New and Advanced Analytical Developments in Oil Processing

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- The use of standard methods for the quality assessement of oils and fats helps suppliers and users to find a common base for discussions.

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Standard Methods

Standard methods are used
to measure quality criteria:

- applied worldwide
- tested by collaborative study
- generally accepted by authorities

AOCS / AOAC / IUPAC / ISO / CEN

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Crude Palm Kernel Oil
RBD Palm Kernel Oil
Crude Palm Kernel Olein
RBD Palm Kernel Olein
Crude Palm Kernel Stearin
RBD Palm Kernel Stearin

Characteristics of Olive Oil Types

	Acidity (%)	Peroxide value (mEq O_2/kg)	Waxes (mg/kg)	Saturated acids in 2-position of the triglyceride (%)	Stigmasta-dienes (mg/kg) (1)	Difference between HPCL and theoretical ECN42	Organoleptic assessment Median of defects (Md)
1. Extra virgin olive oil	≤ 0.8	≤ 20	≤ 250	≤ 1.5	≤ 0.15	≤ 0.2	Md = 0
2. Virgin olive oil	≤ 2.0	≤ 20	≤ 250	≤ 1.5	≤ 0.15	≤ 0.2	Md ≤ 2.5
3. Lampante olive oil	> 2.0	-	≤ 300 (3)	≤ 1.5	> 0.50	≤ 0.3	Md > 2.5 (2)
4. Refined olive oil	≤ 0.3	≤ 5	≤ 350	≤ 1.8	-	≤ 0.3	-
5. Blended olive oil composed of refined & virgin olive oils	≤ 1.0	≤ 15	≤ 350	≤ 1.8	-	≤ 0.3	-
6. Crude olive-pomace oil	-	-	> 350 (4)	≤ 2.2	-	≤ 0.6	-
7. Refined olive-pomace oil	≤ 0.3	≤ 5	> 350	≤ 2.2	-	≤ 0.5	-
8. Olive-pomace oil	≤ 1.0	≤ 15	> 350	≤ 2.2	-	≤ 0.5	-

(1) Sum of isomers that could (or could not) be separated by capillary column.

(2) Or if the median of defects is ≤ 2.5 and the median of fruity is 0.

(3) Oils with a wax content of between 300 and 350 mg/kg are considered to be lampante olive oil if the total aliphatic alcohol content is ≤ 350 mg/kg or if the erythrodiol and uvaol content is ≤ 3.5 %.

(4) Oils with a wax content between 300 and 350 mg/kg are considered to be crude olive-pomace oil if the total aliphatic alcohol content is > 350 mg/kg and if the erythrodiol and uvaol content is > 3.5 %.

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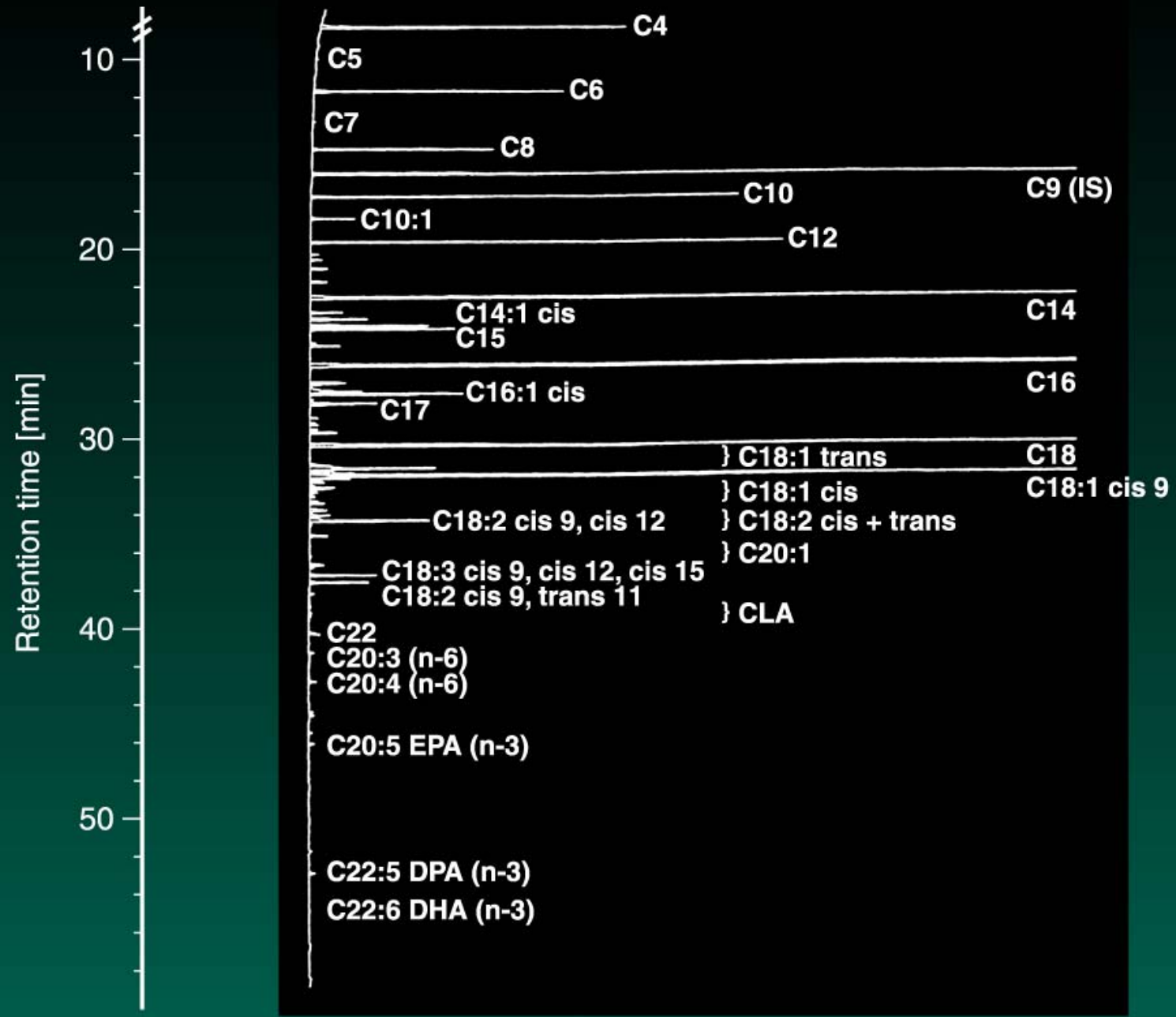

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Fatty Acids[1] (%)

		Peanut
Butyric *(Butanoic)*	$C_4H_4O_2$	
Caproic *(Haxanoic)*	$C_6H_{12}O_2$	
Caprylic *(Octanoic)*	$C_6H_{16}O_2$	
Capric *(Decanoic)*	$C_{10}H_{20}O_2$	
Lauric *(Dodecanoic)*	$C_{12}H_{24}O_2$	
Lauroleic *(cis-9-Dodecenoic)*	$C_{12}H_{22}O_2$	
Myristic *(Tetradecanoic)*	$C_{14}H_{28}O_2$	x
Myristoleic *(cis-9-Tetradecenoic)*	$C_{14}H_{26}O_2$	
Palmitic *(Hexadecanoic)*	$C_{16}H_{32}O_2$	6
Palmitoleic *(cis-9-Hexadecenoic)*	$C_{16}H_{30}O_2$	x

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Fatty Acids[2] (%)

		Peanut
Stearic *(Octadecanoic)*	$C_{18}H_{36}O_2$	5
Oleic *(cis-9-Octadecenoic)*	$C_{18}H_{34}O_2$	61
Ricinoleic *(12-Hydroxy-cis-9-Octadecenoic)*	$C_{18}H_{34}O_3$	
Linoleic *(cis-9, cis-12-Octadecadienoic)*	$C_{18}H_{32}O_2$	22
Linolenic *(cis-9, cis-12, cis-15-Octadecatrienoic)*	$C_{18}H_{30}O_2$	x
Eleostearic *(cis-9, trans-11, trans-13-Octadecatrienoic)*	$C_{18}H_{30}O_2$	
Licanic *(4-Keto-9, 11, 13-Octadecatrienoic)*	$C_{18}H_{28}O_3$	

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Fatty Acids[3] (%)

		Peanut
Arachidic *(Eicosanoic)*	$C_{20}H_{40}O_2$	2
Gadoleic *(cis-9-Eicosenoic)*	$C_{20}H_{38}O_2$	
Arachidonic *(5, 8, 11, 14-Eicosatetraenoic)*	$C_{20}H_{32}O_2$	
Behenic *(Docosanoic)*	$C_{22}H_{44}O_2$	3
Erucic *(cis-13-Docosenoic)*	$C_{22}H_{42}O_2$	
Clupanodonic *(4, 8, 12, 15, 19-Docosapentaenoic)*	$C_{22}H_{36}O_2$	
Lignoceric *(Tetracosanoic)*	$C_{24}H_{48}O_2$	1
Nisinic *(4, 8, 12, 15, 18, 21-Tetracosahexaenoic)*	$C_{24}H_{38}O_2$	
Cerotic *(Hexacosanoic)*	$C_{26}H_{52}O_2$	
Montanic *(Octacosanoic)*	$C_nH_{2n}O_2$	

