TECHNICAL ADVANTAGES OF USING PALM OIL IN FOOD APPLICATION

Dr. Mohd Suria Affandi Yusoff
Sime Darby Research Sdn Bhd
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3. Palm Oil in Food Applications

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Introduction
Introduction to Palm Oil

- Yearly production PO approx. 5 MT/ha
- Economic productivity ~ 20-25 years
- **Versatile Oil** – cooking, frying, baking, confectionery, margarines, spreads
- **Stable Oil** – Not easily oxidized
1 tree = 2.5 round harvesting/mth
1 tree = 25–35 mt/yr/ha
Oil Palm – Fresh Fruit Bunch (FFB)

Basic Facts

- Fruitlets per bunch: 2800-3000
- Bunch Weight: 30 kg
- Fruit size: 5 cm
- Fruit shape: Oval
- Fruit Color: Yellowish Red
- Fruitlet weight: 10 gm
Anatomy of an Oil Palm Fruit

Mesocarp: Palm Oil (PO)

Kernel: Palm Kernel Oil (PKO)

Shell

Basic Facts

• Kernel per fruit: 5-8%
• Mesocarp per Fruit: 85-92%
• Oil per mesocarp: 20-50%
• Oil per bunch: 23-25%
<table>
<thead>
<tr>
<th>Fatty Acid Composition</th>
<th>Palm kernel oil</th>
<th>Palm oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12 (Lauric)</td>
<td>47.6 - 50.0</td>
<td>0.2 - 3.6</td>
</tr>
<tr>
<td>C14 (Myristic)</td>
<td>14.6 - 18.6</td>
<td>1.0 - 2.5</td>
</tr>
<tr>
<td>C16 (Palmitic)</td>
<td>8.6 - 13.6</td>
<td>37.2 - 47.6</td>
</tr>
<tr>
<td>C18 (Stearic)</td>
<td>2.0 - 3.8</td>
<td>4.4 - 13.3</td>
</tr>
<tr>
<td>C18:1 (Oleic)</td>
<td>13.7 - 16.5</td>
<td>29.9 - 40.7</td>
</tr>
<tr>
<td>C18:2 (Linoleic)</td>
<td>2.2 - 3.4</td>
<td>9.2 - 11.6</td>
</tr>
</tbody>
</table>
Palm Oil & Its Fractions

# Fatty Acid Composition of PO and PKO Products

<table>
<thead>
<tr>
<th></th>
<th>Palm Kernel Oil</th>
<th>Kernel OleiPalm</th>
<th>Palm Kernel Stearin</th>
<th>Palm Oil</th>
<th>Palm Oil Olein</th>
<th>Palm Oil Stearin</th>
<th>Palm mid Fract</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:0</td>
<td>0.3</td>
<td>0.4</td>
<td>0.2</td>
<td></td>
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</tr>
<tr>
<td>8:0</td>
<td>4.4</td>
<td>5.4</td>
<td>1.2 - 3.5</td>
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<td></td>
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</tr>
<tr>
<td>10:0</td>
<td>3.7</td>
<td>3.9</td>
<td>2.4 - 3.6</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12:0</td>
<td>48.3</td>
<td>41.5</td>
<td>55.6 - 58.6</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1 - 0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>14:0</td>
<td>15.6</td>
<td>11.8</td>
<td>18.1 - 24.7</td>
<td>1.1</td>
<td>1.0</td>
<td>1.1 - 1.9</td>
<td>0.8</td>
</tr>
<tr>
<td>16:0</td>
<td>7.8</td>
<td>8.4</td>
<td>7.1 - 7.9</td>
<td>44.0</td>
<td>39.8</td>
<td>47.2 - 73.6</td>
<td>52.8</td>
</tr>
<tr>
<td>16:1</td>
<td></td>
<td></td>
<td></td>
<td>0.1</td>
<td>0.2</td>
<td>0.0 - 0.2</td>
<td></td>
</tr>
<tr>
<td>18:0</td>
<td>2.0</td>
<td>2.4</td>
<td>1.5 - 1.8</td>
<td>4.5</td>
<td>4.4</td>
<td>4.4 - 5.6</td>
<td>6.7</td>
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<tr>
<td>18:1</td>
<td>15.1</td>
<td>22.8</td>
<td>2.6 - 1.5</td>
<td>39.2</td>
<td>42.5</td>
<td>15.6 - 37</td>
<td>34.7</td>
</tr>
<tr>
<td>18:2</td>
<td>2.7</td>
<td>3.3</td>
<td>0.2 - 1.5</td>
<td>10.1</td>
<td>11.2</td>
<td>3.2 - 9.8</td>
<td>3.9</td>
</tr>
<tr>
<td>18:3</td>
<td>0.2</td>
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<td></td>
<td>0.4</td>
<td>0.4</td>
<td>0.1 - 0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>IV</td>
<td>17.8</td>
<td>25.5</td>
<td>4.1 - 9.6</td>
<td>53.3</td>
<td>58.0</td>
<td>21.6 - 49.4</td>
<td>35.9</td>
</tr>
</tbody>
</table>
Solid Fat Content (SFC) of Various Palm Fractions

