



**An introduction to High Oleic,
Low Linolenic (HOLL)
Winter Oilseed Rape Oil**

WE 
HOLL

To be used only for communication with industry professionals - Not to be used with consumers.*

What is HOLL in oilseed rape?

- HOLL refers to a range of winter oilseed rape (WOSR) varieties with a High Oleic and Low Linolenic (HOLL) fatty acid oil profile. It was achieved by conventional breeding methods to provide an oilseed rape (OSR) oil with a specific fatty acid profile benefiting food processors, foodservice operators and consumers.

Improved fatty acid profile in HOLL OSR oil

- Compared to regular OSR oil the HOLL OSR oil shows an increase in oleic acid content of 26% (> 75%) and has reduced linolenic content to less than 3% (Fig. 1).

Fatty acids profile (%)

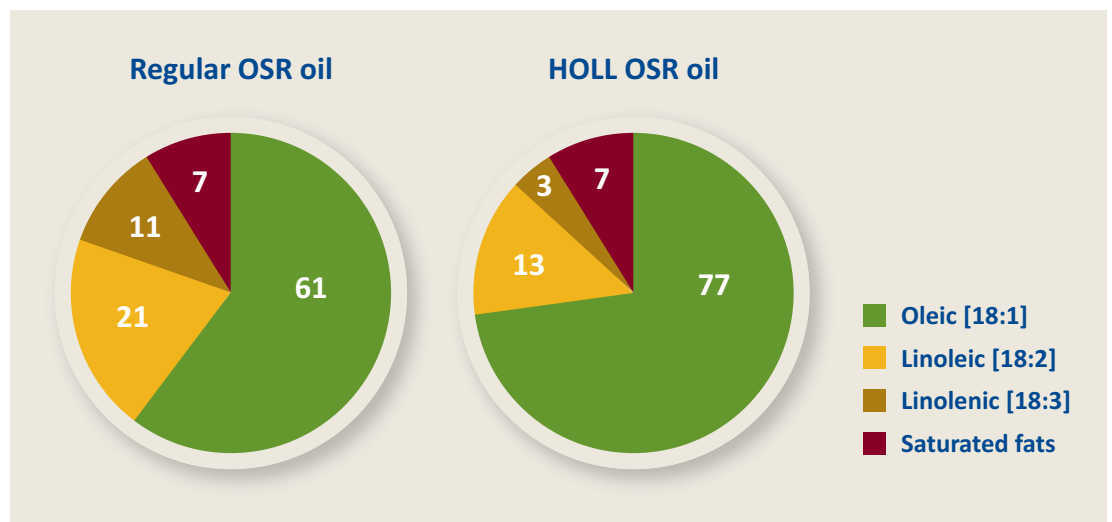


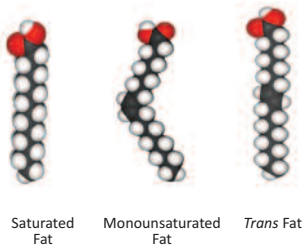
Figure 1. Adapted from Dubois et al. (2008) OCL, 15, 56-75⁰, internal Monsanto data for HOLL OSR oil



HOLL OSR oil has higher amount of oleic acid and less polyunsaturated acids than regular OSR oil (Fig. 3).

- These changes lead to an improved frying performance compared to regular OSR oil.

Fatty acids' molecular models



Double bonds introduce a bend in the hydrocarbon chain of unsaturated fatty acids, which makes it more difficult for them to pack tightly. On the contrary, in saturated fatty acids, with no bends, the fatty acids can pack closely, which make them often solid at room temperature.

Figure 2. (Wikipedia)**.

Classification of fatty acids

Unsaturated	Monounsaturated: Oleic acid (only one double bond in the hydrocarbon chain)	"Good Fat"
	Polyunsaturated: Linoleic acid (Omega 6) and alpha-linolenic acid (Omega 3) (two and three double bonds in the hydrocarbon chain, respectively)	
Saturated	No double bonds in their hydrocarbon chains	"Bad Fat"
Trans	Artificially created form of fatty acid that occurs when an unsaturated fat is hydrogenated (in order to lower the number of double bonds)	

Table 1. Classification of fatty acids, here American Heart Association® & British Nutrition Foundation. (0a&0b)

- **Partial hydrogenation** is the process that adds hydrogen atoms to unsaturated oil, making the fat more solid and stable but creating *trans* fats, which are suggested to be harmful to health.



