

Palm Oil & Fractions: Characteristics and Properties

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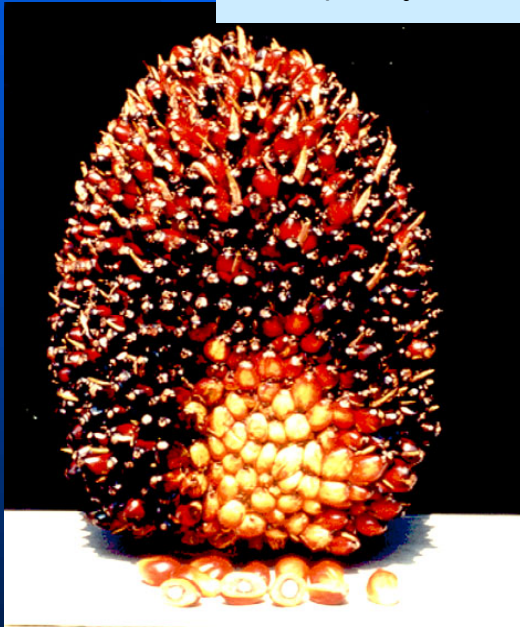
**OFI Middle East 2008,
14-16 April, Abu Dhabi**

**PALM OIL INDUSTRY-RM45.1b,
PLANTED AREA OF 4.3m hectares,
production of 15.8 m tonnes oil.**

Oil Palm Bunch

Oil per bunch
20-30%

15.8m tonne CPO



Bunch weight 20-30 kg

Fruit spiklets



1.95m tonne PKO



Kernels

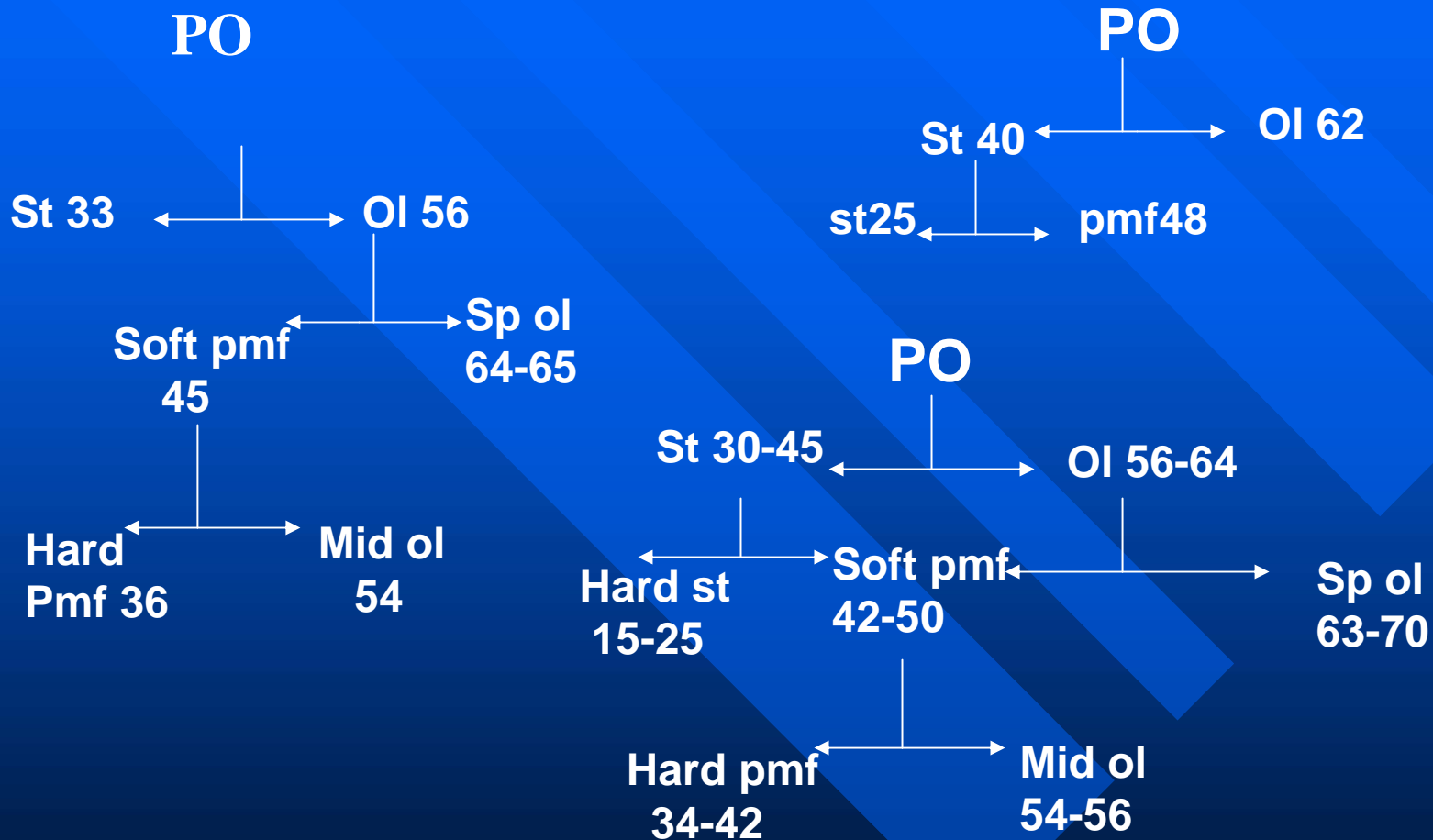
Why PALM OIL?

