



High oleic palm oil has a lower saturate value than conventional palm oil

The high oleic option

A hybrid form of palm oil grown in Colombia and Ecuador has a higher oleic content than conventional palm oil, offering applications in frying, baking and chocolate spreads

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High oleic palm oil (HOPO) is a non-GMO hybrid, known as *Oleifera X Guineensis* (OXG). It was developed and introduced in Colombia, Ecuador and other countries in the 1990s as a result of a cross between the male *Elaeis guineensis*, (the conventional palm tree from the Gulf of Guinea in Africa) and the female *Elaeis oleifera*, originally from tropical South America, including the Amazon Basin of Brazil, Colombia and other countries in the region.

As the South American palm tree yields fruits with significantly higher oleic content and far higher levels of tocopherols, tocotrienols and beta carotene, this hybrid has a different fatty acid profile to the *Elaeis guineensis* fruit oil.

The *Elaeis oleifera* oil, also known as “Noli” in Colombia and “Caiaué” in Brazil, contains around 65% oleic acid, 20% saturated fatty acids (SAFA) and only 15% polyunsaturated fatty acids (PUFA). As a result of hybridisation, the oil resulting

from the OXG hybrid contains more than 50% oleic acid, 33% SAFA and 12% PUFA, a very balanced fatty acid profile.

HOPO is chiefly grown in Colombia and Ecuador, where the planted area is projected to nearly triple from 55,033ha in 2013 to 153,400ha in 2020 (see Table 1, following page).

Production of the oil will grow even more, from 84,278 tonnes in 2013 to a forecast 428,501 tonnes in 2020.

HOPO has a higher production cost, due to the need for assisted pollination, but research is currently underway to address this. It also has a lower amount of kernel and therefore less palm kernel oil. But in areas where bud rot is endemic, growing HOPO is an alternative as it is tolerant to the disease.

Physically, HOPO is more liquid at room temperature than conventional palm oil as it has a different solid fat content (SFC) curve derived from its different

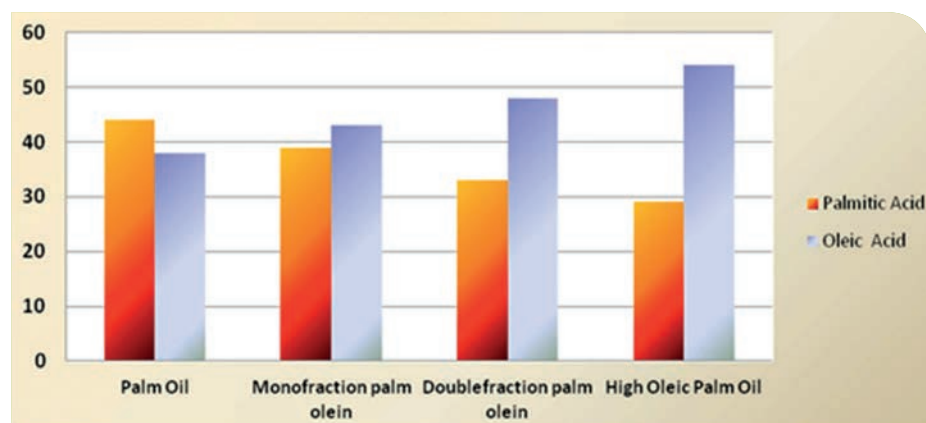


Figure 1: Fatty acid comparison of palm oil and fractions vs high oleic palm oil (%)

Source: Lipidos Santiago

Colombia & Ecuador	2013	2015	2020 (projected)*
Planted area (hectares)	55,033	76,700	153,400
Production of oil (metric tonnes)	84,278	177,219	428,501

Table 1: High oleic palm oil in Colombia and Ecuador

Source: *Lipidos Santiga*

	Palm oil	Monofraction palm olein IV56	Double fraction palm olein IV56	High oleic palm oil (HOPO)
Saturated fatty acids (%)	46-55	42-48	37-42	27-37
Monounsaturated fatty acids (%)	36-44	41-45	43-50	49-57
Polyunsaturated fatty acids (%)	9-13	10-14	10-17	9-14

Table 2: Comparison of fatty acid profile

Source: *Lipidos Santiga*

		Conventional palm oil	HOPO vs conventional palm oil	Olein 56	HOPO vs olein 56	Olein 56
Melting point (°C)	19	37		24		6
% SFC 10°C				30.0		2.5
% SFC 20°C	3.5	24.2		8.0		0
% SFC 25°C	2.0	15.0		3.5		0
% SFC 30°C	0.5	9.5		1.0		
% SFC 35°C		5.5				
% SFC 40°C		2.5				
Lauric (C12:0)	0.3	0.3		0.3		0.2
Myristic (C14:0)	0.5	0.9		0.9		0.9
Palmitic (C16:0)	29.0	43.0		39.5		34.0
Stearic (C18:0)	3.0	4.5		4.5		4.0
Oleic (C18:1)	53.0	39.0		42.5		45.5
Linoleic (C18:2)	0.5	0.2		11.0		13.0
Linolenic (C18:3)	0.5	0.2		0.2		0.3
% SAFA	33.0	49.0	Decrease of 32%	45.5	Decrease of 27%	39.5
% MUFA	53.0	39.5	Increase of 36% MUFA and 31% PUFA	42.5	Increase of 24% MUFA and 20% PUFA	46.0
% PUFA	12.5	10.5		12.0		14.0

Table 3: High oleic (HOPO) vs. conventional palm oil

Source: *Lipidos Santiga*

► triglyceride composition.