Why HOLL OSR oil is a Better Option ...

- ... It has more than 75% of oleic acid (Fig. 3).
 - Replacing saturated fats in the diet with unsaturated fats contributes to the maintenance of normal blood cholesterol levels, and oleic acid is an unsaturated fat (EFSA 2011¹).
- ... Even with significantly reduced linolenic acid content, which leads to a better frying performance, HOLL OSR oil still has a good content of Omega 3 (> 0,6g alpha-linolenic acid per 100g and per 100kcal²), and contains a good amount of Omega 6 (linoleic acid).
 - Omega 3 and 6 are two essential fatty acids which contribute to the maintenance of normal blood cholesterol concentrations (EFSA 2009^{2a & 3}).

Recent studies suggest that higher linoleic acid (Omega 6) intake is associated with lower risk of coronary heart disease in a dose–response manner (Farvid 2014⁴), and that increased intake of linoleic acid may lower risk of total and cardiovascular disease mortality in generally healthy older adults (Wu 2014⁵).

- ... It has one of the lowest level of saturated fats compared to most vegetable oils (Fig. 3), providing a good option to reduce the daily intake of these “bad fats”.
 - Dietary guidance recommends a reduction of saturated fats in the diet because they are related to cardiovascular events (EFSA 2010⁶).
- ... It has only trace amounts of *trans* fats.
 - *Trans* fatty acids are associated with coronary heart disease; dietary guidance recommends to eliminate *trans* fats as much as possible (EFSA 2004⁷ & EFSA 2010⁸).
 - Helps food manufacturers meet lower *trans* fats levels in finished product.
- ... It has a good natural vitamin E content (FEDIOL⁹).
 - Vitamin E protects lipids, proteins and DNA against oxidative damages (EFSA 2010¹⁰).



Fatty acid profiles of common edible oils

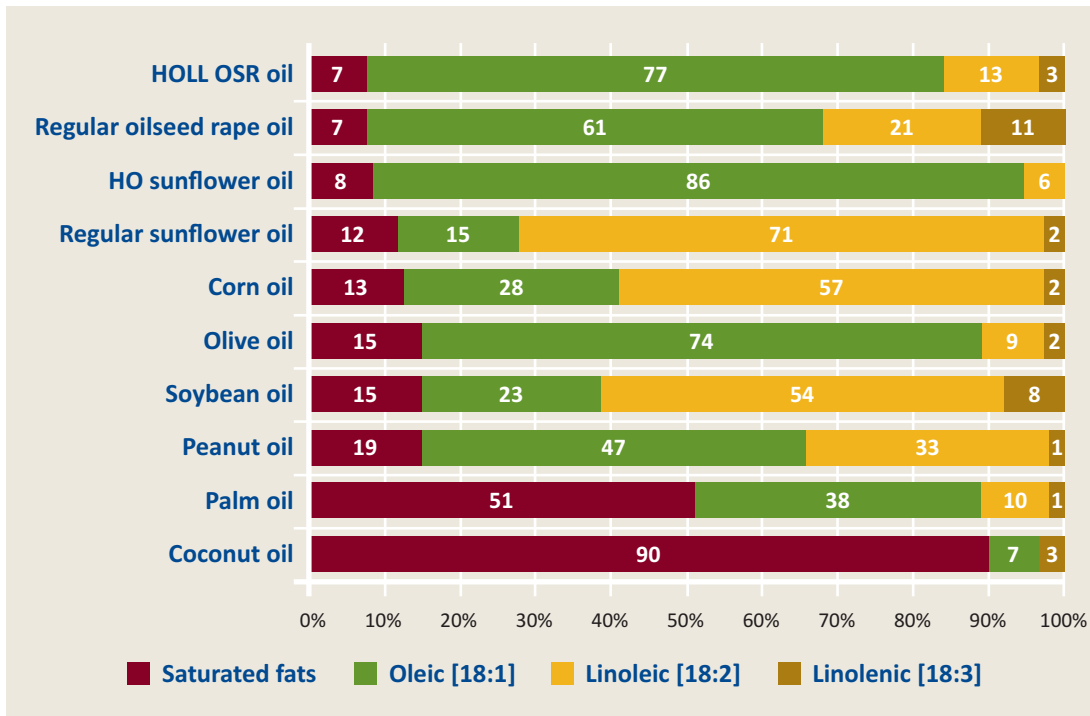


Figure 3: Adapted from Dubois *et al.* (2008) OCL, 15, 56-75⁰, Monsanto data for HOLL OSR oil