- Versatility
- Cost effectiveness
- Wide range of products
- 20% solids at 20C-suited for formulation of plastic fat products
- Nutritive value

PALM OIL- A BALANCED OIL

- **50% UNSATURATED** • **50% SATURATED**

Fractionation of palm oil



Source:Kellen, M.

FATTY ACID COMPOSITION OF PALM OIL PRODUCTS

FAC	Palm Oil	Palm Olein	Super Olein	Palm Stearin
C12:0	0.2	0.2	0.3	0.1-0.3
C14:0	1.1	1.1	1.0	1.1-1.7
C16:0	44.0	40.9	35.4	49.8-68.1
C18:0	4.5	4.2	3.8	3.9-5.6
C18:1	39.2	41.5	45.1	20.4-34.4
C18:2	10.1	11.6	13.4	5.0-8.9
C18:3	0.4	0.3	0.3	0.1-0.5
C20:0	0.4	0.2	0.3	0.3-0.6

Triacylglycerol composition of palm oil

TAG	wt%	TAG	wt%	TAG	wt%	TAG	wt%	TAG	wt%
All 0 db	7.4	All 1 db	36.8	All 2 db	34	All 3 db	16.1	All>3 db	5.6
PPP	5.1	MOP	0.9	POO	20.3	OOO	4.4	LOO	1.8
PPSt	1.2	POP	23.7	StOO	2.4	POL	4.1	OLO	1.2
PStP	0.3	POSt	5.7	OPO	1	PLO	5.6		
		PPO	4.4	PLP	6.5				
		PStO	0.2	StLP	1.6				

TRIGLYCERIDES OF PALM OIL PRODUCTS(C No.)

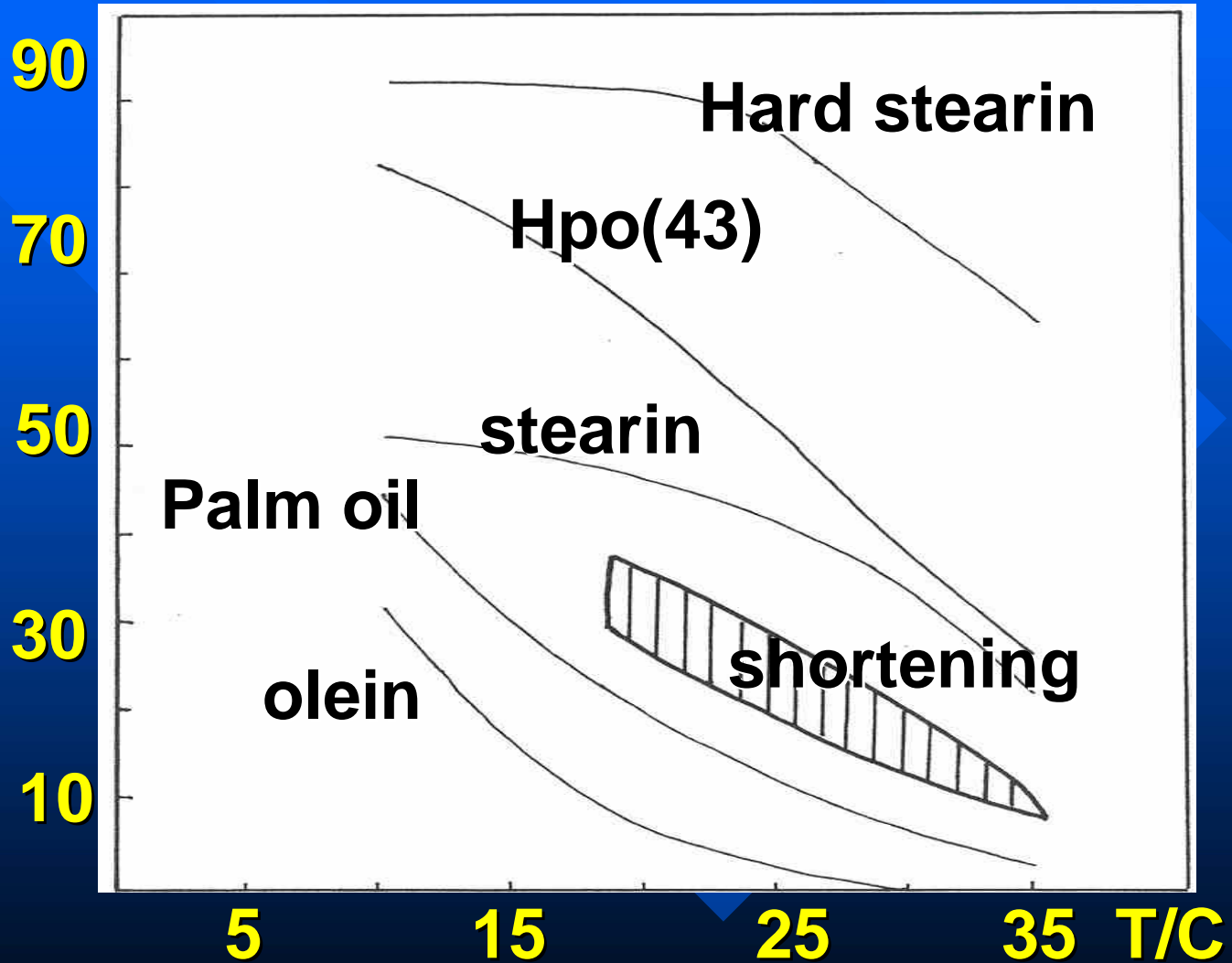
C. No	Palm Oil	Palm Olein	Super Olein	Palm Stearin
C46	0.8	0.8	0.2	3.1
C48	7.4	3.3	1.9	23.7
C50	42.6	39.5	30.8	40.3
C52	40.5	42.7	53.4	25.3
C54	8.8	12.8	13.6	6.9
C56	-	0.7	0.2	0.5