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CRUDE PALM OIL
CRUDE PALM OLEIN
CRUDE PALM STEARIN
REFINED, BLEACHED AND DEODORISED PALM OLEIN
REFINED, BLEACHED AND DEODORISED PALM STEARIN
REFINED, BLEACHED AND DEODORISED PALM OIL
INSTITUT PENYELIDIKAN MINYAK KELAPA SAWIT MALAYSIA
PALM OIL RESEARCH INSTITUTE OF MALAYSIA

Characteristics of Olive Oil Types

	Fatty acids content [1]						Total sterols (mg/kg)	Erythro-diol and uvaol (%) (**)
	Myristic (%)	Linolenic (%)	Arachidic (%)	Eicosenoic (%)	Behenic (%)	Lignoceric (%)		
1. Extra virgin olive oil	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.2	≤ 0.2	≥ 1,000	≤ 4.5
2. Virgin olive oil	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.2	≤ 0.2	≥ 1,000	≤ 4.5
3. Lampante olive oil	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.2	≤ 0.2	≥ 1,000	≤ 4.5 [2]
4. Refined olive oil	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.2	≤ 0.2	≥ 1,000	≤ 4.5
5. Blended olive oil composed of refined & virgin olive oils	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.2	≤ 0.2	≥ 1,000	≤ 4.5
6. Crude olive-pomace oil	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.3	≤ 0.2	≥ 2,500	> 4.5 [3]
7. Refined olive-pomace oil	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.3	≤ 0.2	≥ 1,800	> 4.5
8. Olive-pomace oil	≤ 0.05	≤ 1.0	≤ 0.6	≤ 0.4	≤ 0.3	≤ 0.2	≥ 1,600	> 4.5

(1) Other fatty acids present (%): palmitic: 7.5 to 20.0; palmitoleic: 0.3 to 3.5; heptadecanoic: ≤ 0.3; steraic: 0.5 to 5.0; oleic: 55.0 to 83.0; linoleic: 3.5 to 21.0.

(2) Oils with a wax content of between 300 and 350 mg/kg are considered to be lampante olive oil if the total aliphatic alcohol content is ≤ 350 mg/kg or if the erythrodiol and uvaol content is ≤ 3.5 %.

(3) Oils with a wax content of between 300 and 350 mg/kg are considered to be crude olive-pomace oil if the total aliphatic alcohol content is above 350 mg/kg and if the erythrodiol and uvaol content is > 3.5 %.

Notes:

(a) The results of the analyses must be expressed to the same number of decimal places as used for each characteristic. The last digit must be increased by one unit if the following digit is > 4.

(b) If just a single characteristic does not match the values stated, the categoory of an oil can be changed or the oil declared impure for the purposes of this Regulation.

(c) If a characteristic is marked with an asterisk (*), referring to the quality of the oil, this means the following:
- for lampante olive oil, it is possible for bboth the relevant limits to be different from the stated values at the same time
- for vigin olive oils, if at least one of these limits is different from the stated values, the category of the oil will be changed, although they will still lbe classified in one of the categories of virgin olive oil.

(d) If a characteristic is marked with two asterisks) this means that for all types of olive-pomace oil, it is possible for both the relevant limits to be different from the stated values at the same time.

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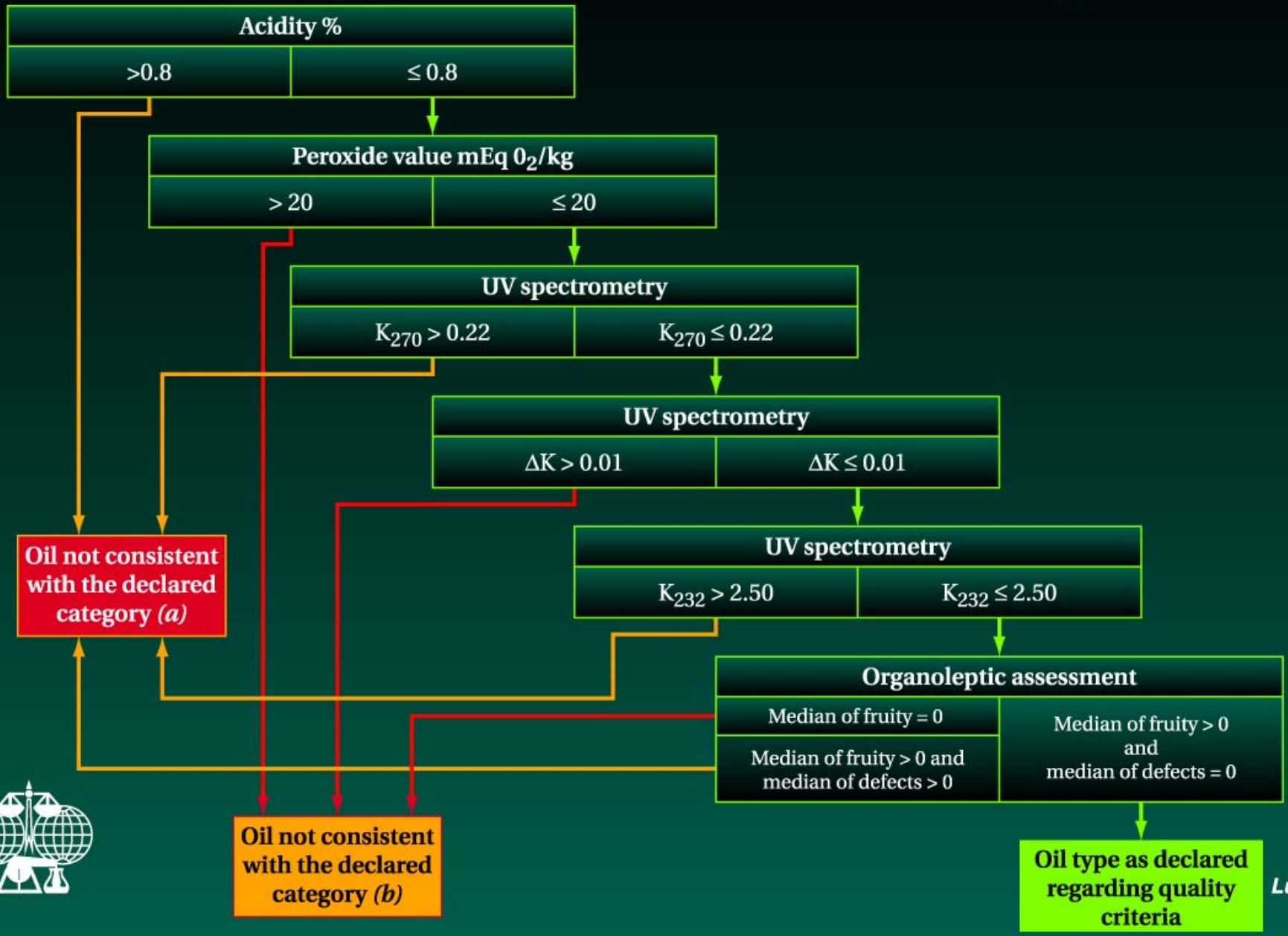
Quality Criteria of Extra Virgin Oil