HOLL OSR oil is one of the options which combines the lowest levels of saturated fats with a substantial level of oleic acid.

Why HOLL OSR oil is a great alternative for Deep Frying ...

The level of unsaturation is the main factor that promotes oxidation and break down during use of the hot oil. HOLL OSR oil, with less saturated fatty acids and higher levels of oleic acid is more heat resistant than many edible oils.

- ... It has a higher smoke point (246°C) resulting in higher resistance to heat process than most edible oils, thus being a good choice for the frying industry (Table 2).



Smoke point of common edible oils


Oil	Smoke point (°C)
HO sunflower oil	248
HOLL OSR oil	246
Peanut	244
Regular rapeseed	242
Sunflower	240
Corn	234
Soybean	234
Olive processed	220
Extra virgin olive	166

Table 2. (adapted from Canola Council of Canada¹¹).

HOLL OSR oil has a high smoke point (246°C), four degrees higher than regular OSR oil and close to HO sunflower oil, indicating its high resistance to heat processing.

- ... It has similar behavior alone and in blends and it also has better performance in the development of total polar materials (TPM) than regular rapeseed oil (Fig. 4), indicating that the frying life of HOLL OSR oil is longer than for regular OSR oil. Moreover, it has similar behavior to HO sunflower oil in the development of total polar materials (TPM), which indicates substitutability (Fig. 5).
 - Polar materials are the compounds produced due to changes in the oil during heating or frying of oils. Their evaluation in used frying oils is an excellent measurement of oil degradation.
 - In some European countries the discarding level of an oil is set by 24-27% of polar components (Table 3).
 - This increase in shelf life means less frequent oil changes for operational and financial efficiencies.

Limitations in official regulations on used frying fats and oils



Country	Polar compounds max. (%)	Smoke point (°C)
Austria	27	170
Belgium	25	170
France	25	-
Germany	24	170
Italy	25	-
Spain	25	-

Table 3. (Fox 2001¹²).

HOLL OSR oil has a higher smoke point (246°C) compared to what is required in the regulations of some European countries. In addition HOLL OSR oil does not reach the maximum tolerated levels of polar compounds after 14 days of frying.

Frying life

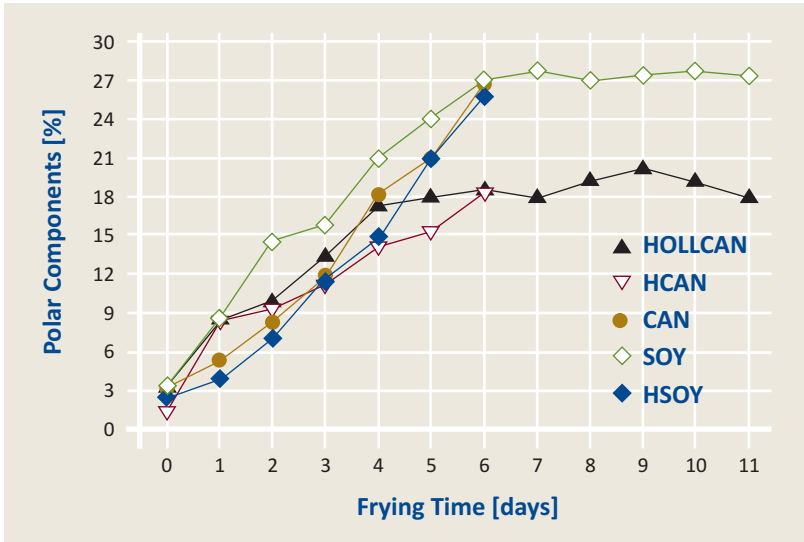


Figure 4. Formation of polar components. (Przybylski 2013¹³).