Two important physical properties of palm oil

SOLID FAT CONTENTS

POLYMORPHISM

Solid fat contents of palm oil products



Morphology of Crystals

α Small

β' Small, $\approx 5 \mu\text{m}$, needle-like

β large, coarse, as large as $50 \mu\text{m}$ or more, dense, flat

β' TENDING

Palm oleins

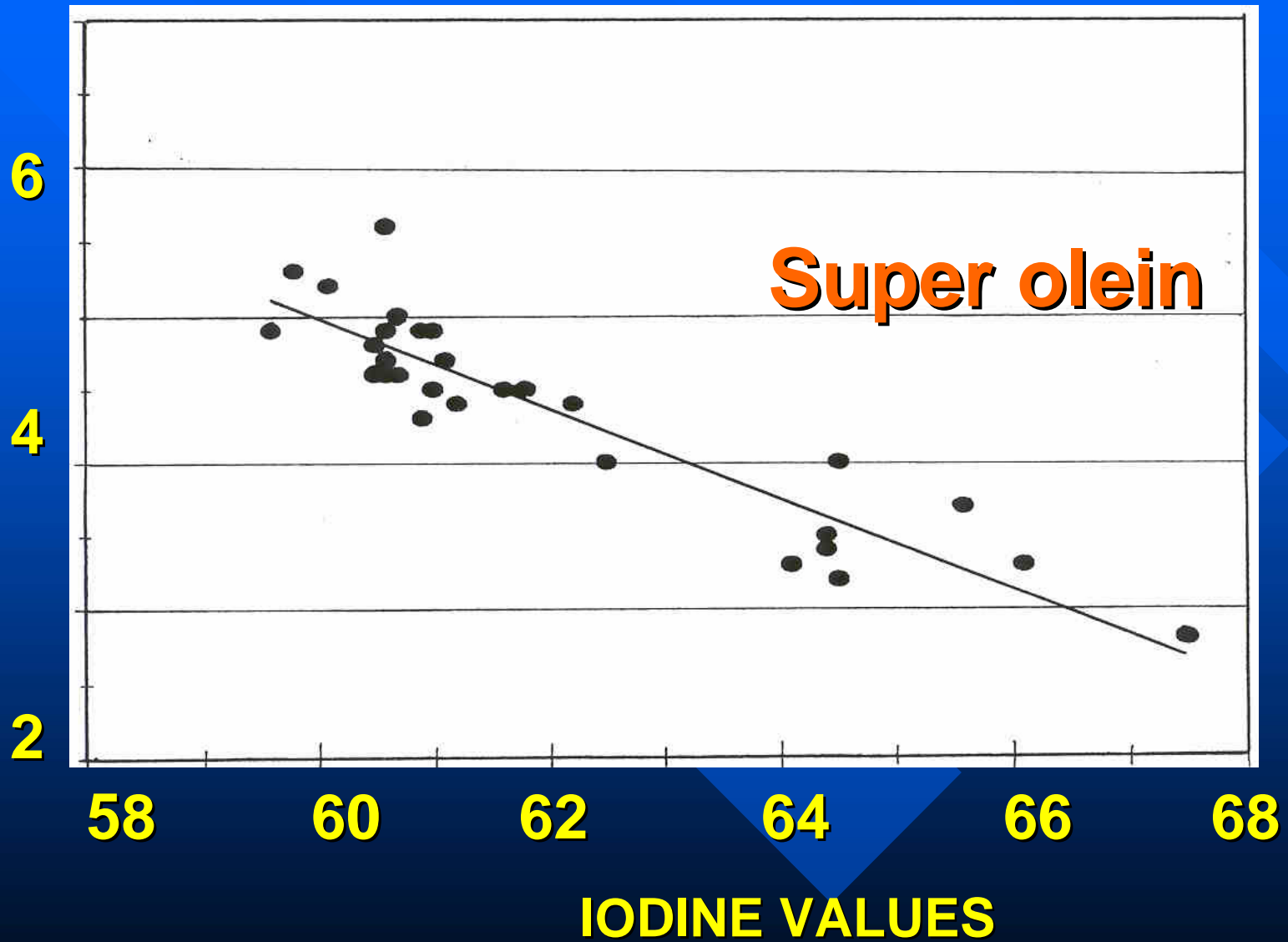
TWO TYPES

- IV 56 – 60
- IV >60

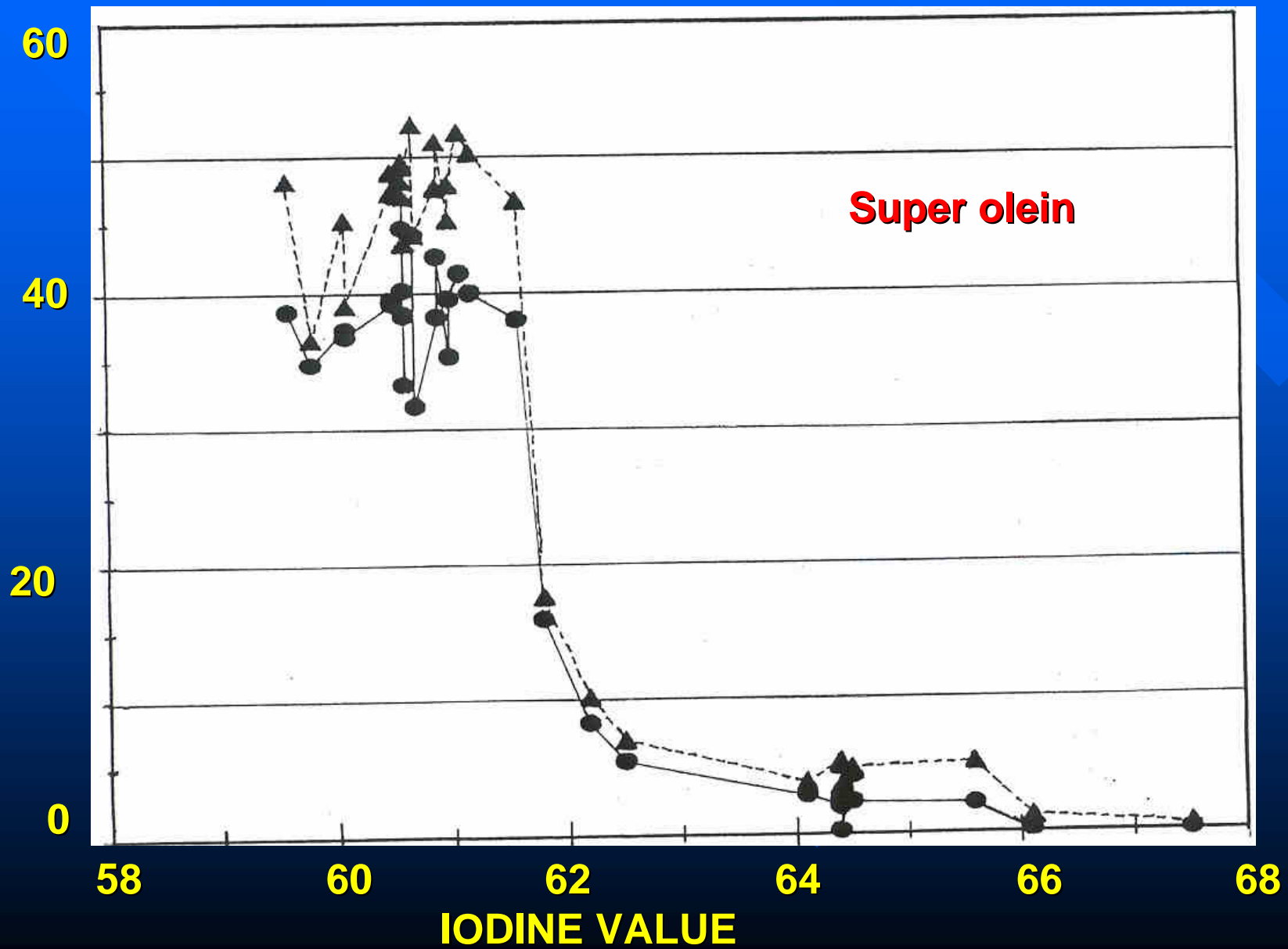
Fatty acid composition(wt%) of palm olein