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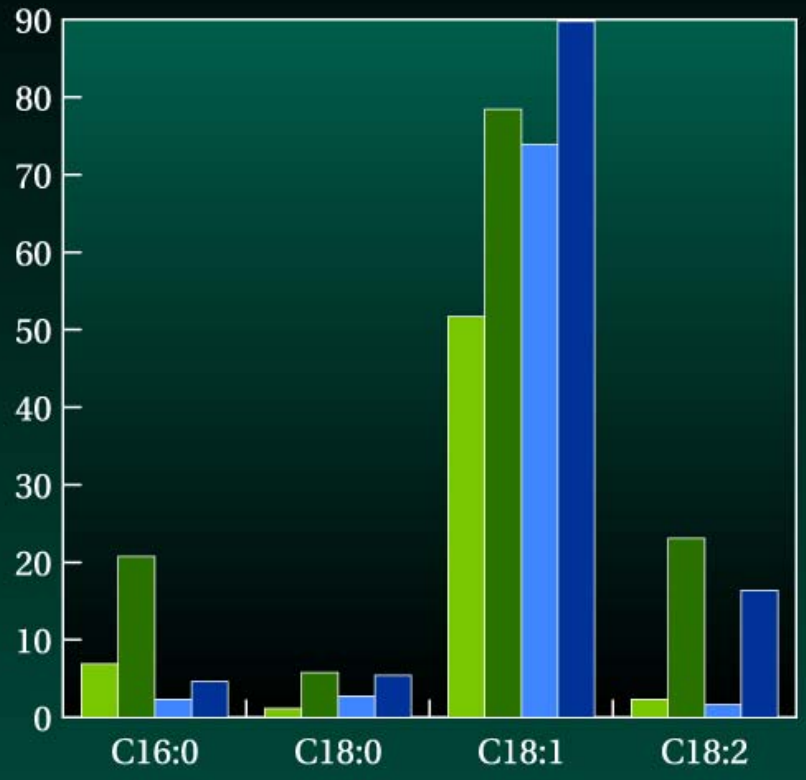
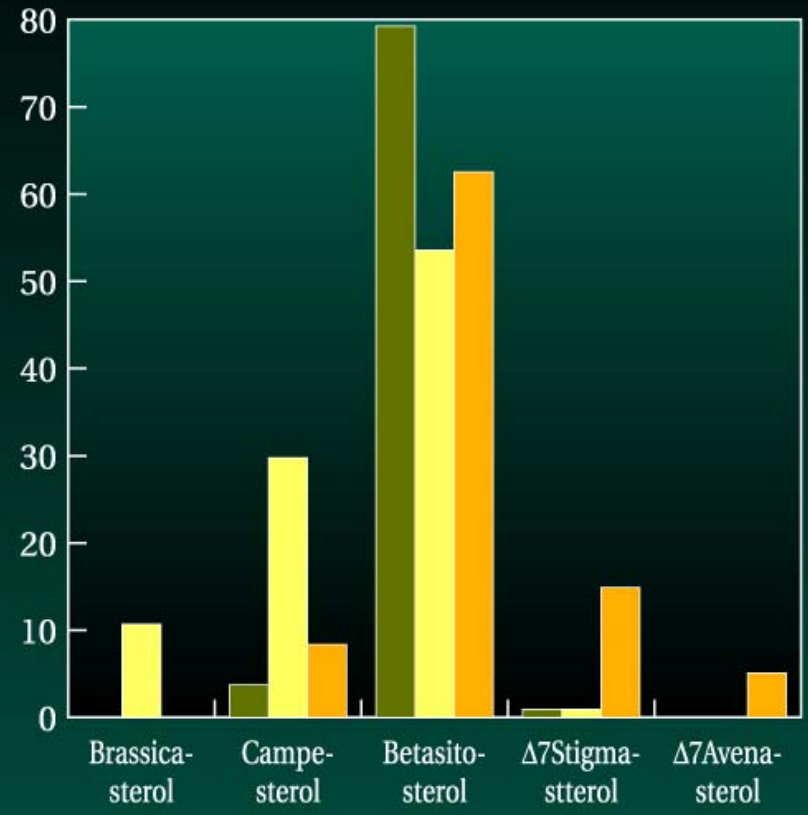
Fatty Acids and Sterol Composition (%) of Different Oils





- Olive mini
- Olive maxi
- Sunflower oleic mini
- Sunflower oleic maxi

- Olive
- Colza
- Sunflower

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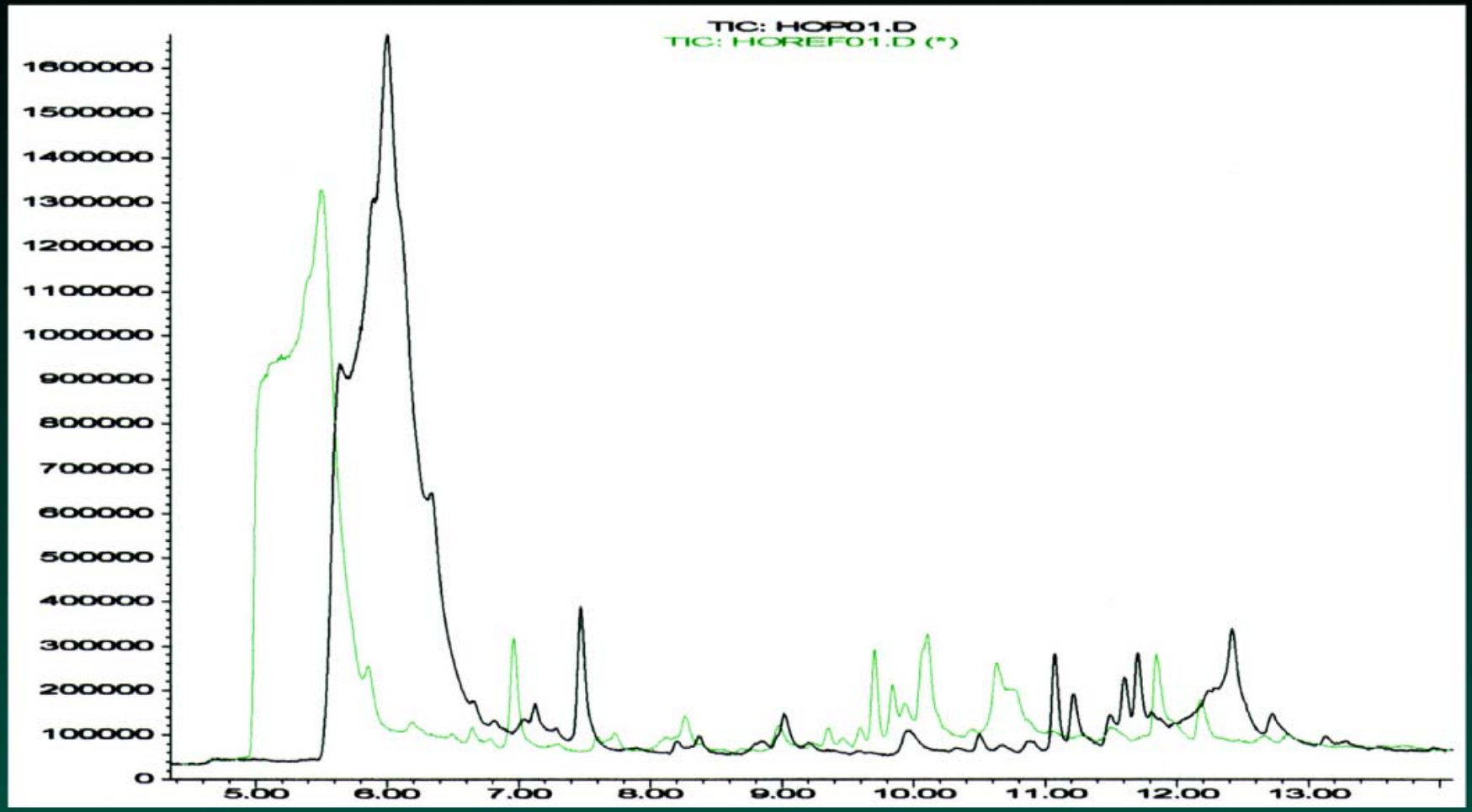
GC/MS Analysis