Figure 1 (previous page), compares the oleic and palmitic content of palm oil and its olein fractions to HOPO. The graph shows that HOPO has more than 50%

oleic acid and less than 30% palmitic acid (a third of total saturated fatty acids). These properties give HOPO a place among oils rather than fats, but with the advantage of a dropping melting point of

22-26°C.

A comparison of the fatty acid profiles between *Elaeis guineensis* (conventional palm oil), HOPO and the mono-fractionated palm olein IV56 and the double-fractionated palm olein IV shows that HOPO has less SAFAs, more MUFAs and a similar level of PUFAs than conventional palm oil (see Table 2, left).

Usage and applications

HOPO can be used in a variety of applications, replacing conventional *Elais Guineensis* palm oil, palm olein IV56 or double fractionated palm olein IV64, depending on the application desired. It is also the cheapest high oleic oil option on the market. If a high oleic acid profile is required, HOPO has an ideal balanced composition. When it is used to replace conventional palm oil or palm olein, the SAFA content is reduced and MUFA is increased, making it a good option for food manufacturers and consumers.

A common practice to improve the nutritional values in products such as biscuits or baked goods is to replace part of the solid fat with oils such as high oleic sunflower oil, conventional sunflower oil or rapeseed oils, in order to reduce the content of saturated fats.

This can also be achieved with blends of palm or coconut oil with seed oils and then carrying out an interesterification process (either chemical or enzymatic), to improve plasticity. However, this sometimes has a negative effect on the texture of the finished product. Moreover, the interesterification process is expensive, capacity is limited and the enzymatic process requires large production batches.

In such cases, the use of HOPO is a good alternative. The product's nutritional value can be improved without compromising on the texture. In addition, due to HOPO's higher melting point than oils such as sunflower, soyabean or rapeseed, a larger amount of the solid fat can be replaced with HOPO in some applications without significantly lowering the melting point of the total fat used.

Just like palm oil, HOPO has good stability. With an iodine value of (Wijs) 65-69g I₂/100g fat – higher than double fractionated palm olein – it is a good choice for frying applications.

The usage of HOPO ensures more than 11 hours Rancimat at 120°C. Due to its

high tocotrienol content, the stability is typically higher than that of conventional palm oil. The low solid fat content (SFC) of HOPO compared to conventional palm oil is another reason to use it in applications where a low solid content at lower temperatures is required.

For applications like chocolate cream, chocolate filling and ice-cream, it could be interesting to replace part of the fat with HOPO in order to increase the monounsaturated fatty acid content in the product, while maintaining the texture and consistency.

Main markets

The main applications for HOPO are as a multi-purpose oil in hotels and restaurants, and in the snack industry and fast food chains for deep frying. Crude 'virgin' HOPO could sell in the nutritional/health/ethical niche markets. In addition, the oil can be used in baking and pastries, to make biscuits and chocolate fillings and in vitamin A & E production.

Vitamin content

The vitamin content of HOPO is higher

than other vegetable oils and conventional palm oil. The typical provitamin A and vitamin E content in HOPO is:

Provitamin A (betacarotenes), 1100- 1600 ppm

- a-carotene, 430-500 ppm
- b-carotene, 780-900 ppm

Vitamin E (tocotrienols & tocopherols), 1250-1400 ppm

- d-tocotrienol, 105-110 ppm
- b & γ-tocotrienol, 930-940 ppm
- a-tocotrienol, 165-170 ppm
- a-tocopherol, 50-70 ppm

Processing

The processing of HOPO is very similar to that of conventional palm oil, although it has advantages over conventional oil. The generation of the process contaminants, 3-monochloropropanediol (3-MCPD) and glycidol ester (GE), is much lower, due to the fact that the free fatty acids (FFA) of the crude oil is typically much lower.

HOPO can also be fractionated, resulting in an olein yield of more than 85% in the first fractionation. A typical outcome of the fractionation process is:

Olein iodine value (IV) 71-75

- Cloud point, 1.0°C-2.5°C
- Melting point (SMP), 6.0°C-8.5°C

First fractionation stearin (IV) 54-57

- Melting point (SMP), 37°C-40 °C
- Title, 43°C

Spanish oils and fats refiner Lipidos Santaiga (LIPSA) has been processing HOPO since 2013 and is the only company to do so in Europe at its 600,000 tonnes/year refinery in Barcelona and 250,000 tonnes/year plant in Huelva.

Advantages of HOPO

HOPO offers several advantages over conventional palm oil including a lower palmitic acid content and saturates, a high IV olein value, a higher oleic content, a healthier profile richer in provitamin A & E, lower 3-MCPD and GE content, no *trans*-fatty acids and no GMOs. It has high stability in all applications, as well as being higher yielding than conventional palm oil.

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