The graph shows the solid fat content (SFC) as a percentage (%) on the y-axis and temperature in degrees Celsius (°C) on the x-axis for different palm fractions:

- Palm Oil
- Olein
- Soft PMF
- Soft Stearin
- Hard Stearin
- Hard PMF
- Super Stearin

The graph illustrates the variation in SFC with temperature for each fraction, indicating the melting behavior and the solidification process at different temperatures.
# Categories of Oils and Fats Based on SMP

<table>
<thead>
<tr>
<th>Soft Oils</th>
<th>Semi Solid Fats</th>
<th>Hard Fats</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBO</td>
<td>Butter oil</td>
<td>Palm Stearin</td>
</tr>
<tr>
<td>Palm olein</td>
<td>Palm oil</td>
<td>Tallow</td>
</tr>
<tr>
<td>CSO</td>
<td>Lard</td>
<td>Hard fraction of butter fraction</td>
</tr>
<tr>
<td>SFO</td>
<td>Hydro. Oil SMP 32 -34</td>
<td>Hydro. Oil SMP above 49 C</td>
</tr>
<tr>
<td>RSO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanut oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sesame oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canola, CNO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PKO, PKOo</td>
<td></td>
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</tr>
</tbody>
</table>
Palm Oil Modification Techniques
Increased demand for better quality oils

**Organoleptic/stability**
- Bland taste, no odor
- Light color (brilliant)
- High thermal stability
- High oxidative stability
- Long shelf life

**Functional Properties**
- Good melting profile
- Desired Plasticity
- Crystallisation kinetics

**Nutritional Quality**
- Balanced FA composition (SFA/MUFA/PUFA, ω3-6)
- Low or no *trans* FA (< 1%)
- High natural antioxidants (tocopherols) and vitamins

**Refining**

**Modification**
Oil Refining: Chemical vs Physical

COST vs QUALITY

Chemical refining

Physical refining

Degumming

Degumming

Neutralisation

SOAPS

SPLITTING

ACID OIL

Dewaxing

Winterising

Bleaching

Winterising

Deodorisation

Deodorisation

Refrigeration

Refrigeration

WAXES

WAXES

GUMS

SPENT BE

Refined Oil

Refined Oil

Sime Darby Plantation
Hydrogenation

- Adds hydrogen atoms into vegetable oil
- Reason: To **modify hardness** of the oil for various applications
- **Partial** hydrogenation or **Full** hydrogenation
- Partially hydrogenated fats widely used as confectionery fats
- **BUT** partial hydrogenation produces **trans fatty acids** (aka trans fats)
- **Trans fats** proven to raise cholesterol levels = **Unhealthy**
Hydrogenation Reactor

Hydrogenation Reactor

Agitator 2 kWh / Ton

Headspace 1/3 of total volume

Heating / Cooling Coils 4.5m² / Ton

Top Stirrer Location to Oil Level very important!

Hydrogen Sparge Ring
Trans-free Solutions...