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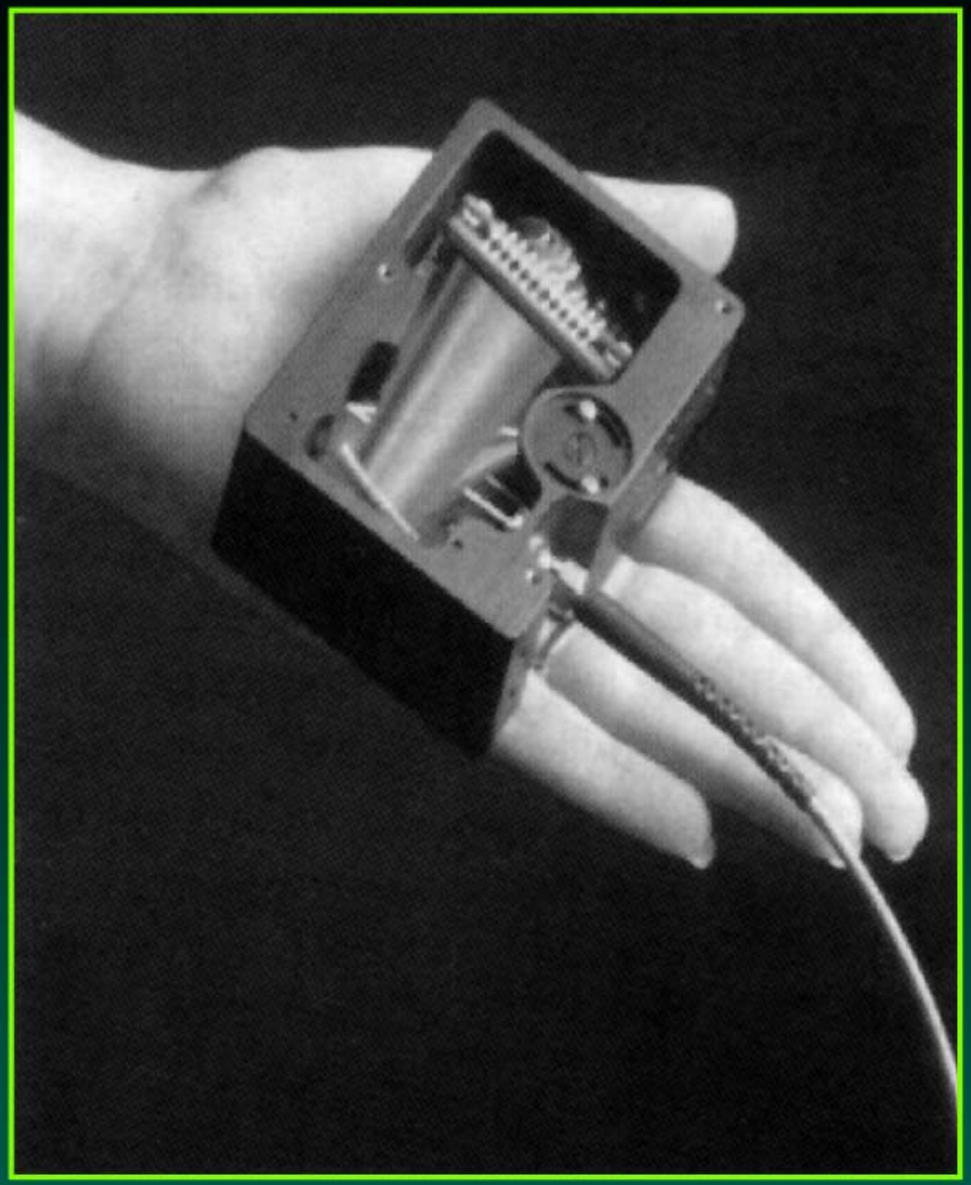
NIR On-line Spectrophotometer



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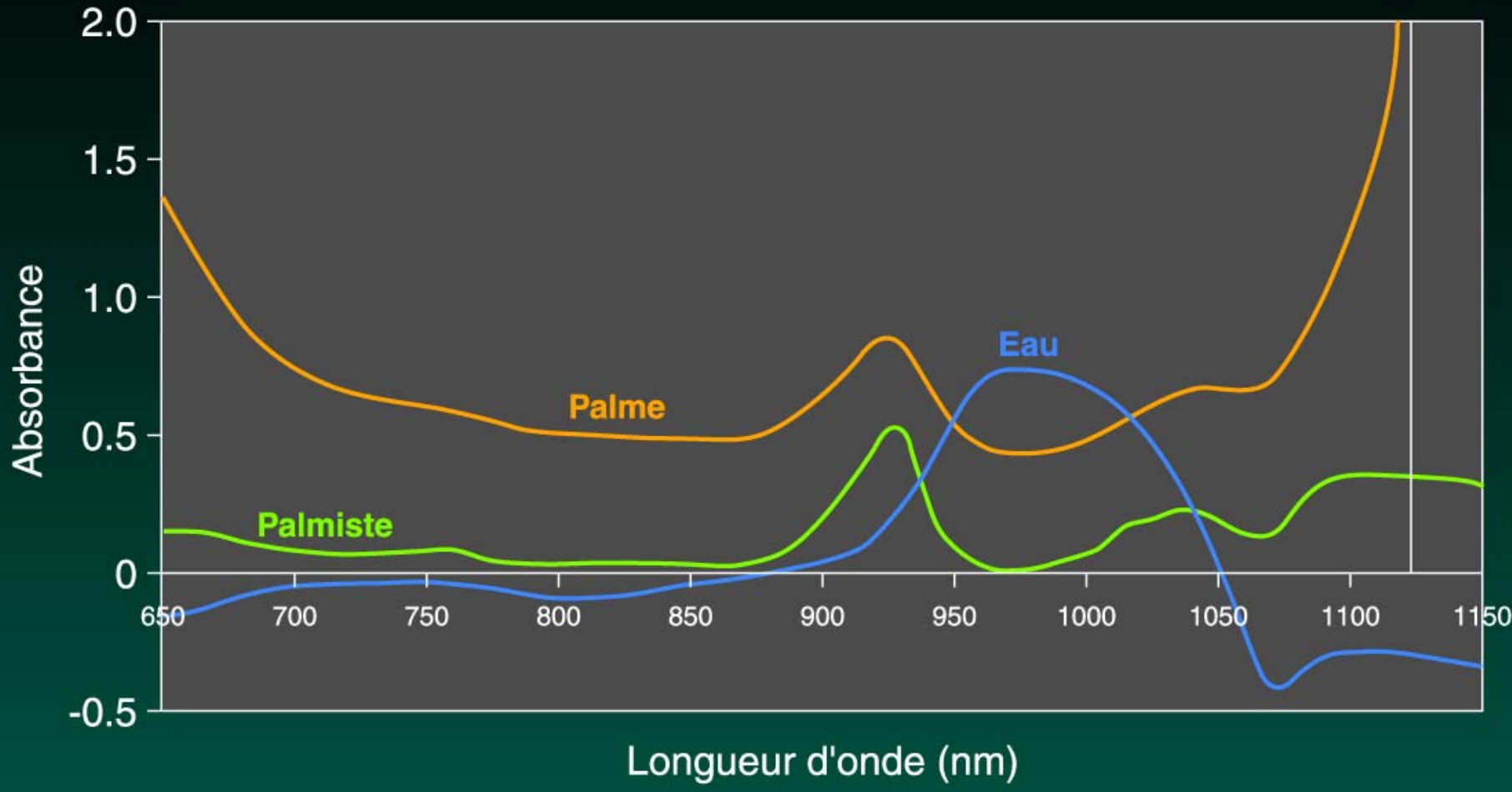
NIR Spectrum



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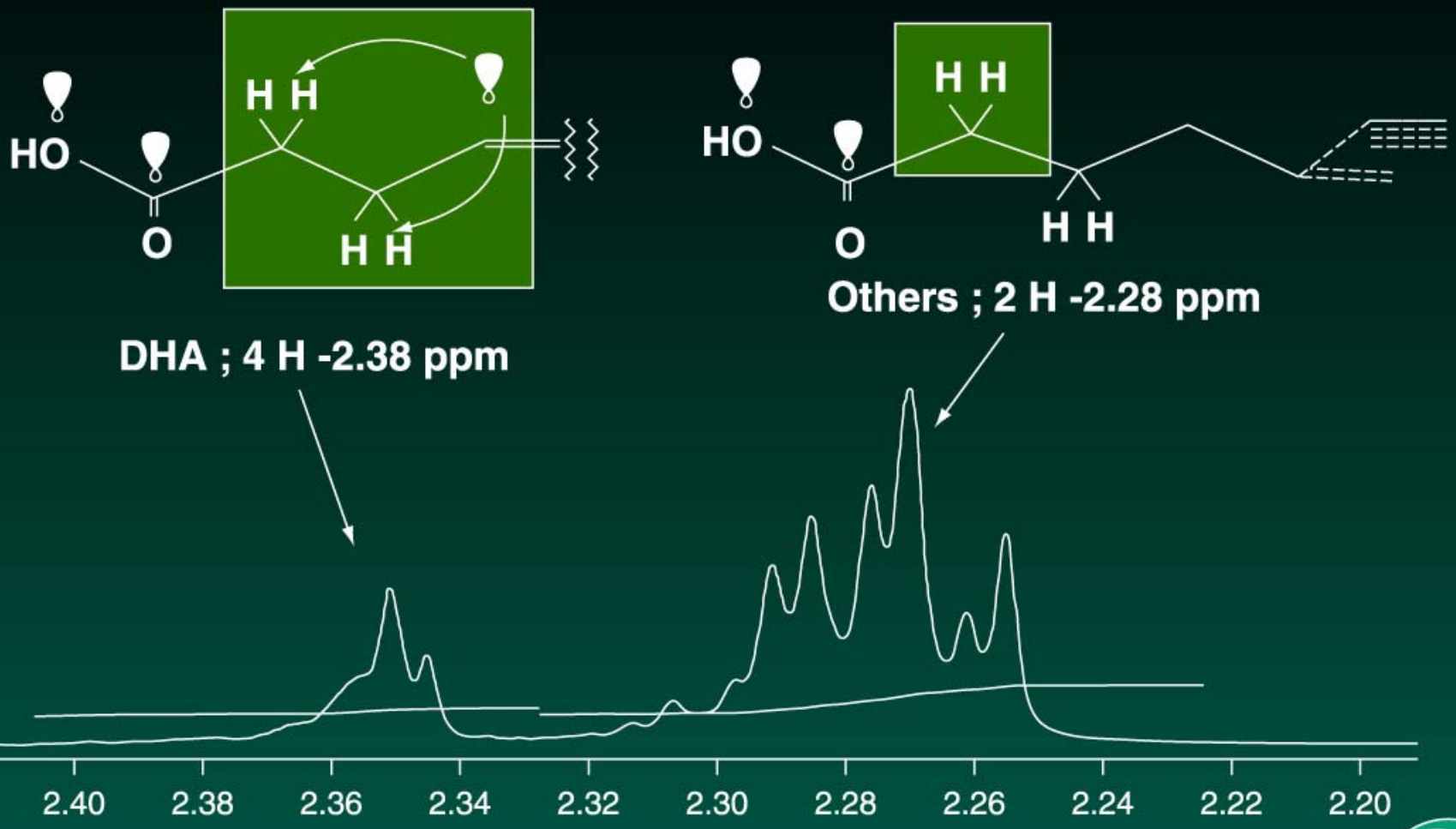
Quantification of DHA Concentration