IV	C14	C16	C18	C18-1	C18-2
<60	1.0	37.9	4.1	43.4	12.5
60-64	1.0	34.8	3.8	45.5	14.2
>65	1.0	30.8	3.6	47.9	15.4

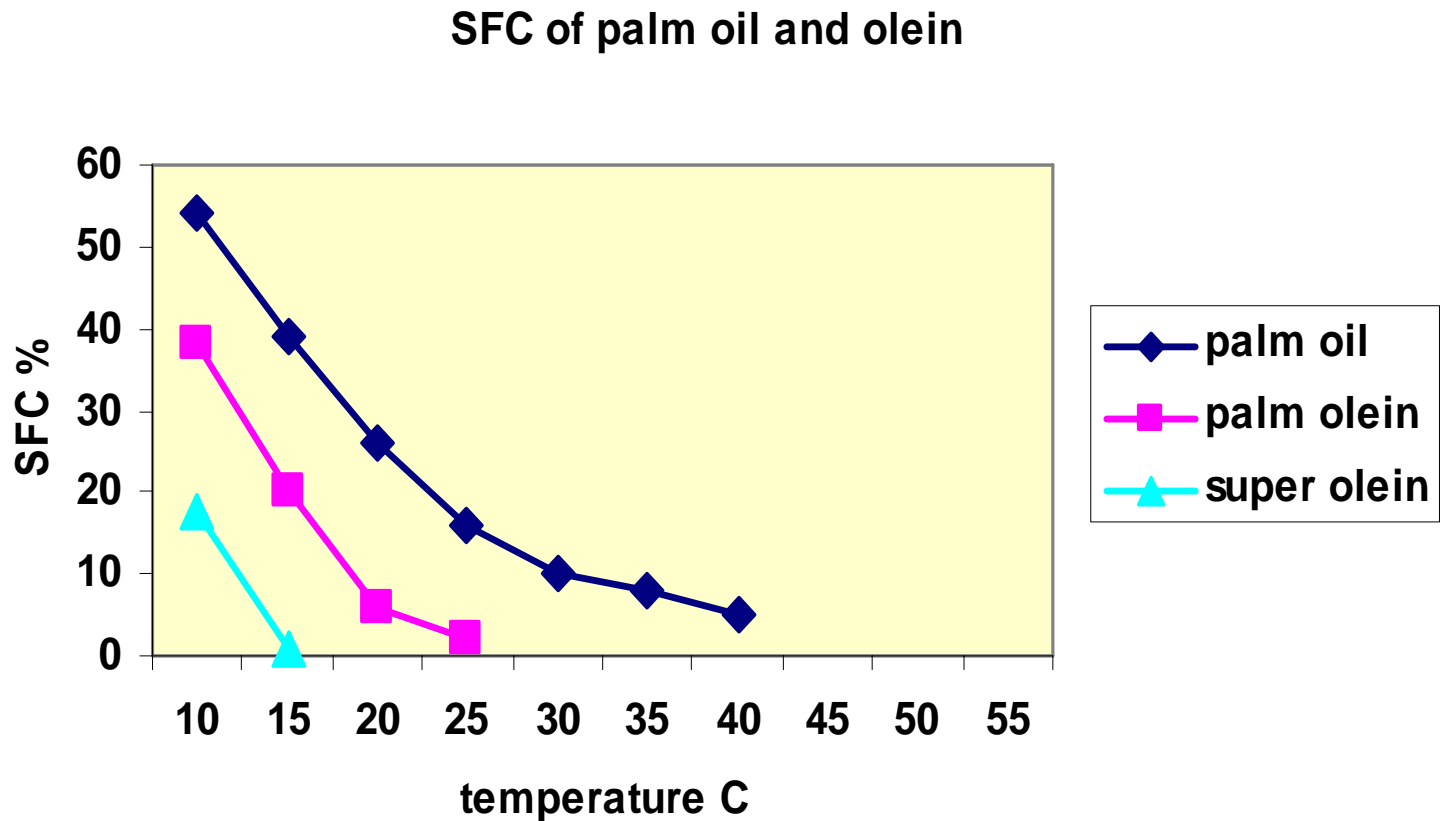
CLOUD PT (C)



SFC AT 2.5 AND 5C



SFC of palm oil and oleins



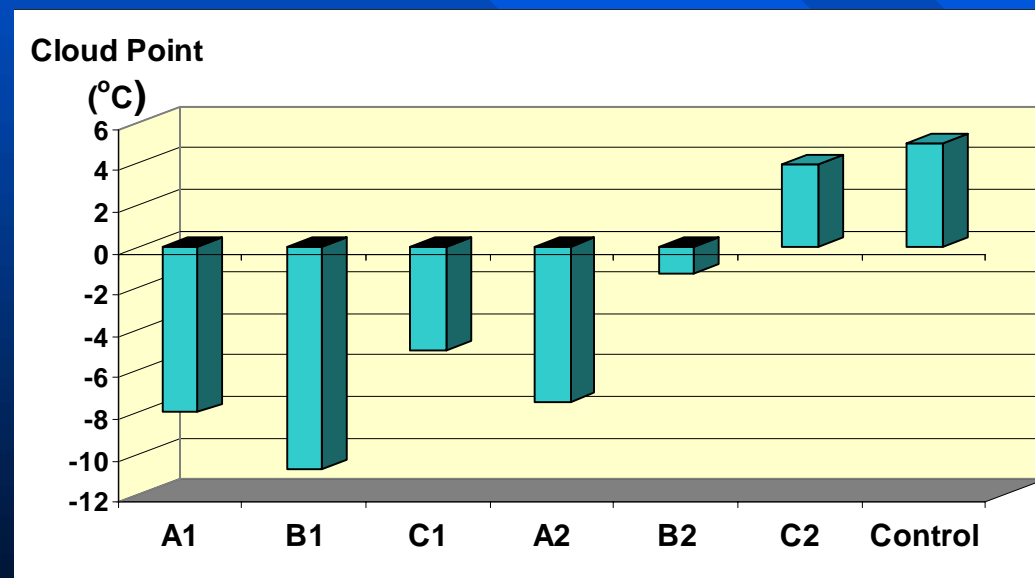
Palm olein

- An excellent choice for food applications.
- Has good oxidative stability.
- Limited use in temperate countries - tends to crystallize and becomes cloudy at low temperature.
- Blending of palm olein with other liquid oils increase the degree of unsaturation (IV) of palm olein.

Binary and ternary blends of palm olein with other liquid vegetable oils, alternatives to partially hydrogenated oils which contain *trans* fatty acids.

Oil blends stay clear in temperate climate.