- Fractionation to get harder fats
- Blending soft oil with harder fats
- Interestesterification (IE) ~ Most recent development
**Interesterification**

- **Rearrangement of the fatty acids in the oil molecule**
  
  *Reason:* To change melting point of the oil/fat

- **Versatile** ~ able to get wide range of fat profile by varying oil type and ratio

**2 ways of doing it:**

1. Chemical Interesterification (CIE)
2. Enzymatic Interesterification (EIE)
Chemical Interesterification (CIE)
Enzymatic Interestesterification (EIE)
Enzymatic Interesteterification (EIE)

Rearrangement of the oil molecule via enzymes

- Cost effective
- Milder reaction conditions
- Selectivity
- Clean & Safe
- “Green chemistry”

EIE provide solutions to partial hydrogenation of soft oils and CIE.
Palm Oil in Food Products - Technical Advantages
Palm Oil Applications

Wide range of application:

- Frying fat
- Cooking oil
- Margarine
- Spread
- Shortening
- Vanaspati
- Confectionery fat
Cooking & Frying Fats

- Palm olein **widely used as cooking oil** in tropical countries

- **Good cooking quality, clear & good oxidative stability**

- Palm olein with **cloud point 10 °C** is the preferred choice in most tropical countries

- Also widely used for **frying in food industry**

- **Good resistance** to gumming, oxidation, foaming, darkening, slower FFA increase, & smoking
Crispa Gold

The Best Vegetable Oil Blend for Caterers

- Uniquely blended for extra long frying life
- Excellent biodispersibility for maximum oil stability and anti-flooding agents
- Minimised foaming and gurgling
- Unique smoking characteristics, crispy, golden results
- Excellent mouth feel
- 20 Litres

Crispa Palm

Premium blend of Palm Oils for superior frying results

- Contains anti-oxidant for maximum oil stability and anti-flooding agent
- Specially formulated for ease-of-use

20 Litres
Margarines & Spreads

- Water-in-oil emulsion with **spreadability, stability and mouthfeel**

- **3 main types:** (1) Table margarine, (2) industrial/baking margarine, (3) pastry margarine

- Other margarine types: stick, whipped soft, pourable, low-fat spreads

- Table margarine: Palm olein suitable as liquid component; Palm stearin suitable as solid component

- Palm oil **imparts plasticity** to margarine. Good working properties. **Good crystallisation** properties
Pastry Margarine (KEMPUFF 39)

Product Characteristics
• Good in plasticity & easy handling
• Flavored & colored
• High in solid profile
• It is normally in slab form with various sizes

Application
• Formulated for preparation of danish pastry, puff pastry and croissant
• As a laminating (roll in) fat in dough to give layer effect to the end product

Functionality
• Impart good layering to puff pastries & croissant
• Contribute taste & richness to the food
• Provide tenderness to croissant & puff pastries
• Improve volume of croissant & puff pastries
Cake and Cream Margarine (IM39)

Product Characteristics
• This margarine is a high quality bakery fat specially formulated and texturized to give good creaming volume for cakes & cookies
• It also can be used in a wide range of temperatures and does not oil out on exposure to normal storage temperatures of up to 40°C

Application
• Cakes, cookies, cake decoration creams, bakery filling creams, coffee roasting and Asian type of bread like paratha, capati, lebanese bread and etc.

Functionality
• Improves volume and softness of the cakes
• Increases taste and gives pleasant mouth feel
• Contributes to softness and an aroma for cookies
Shortenings

- Various types: **frying, baking, icing & filling shortenings**
- Desirable melting range: **34-44 °C**
- Palm oil is preferred due to tendency to **promote β’ crystals** (the preferred type of fat crystal for good mouthfeel)
- IE fats with palm oil gives **good SFC profile** for shortenings
Bakery Shortening (AP40)

Product Characteristics
- It's specially formulated and texturised to give good creaming properties over a wide range of temperatures
- It does not oil out on exposure to normal room temperature of up to 40°C

Application
- Icing cream, filling creams, cakes and bread, biscuits, crackers and other bakery products

Functionality
- Act as lubricant for dough mixing, handling, proofing
- Promote bread volume
- Cohere gluten strand and shorten it
- Impart desirable eating
- Give good cream volume for icing cream
Specialty Animal Fat Replacer (SAFaR)

Product Characteristics
- Vegetable based fat to imitate the function of animal fats