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Analytical Evaluation of Freshness

- Peroxyde value (PV)
- Anisidin value (AV)
- Thiobarbituric acid (TBA)

Organoleptic
Deterioration (meat and dairy products)

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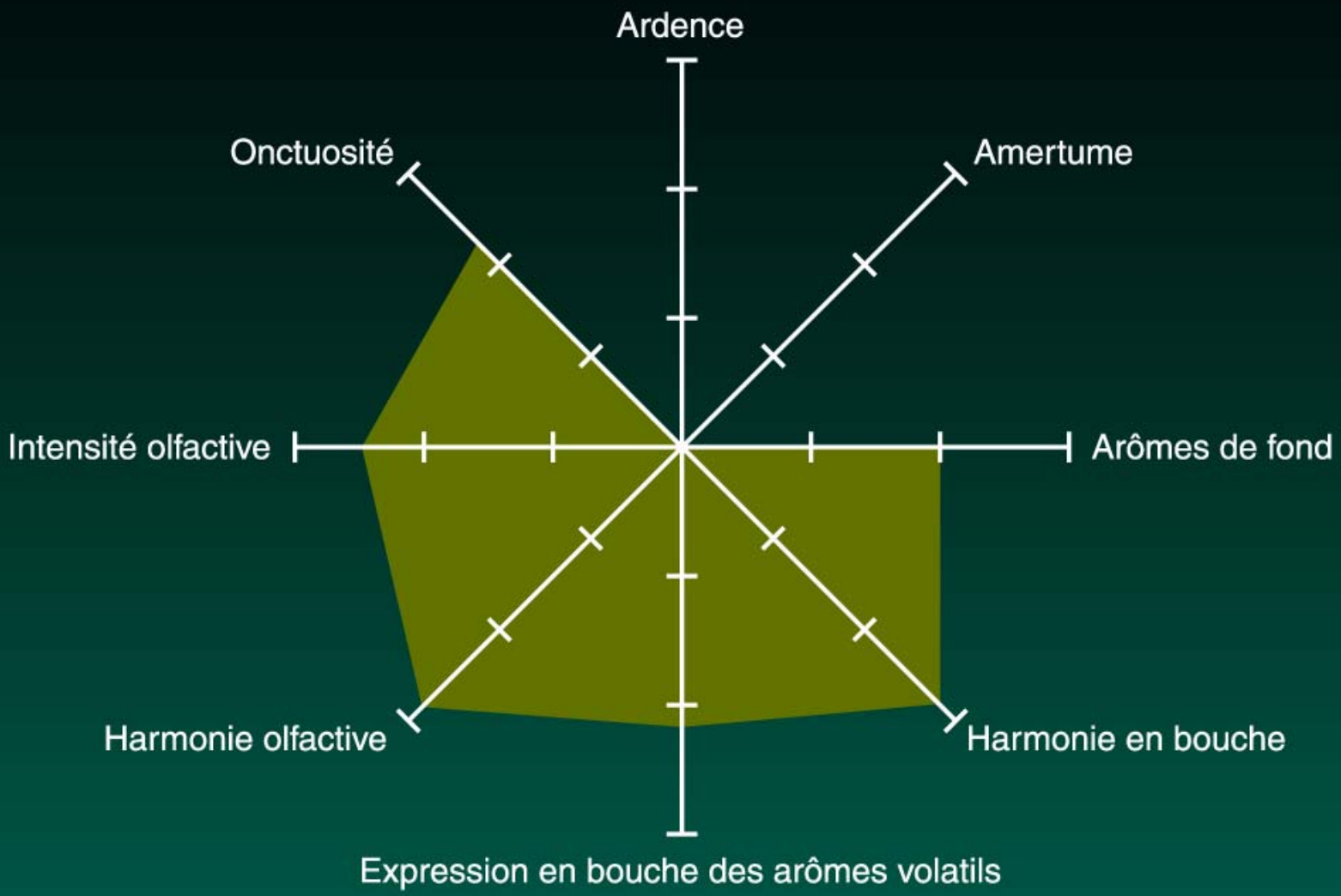
Profile of an Olive Oil



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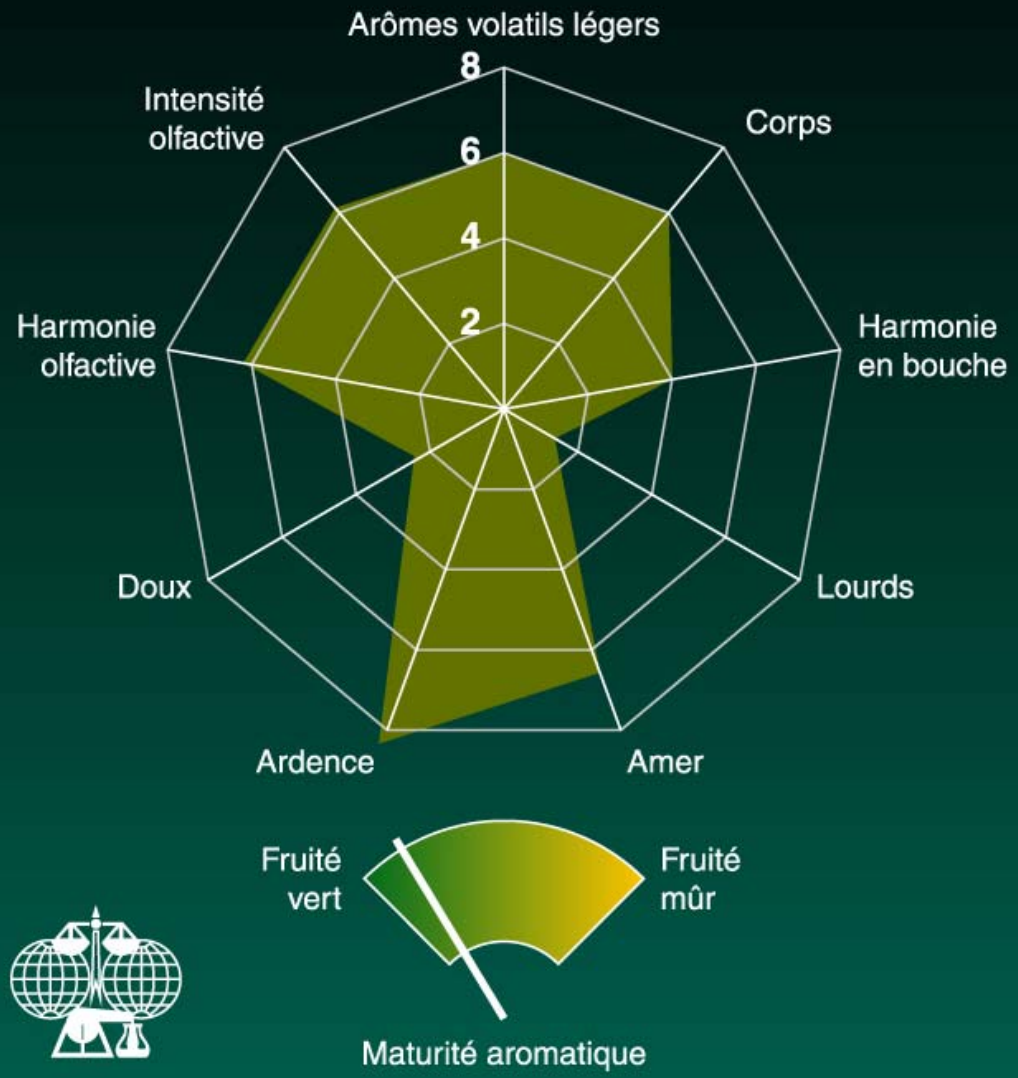
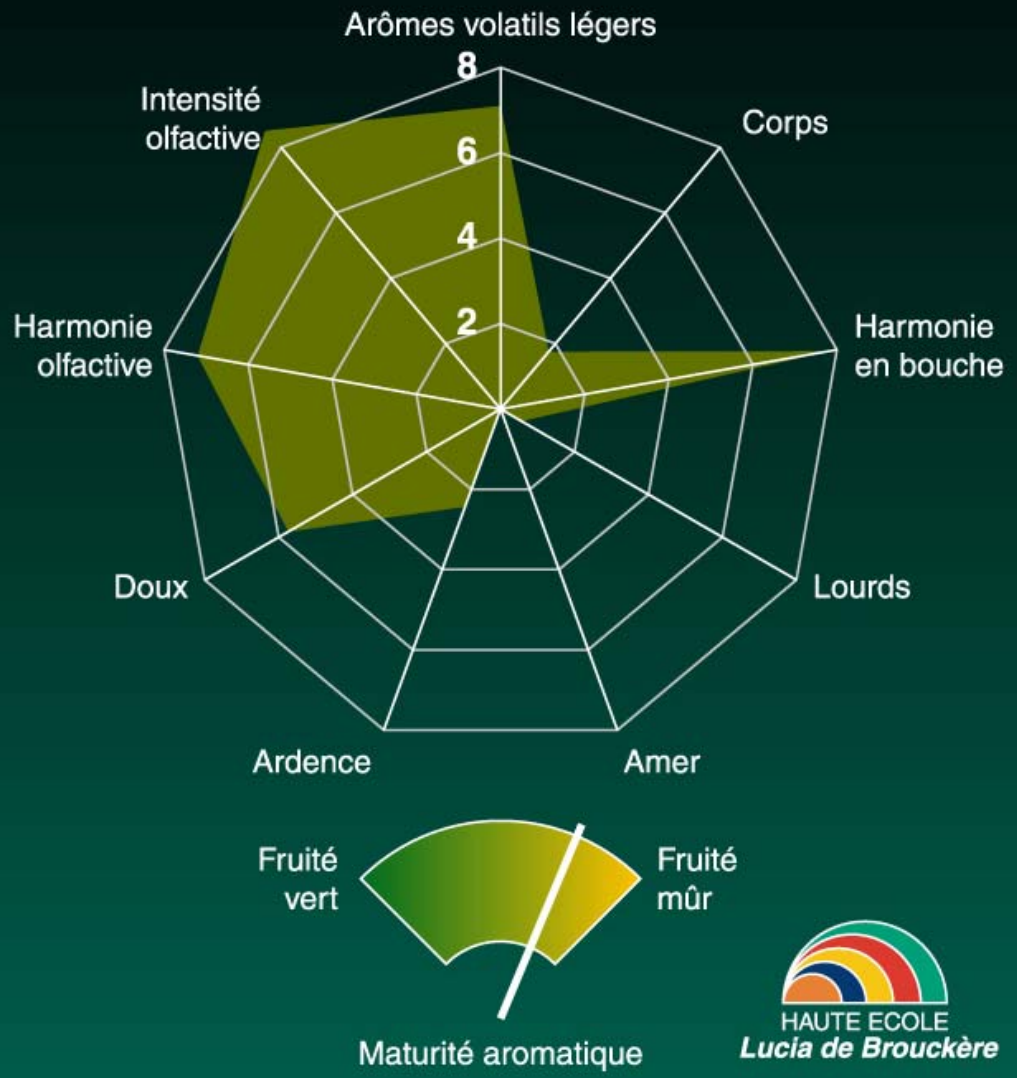
Profile of an Olive Oil