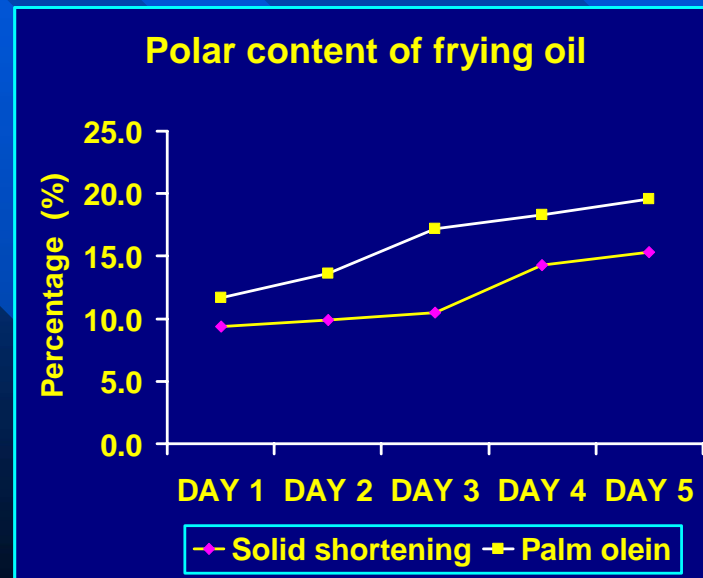
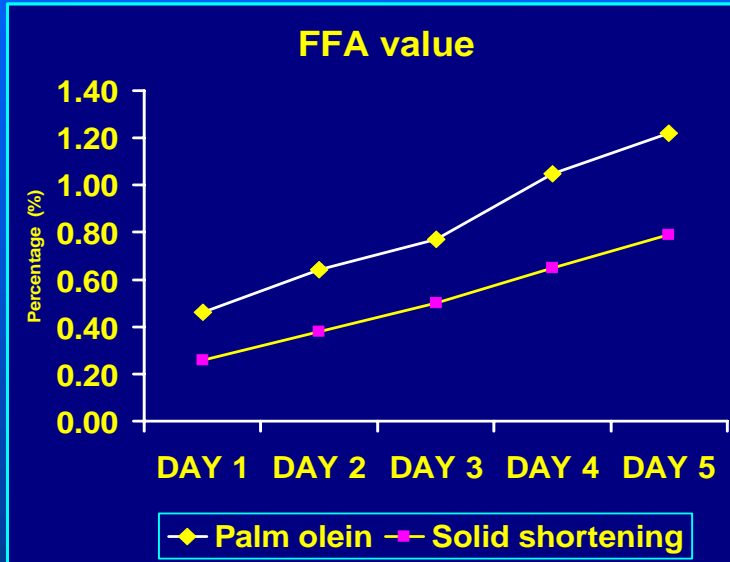
Excellent choice for food applications, e.g. as frying, cooking and salad oils.



Typical specifications of palm olein for snack food frying

■ FFA	<0.05%
■ PV	<1
■ M&I	<0.1%
■ COLOUR	<3R
■ FLAVOUR	BLAND
■ SMOKE POINT	220-240C

Frying performance of palm-based solid shortening vs. palm olein.



ADVANTAGES OF USING PALM-BASED PRODUCTS AS A FRYING MEDIUM

- Abundant supply
- Good heat transfer
- Excellent oxidative and flavour stabilities
- Less foam, polymers and polar compounds compared to soft oils

Palm stearins

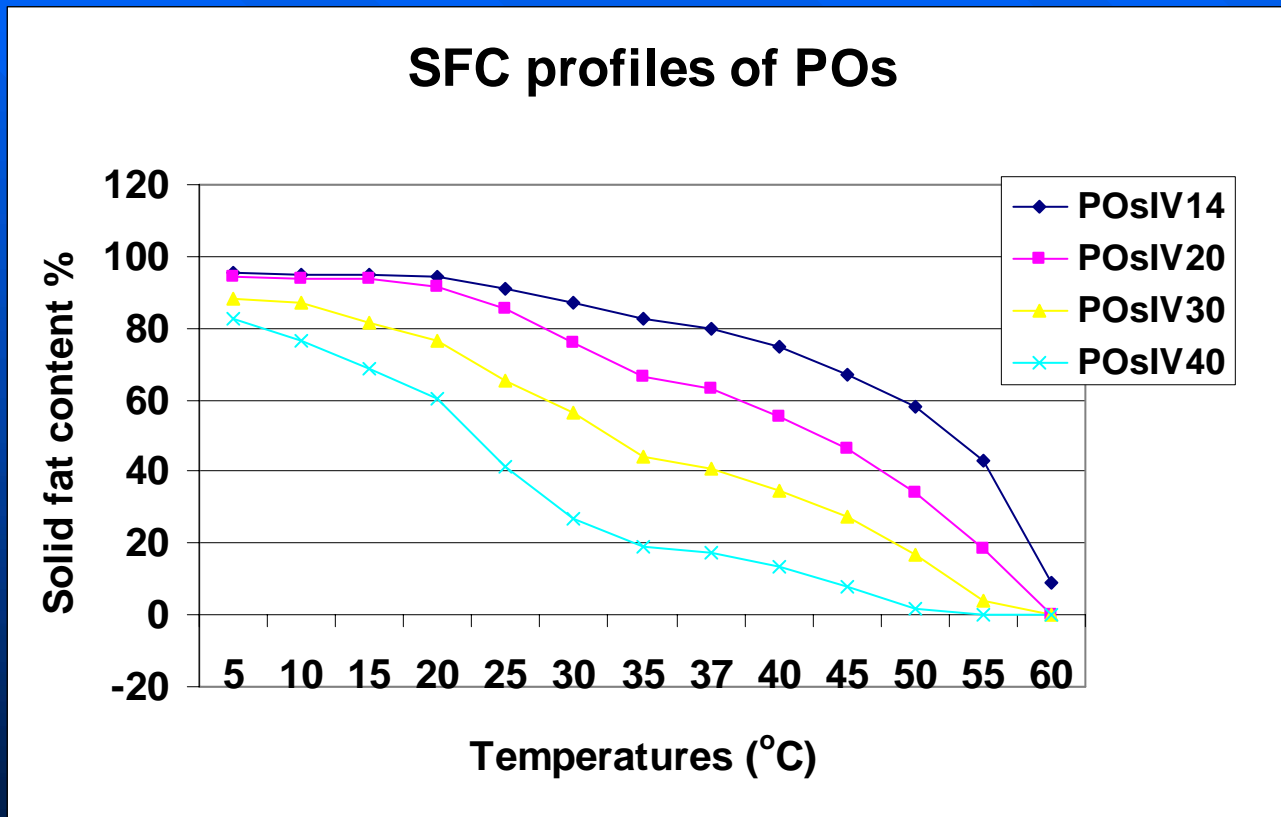
Fatty acid composition of commercially available palm stearins