Application
- Beef sausages, burger patties, chicken nuggets, pepperoni, meat balls

Benefits
- Cholesterol free as its 100% vegetable based
- Free from pathogenic and spoilage microbes
- Improve product shelf life
- Cost effective when the meat price is higher
Milk Fat Replacer (MFR)

Product Characteristics
- Palm oil based vegetable shortening as replacement for dairy milk fat
- Texturized for easy handling

Application
- Dairy milk fat, cheese, ice cream

Benefits
- Cholesterol free as its 100% vegetable based
- Consistency in quality
- Cost effective
Vanaspati

- Vegetable ghee to **substitute butterfat** (ghee)
- Widely used in India, Pakistan & Eastern Mediterranean countries
- In the past, hydrogenated fats were used
- Now, **trans-free vanaspati** from palm stearin blended with soft oils is used
- IE of palm stearin and palm olein able to give **softer texture** than hydrogenated vanaspati
Vanaspati
Red Palm Oil/Olein

- Palm olein with high amounts of β-carotenes
- **Deep reddish color** cooking oil
- **Widely accepted in Japan** for healthful benefits
Red Palm Superolein

Properties
- Natural vegetable liquid oil
- Bright red colour
- Natural beta-carotene
- Source of pro-vitamin A and vitamin E

Benefits
1. **Colorant** which enhances food presentation
2. Improves product *shelf life*
3. Adds *nutritional value* to foodstuffs

- Clean labelling
- Easy dosing and mixing

Contact details
jomasales@simedarby.com
Red Palm Superolein: a Natural Colourant

- Visual appeal of a product has an effect on our appetite
- When Red Palm Superolein is added to food products, it produces a yellow to red color

Examples of application: soups, potatoes, margarines, dressings, mayonnaise, seasoning, cheese, bakery products etc.

Visual impact of Red Palm Super Olein in a refined vegetable oil blend
Confectionery Fats (CBE, CBS, CBX)
Confectionery Fats (CBE, CBS, CBX)

- Cocoa butter ~ mainly **POP, POS, SOS**-type triglycerides
- Palm Oil ~ **high in POP**
- Palm oil fraction ~ **Palm Mid Fraction (PMF)** has enriched POP content
- Used as CBE to blend with other exotic fats (illipe, shea fats)
- **Palm kernel oil** ~ Used as lauric-type CBS
- Also can be blended with other lauric oils
Cocoa Butter Substitute

Product Characteristics
- A superior quality cocoa butter substitute made from hydrogenated and fully refined vegetable oils and fractions. It has excellent sharp melting profile
- It is a hydrogenated lauric fat, and trans free

Application
- As total replacer of cocoa butter in compound, for solid and hollow moulding, enrobing and couverture

Functionality
- Having brittle texture
- Have good glossiness and have excellent mouthfeel profile
- Good demoulding properties to the end product
Coating Fat

Product Characteristics

- A high quality lauric coating fat based on hydrogenated and fully refined vegetable oils and fractions
- It has an excellent heat resistance and it’s specially formulated for warmer climates
- It also has excellent microbiological properties, shows good stability against oxidation and it's free from lipases

Application

- As total replacer of cocoa butter in compound chocolate coating for biscuits, wafers, nougats, nuts and raisin
- Suitable for manufacture of glazes, icing, caramels, toffees, fillings and cream
- Milk fat replacer for nondairy creamer, caramel and toffee

Functionality

- Non tempering fat
- Glossy and good mouthfeel
- Non tempering and excellent heat resistance
Soft Confectionery Fat

Product Characteristics
- A soft confectionery fat made from non lauric fat and non hydrogenated fat
- It is also stable and does not oil out during storage

Application
- Compound chocolate spread
- Compound filling in chocolate

Functionality of the soft confectionery fat
- The product remains soft at wide temperature range and after baking
- No waxy taste and has excellent mouthfeel
- Chocolate spread remain soft at wide temperature range
Conclusion
Conclusion

• Palm oil is very versatile in terms of utilization
• Palm oil factions are interchangeable with other fats/oils
• Can be used directly without modification
• Healthy in nature
• Cheapest edible oil in the market
Future Trends of Edible Oil
Thank You