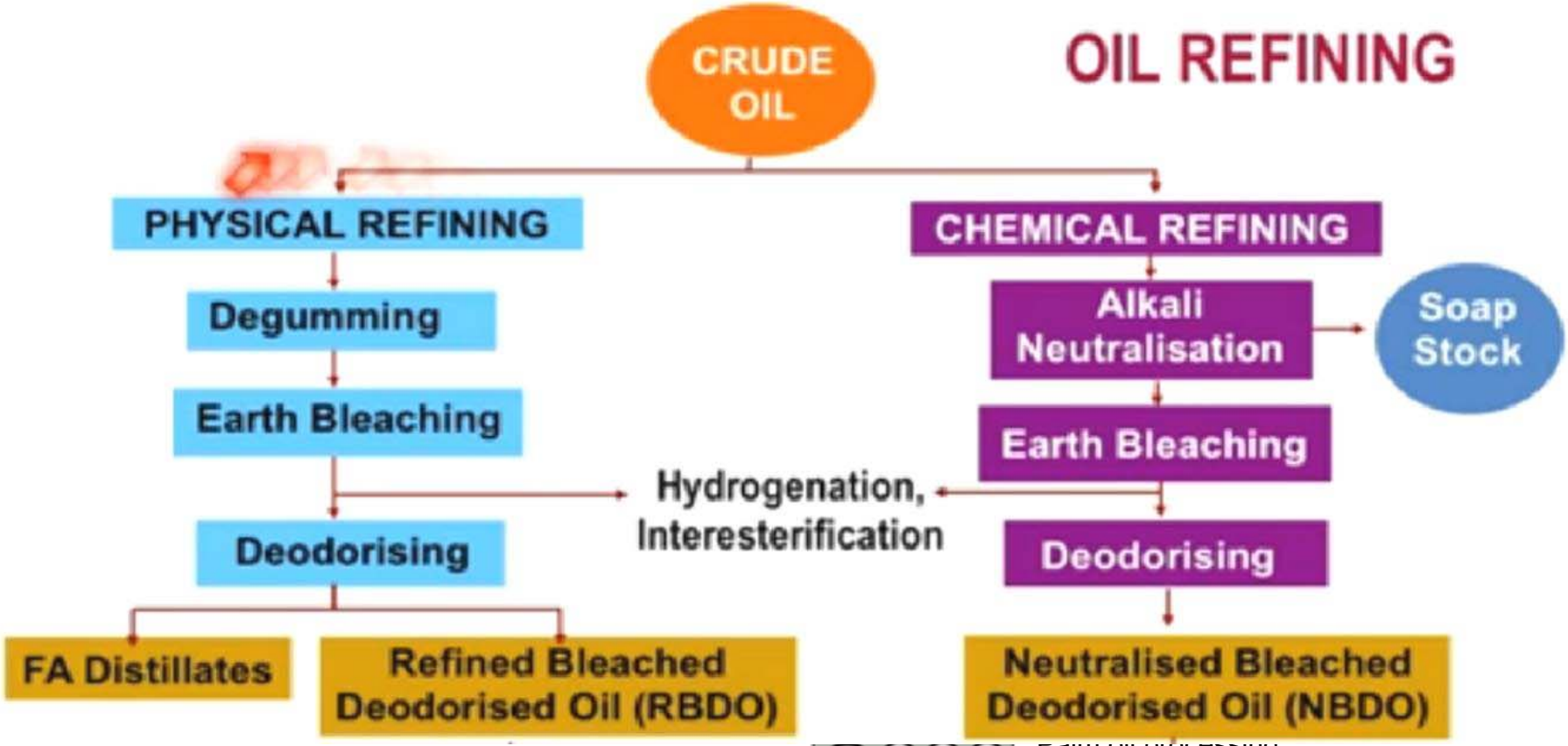
WHY REFINING ?

1. Remove unwanted compounds from fats & oils after extraction before human consumption or for industrial use.
2. **Non-triacylglycerol compounds:**

- free fatty acids
- MAG and DAG
- phospholipids
- unsaponifiable matters
- (sterols, tocotrienols, tocopherols isomers, squalene, etc)

- oxidation products
- trace elements (copper, iron)
- protein degradation products
- waxes
- hydrocarbons
- moisture
- dirt
- contaminants (pesticide residues, polycyclic aromatic compounds, dioxin, etc)

2 TYPES OF REFINING ROUTES



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Refining stages

Degumming

Water-degumming conditions: 60-80 °C, 20-30 min – the agglomerated wet gums are removed by centrifugation.

The non-hydratable phosphatides (NHP) have to be treated with a concentrated acid (acid-degumming)

Phosphoric acid (0.1-0.3% of an 85% solution) or citric acid (0.1-1% of a 30% solution) are used.

For physical refining, almost 100% removal of phosphatides is required (super degumming).

Refining stages

Neutralization

The purpose is to remove almost all of the FFA present in the crude oil (typically to 0.01 – 0.03%)

An alkali solution (usually NaOH or caustic soda; 8-24% conc., depending on the type of oil & initial FFA) reacts readily with FFA to produce soaps & water — the insoluble soap (soapstock) is removed by centrifugation.

Neutralization consists of 3 steps: neutralization, washing (to remove traces of soap) and drying (to remove residual moisture to ~ 0.1%).

Refining stages

BLEACHING

The prime purpose is to remove the colouring compounds (carotene, chlorophyll) by adsorption on a suitable material.

It is also the last stage in which residual phosphatides, soaps, metals & oxidation products can be removed prior to deodorisation.

Natural bleaching clays (Al silicates) were originally used in the adsorptive bleaching process. Today, acid-activated bleaching earths are used with adsorptive, catalytic & ion exchange properties.

DIFFERENT STAGES OF REFINING

Bleaching

1. bleaching earth (0.3 – 0.6%) is added to the oil at 90-120^{o}C in agitated vessels under vacuum followed by filtration

FRACTIONATION (MALAYSIA)

- Fractionation of RBD palm oil into palm olein & stearin is accomplished via:

a) Dry fractionation
b) Detergent fractionation (not popular now)
c) Solvent fractionation (no longer in used due to economically feasibility concern)

DRY FRACTIONATION

- RBDPO is kept at 70°C (destroy crystal memory)
- RBDPO is cooled and agitated slowly until 22°C
- Thick semi-solid slurry is filtered.
- The types of filters used are drum rotary filters (Stockdalea) & stainless steel belt filters (Florentine) which operates using vacuum suction to separate the liquid olein from the stearin crystals
- Membrane recessed plate Filter Presses using “Squeezing techniques” are commonly practice now.

Detergent fractionation

- Popular before the introduction of membrane filter.
- Process

1. Cooling of RBDPO until 22°C
2. Slurry is mixed with detergent (sodium lauryl sulphate solution) & an electrolyte (magnesium sulphate)
3. Fractionation carried out using centrifugal technique.

Solvent fractionation

- Not economical to fractionate normal stearin & olein
- High investment cost
- Skilled manpower and additional solvent recovery and purification required

Solvent fractionation

- Process

1. Common solvent used : hexane & acetone
2. Solvent : oil ratio = 1 : 3
3. Cooled down using crystallizer
4. Filter using vacuum suction.

Conclusion

- Physical and chemical refining has pros and cons need to be considered during refining process
- Fractionations involves several steps and collective consideration should be done in order to chose the best method for fractionation.

Chapter description

All pictures/photographs/diagrams/figures used in this chapter is subjected to common creative that for education purposes