Fatty acids	Range(wt%)
16:0	47-82
18:0	4 - 6
18:1	11-37
18:2	1-10

Characteristics of Palm Stearin

Parameters	Range
Slip Melting Point °C	44 - 60
Iodine Value	14 - 49

SFC of palm stearins



FATTY ACID COMPOSITION OF COCOA BUTTER, PALM, ILLIPE AND SHEA FAT

Fatty acid	Cocoa butter	PMF	Illipe	Shea
C12:0	Trace	0.1	Trace	0.5
C14:0	0.7	1.2	0.3	0.6
C16:0	25.2	46.8	17.5	4.2
C18:0	35.5	3.8	45.8	40.6
C18:1	35.2	37.6	35.2	47.3
C18:2	3.2	10.0	0.7	5.4
Total saturated	61.4	51.9	63.6	45.4

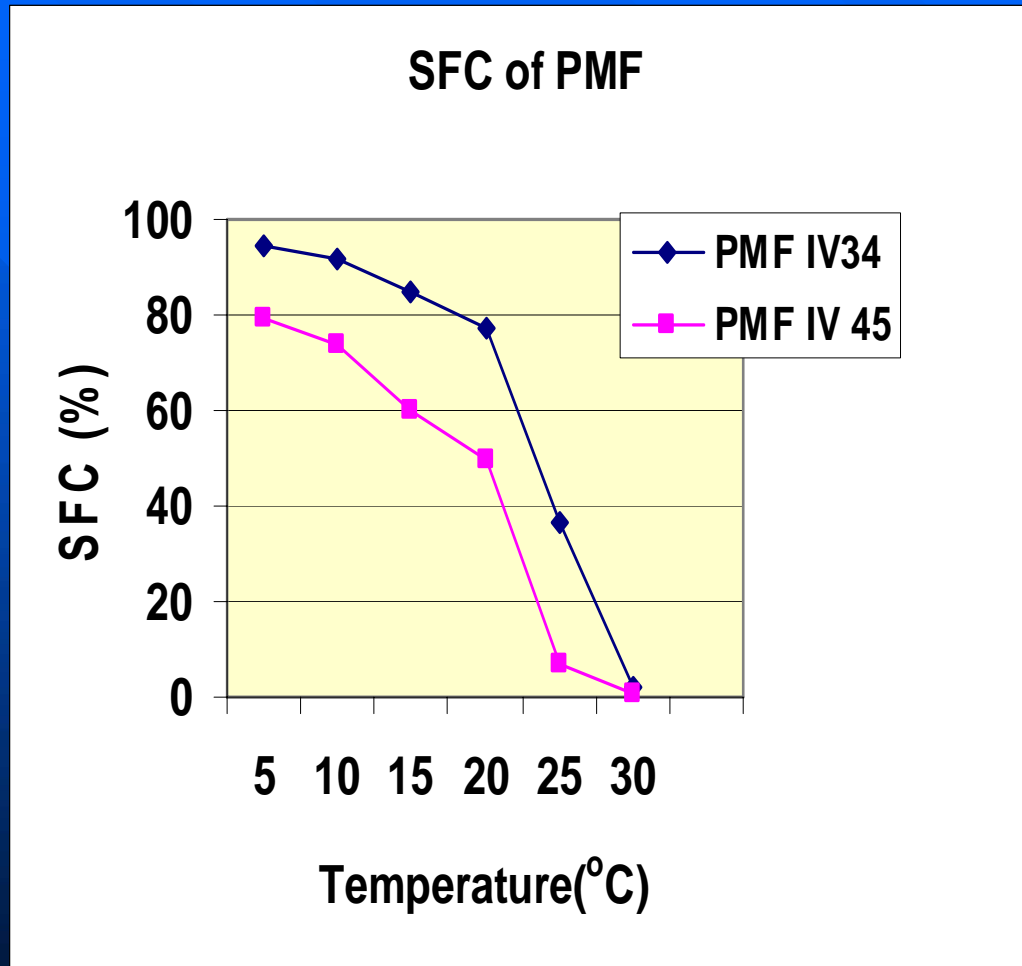
POP, POS, SOS

POP

POS & SOS

SOS

SFC of PMF



TOCOPHEROLS/ TOCOTRIENOLS IN OILS

**TOCOPHEROL
- RICHED**

**SOY, CORN
COTTONSEED,
SUNFLOWER,
RAPESEED**

**TOCOTRIENOL-
RICHED**

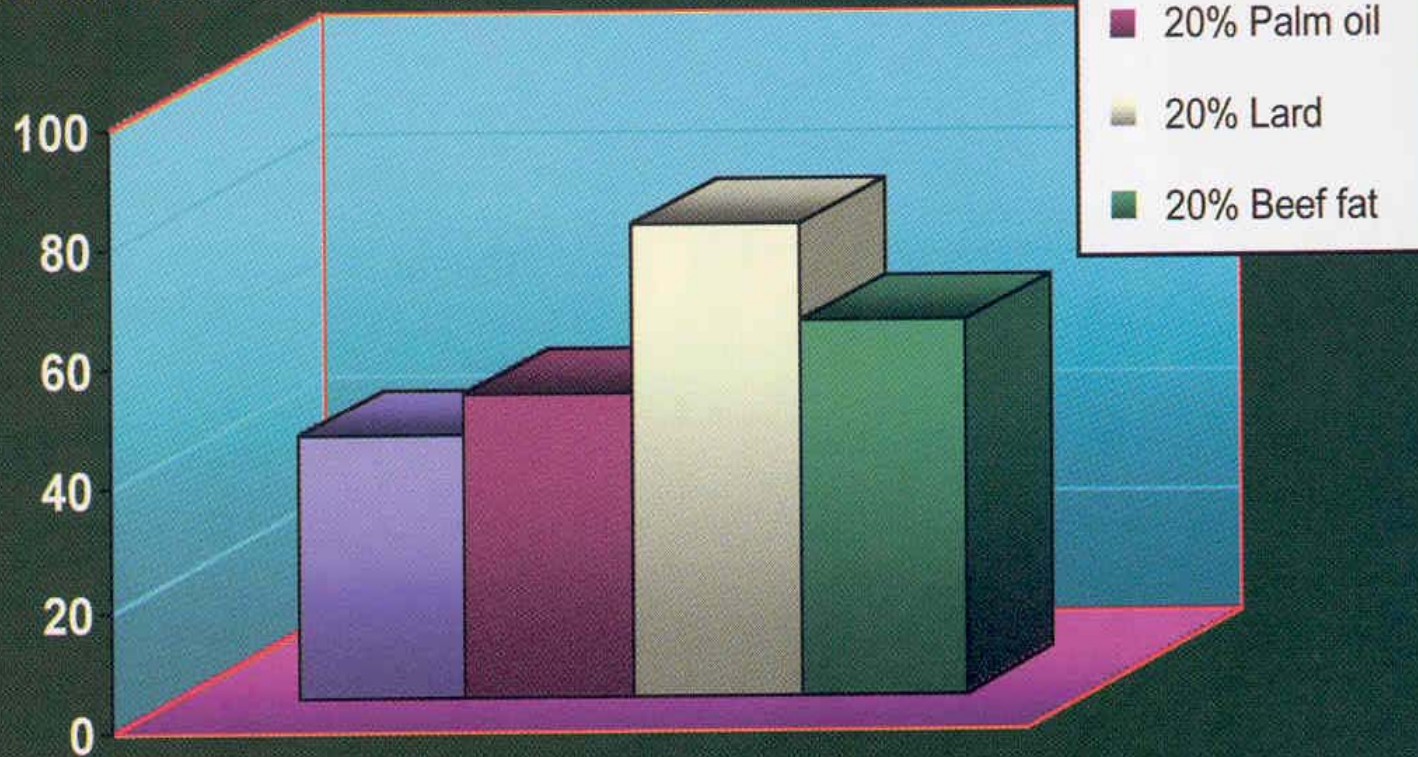
**PALM,
WHEATGERM,
RICEBRAN**

TOCOPHEROLS/TOCOTRIENOLS IN PALM OIL PRODUCTS

Type	mg/kg
Crude palm oil	600 - 1000
Crude palm olein	800 - 1000
Refined palm oil	350 - 630
Refined palm olein	468 - 673

Effect of palm oil and other fats on cancer development

Tumour Incidence %



Source: Sylvester et al. (1986). Cancer Research.

A 20% palm oil (PO) diet was protective and comparable to a 5% corn oil (CO) diet. It was also better than a 20% lard and a 20% beef fat (BF) diets.

CAROTENOID COMPOSITION IN CRUDE PALM OIL

TYPE	%
PHYTOENE	1.3
β CAROTENE	56
α CAROTENE	35
LYCOPENE	1.3
OTHERS	6.4

Vitamin A precursor

Novel palm products-nutrolein

- A nutritious cooking oil, extracted from selected palms and processed under stringent QC to retain carotenoids and tocopherols.

	Specifications
FFA	0.10%
IV	64 min
Cloud point	4C
SMP	16C
carotene	400ppm min
tocols	800ppm min

Advantages of palm oil

- **Versatility**
- **Unique in composition**
- **Functionality**
- **Healthy, natural oil**
- **Trans-free formulations**
- **Stability**
- **Abundance**
- **Consistent supply**