Huile obtenue à partir d'olives insuffisamment mûres



Huile obtenue à partir d'olives très mûres



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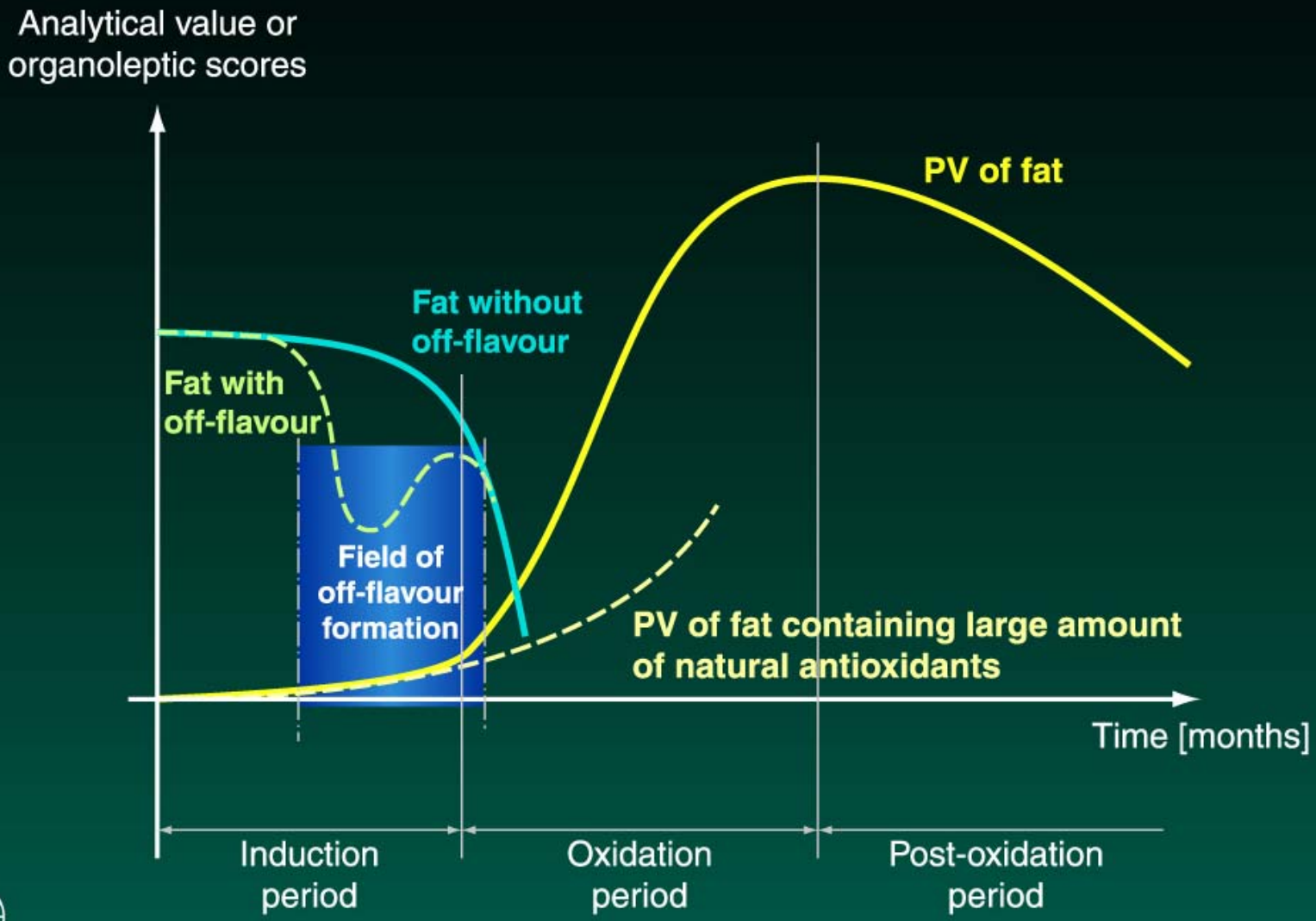