Legend: HOLLCAN/ HOLL OSR oil; HCAN: hydrogenated canola frying shortening; CAN: regular RBD (Refined, Bleach & Deodorized) canola; SOY: standard RBD soybean oil; HSOY: hydrogenated soybean frying shortening.

HOLL OSR oil shows that the frying life can be expanded from 6 to more than 11 days compared with regular OSR oil.

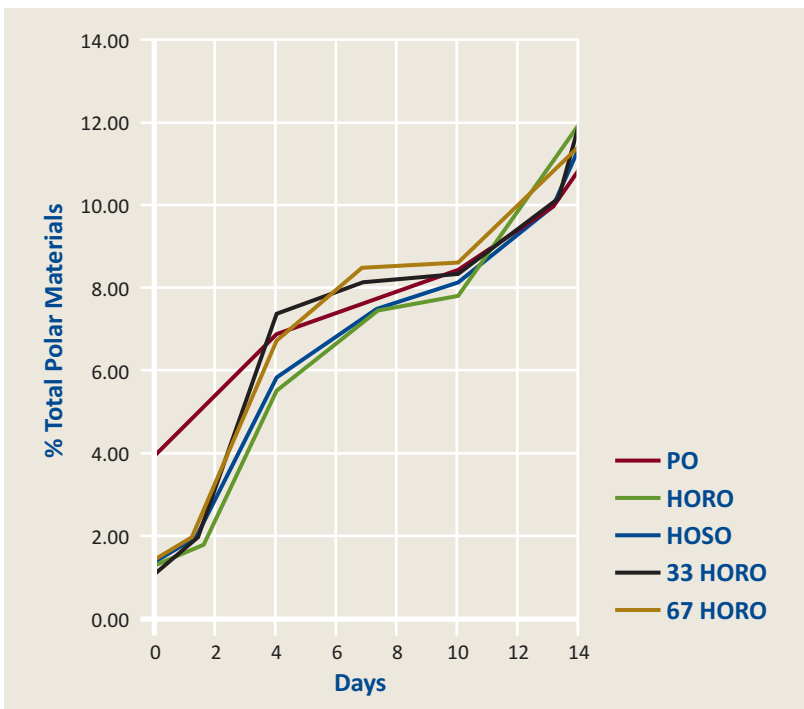


Figure 5. Total Polar Materials analytical (Leatherhead Food Research UK¹⁴).

Legend: PO: palm olein 64; HORO: HOLL OSR oil; HOSO: HO sunflower oil; 33 HORO: Oil blend (33% HORO, 67% HOSO); 67 HORO: Oil blend (67% HORO, 33% HOSO).

HOLL OSR oil has similar behavior to HO sunflower oil in the development of total polar materials. HOLL OSR oil is a versatile oil which can be used as a stand-alone oil in addition to being a component in oil blends based on specific customer requirements and needs.



- ... It results in good sensory evaluation of the fried products.