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Melting

Solid fat contents versus temperature
melting points

Solid  Liquid

Solidification

Cooling curves

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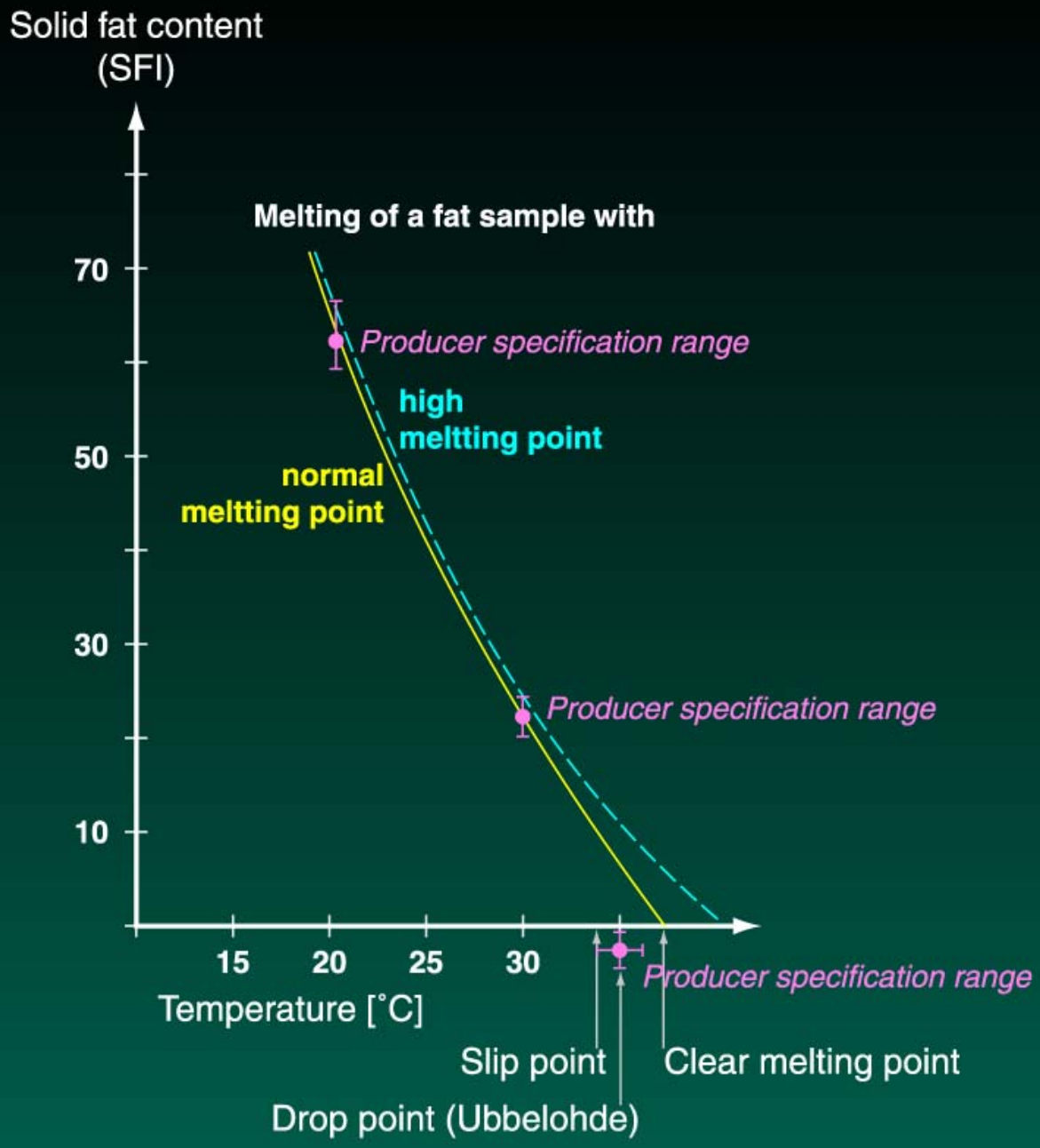

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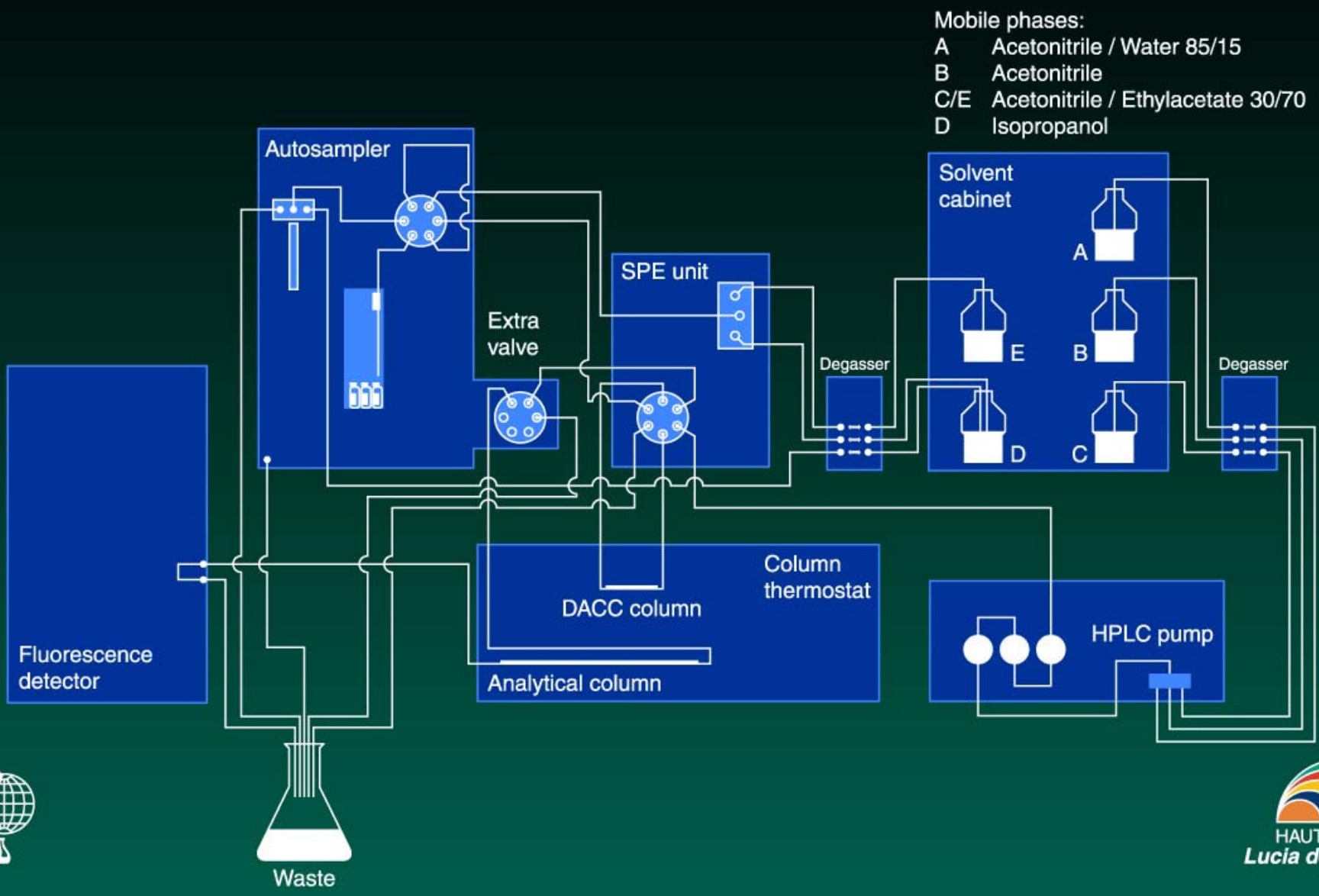
Tubing Connections of the HPLC System



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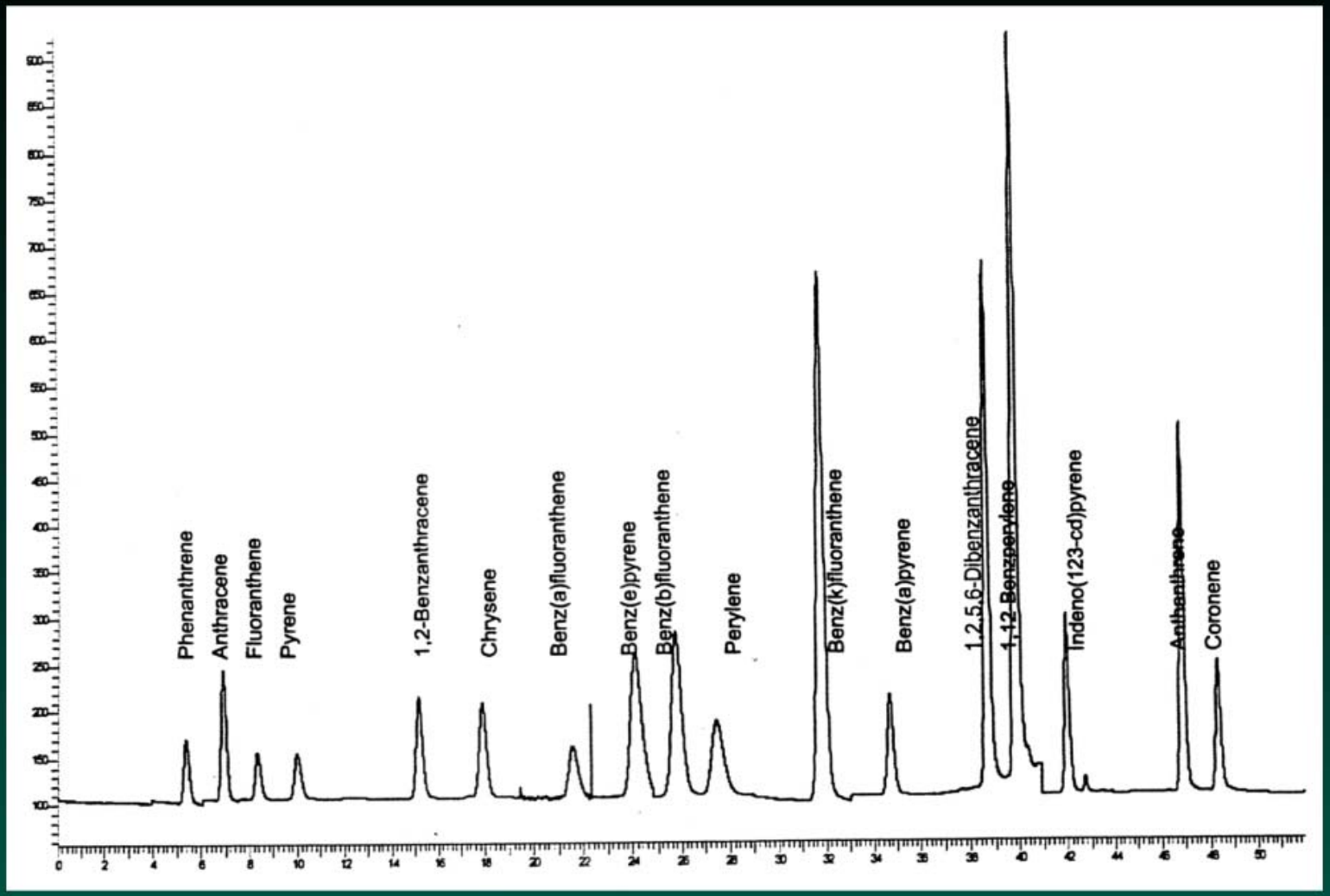
Chromatogram of a Calibration Sample