Sensory evaluation of French fries

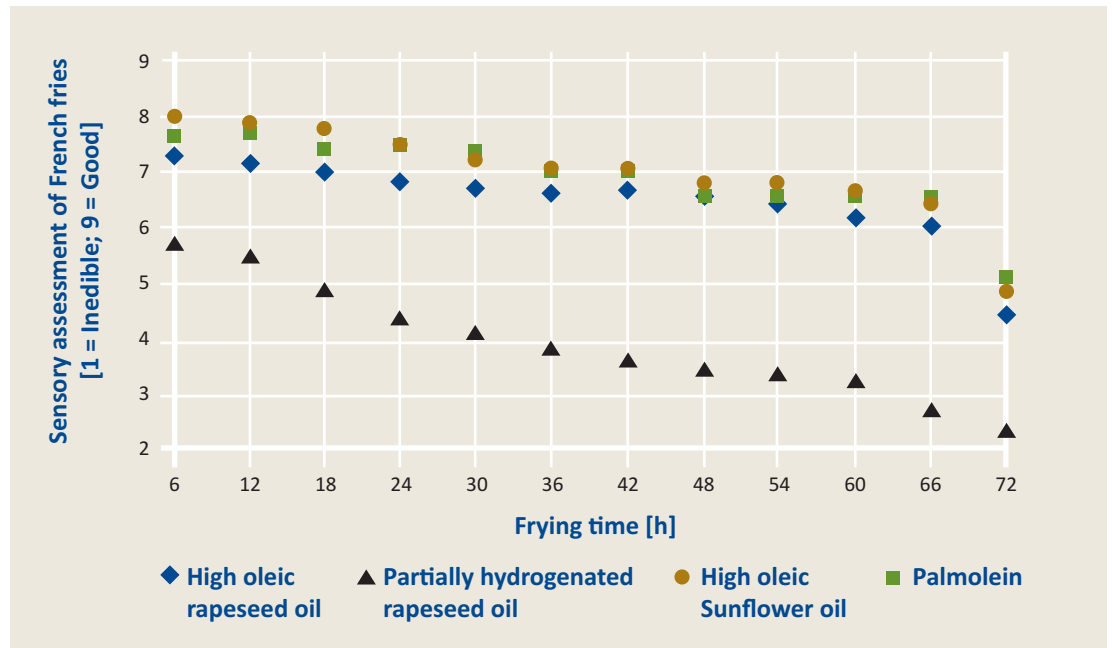


Figure 6. (Matthäus 2006¹⁵).

Even after 66 hours using the oil for deep frying, French fries obtained with HOLL OSR oil (High oleic rapeseed oil) had a satisfactory taste, close to French fries fried in HO sunflower oil and palmolein (Fig 6).

Regular OSR oil vs. HOLL OSR oil

- HOLL OSR oil is even better than regular OSR oil for hot applications because its new fatty acid profile leads to improved functional properties (Table 4).



Comparison between regular OSR oil and HOLL OSR oil

Characteristics	Regular OSR oil	HOLL OSR oil
Oleic acid	< 65%	> 75%
Polyunsaturated fatty acids	> 30	< 18
Smoke point	242°C	246°C
Fry life	≈ 6 days	> 11 days

Table 4. (Dubois *et al.* (2008) OCL, 15, 56-75⁹, internal Monsanto data for HOLL OSR oil, University of Lethbridge in Canola info.org¹¹ & Przybylski 2013¹³).

Summary

In conclusion, from a food industry perspective HOLL OSR oil balances the three practical requirements for a functional food oil:

- **Nutrition:** HOLL OSR oil is the option which combines one of the lowest levels of saturated fats with substantial levels of oleic acid and only trace levels of *trans* fats.
- **Functionality:** with no substantial differences in taste, color and texture between the most used edible oils (e.g. palm olein and HO sunflower oil).
- **Stability:** with twice the frying life of regular OSR oil and similar performance to HO sunflower oil.

4 GOOD REASONS TO USE HOLL OSR OIL

1) It is a better option compared to most other oils for fried use because it has:

- One of the lowest saturated fat level
- Only trace level of *trans* fats
- Substantial level of oleic acid
- Good amount of Omega 3 (alpha-linolenic acid)
- Good amount of vitamin E

2) It is stable at high temperatures

3) It has longer frying life than most edible oils

4) It provides good taste to fried products



References

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- 0b)** British Nutrition Foundation.
<http://www.nutrition.org.uk/healthyliving/basics/fats.html>
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- 2a)** EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA); Scientific Opinion on the substantiation of health claims related to linoleic acid and maintenance of normal blood cholesterol concentrations (ID 489) pursuant to Article 13(1) of Regulation (EC) No 1924/2006 on request from the European Commission. EFSA Journal 2009; 7(9):1276. [12 pp.]. doi:10.2903/j.efsa.2009.1276. Available online: www.efsa.europa.eu
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**Source of molecular models picture:

Saturated fat: <https://commons.wikimedia.org/wiki/File:Myristic-acid-3D-vdW.png>

Monounsaturated fat: <https://commons.wikimedia.org/wiki/File:Oleic-acid-3D-vdW.png>

Trans fat: https://en.wikipedia.org/wiki/Trans_fat#/media/File:Elaidic-acid-3D-vdW.png

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