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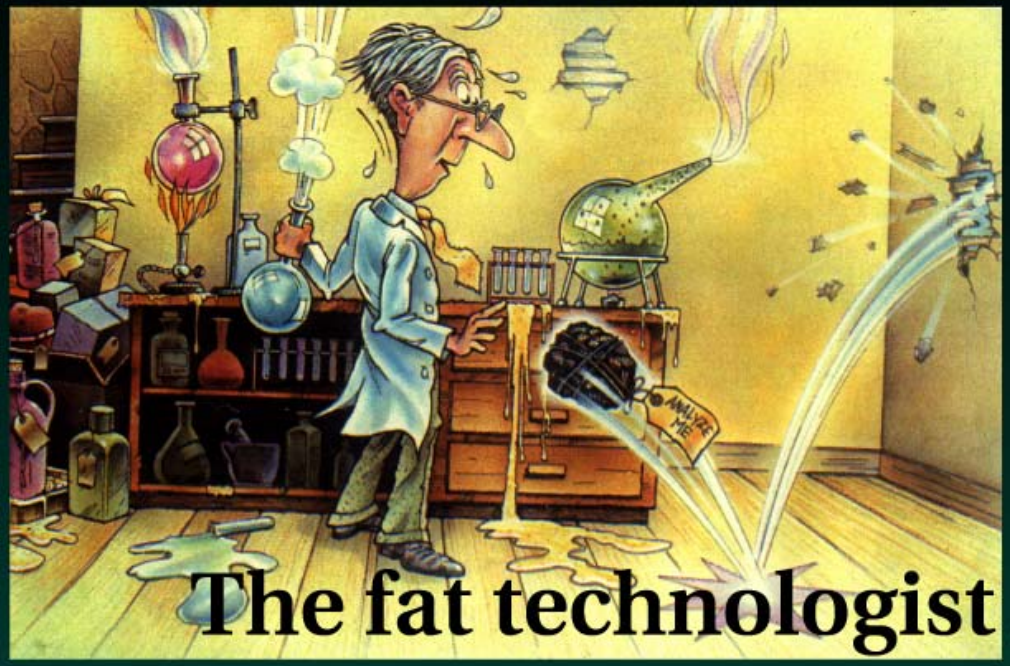
Fire Extinguishing
Chemical waste
Panreac

Conclusion



The fat technologist is not an analyst solving isolated analytical problems but rather a system chemist dealing with oils and fats for their optimal use in food.

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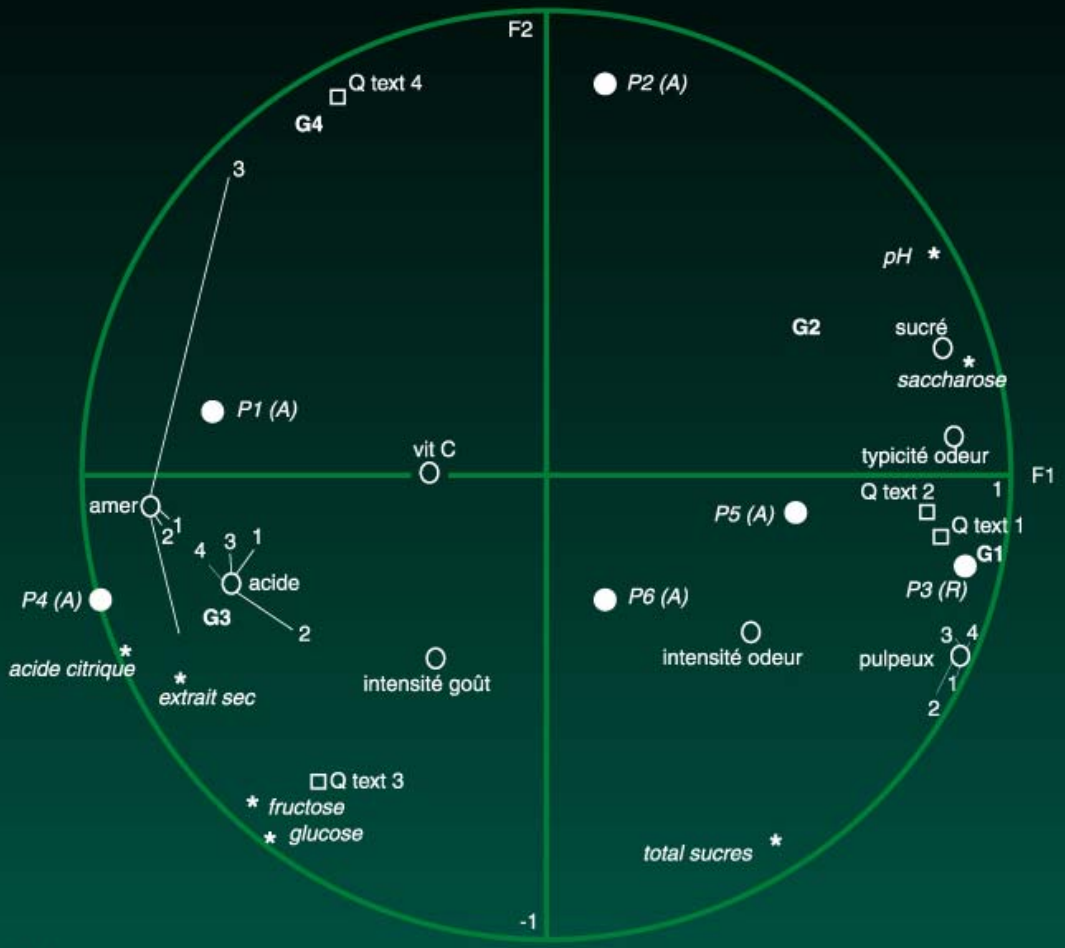
Multidimensional Analysis



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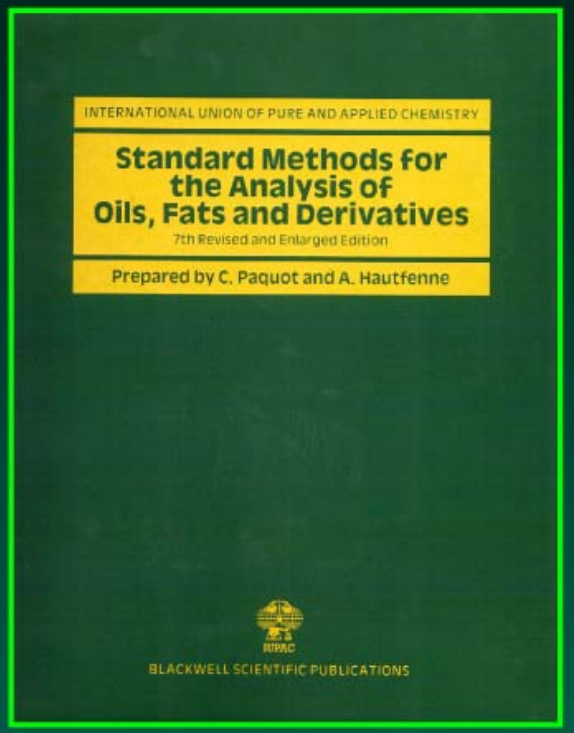
IUPAC Standard Methods

- Today, more than 120 standard methods have been accepted after having been tested by international collaborative studies.



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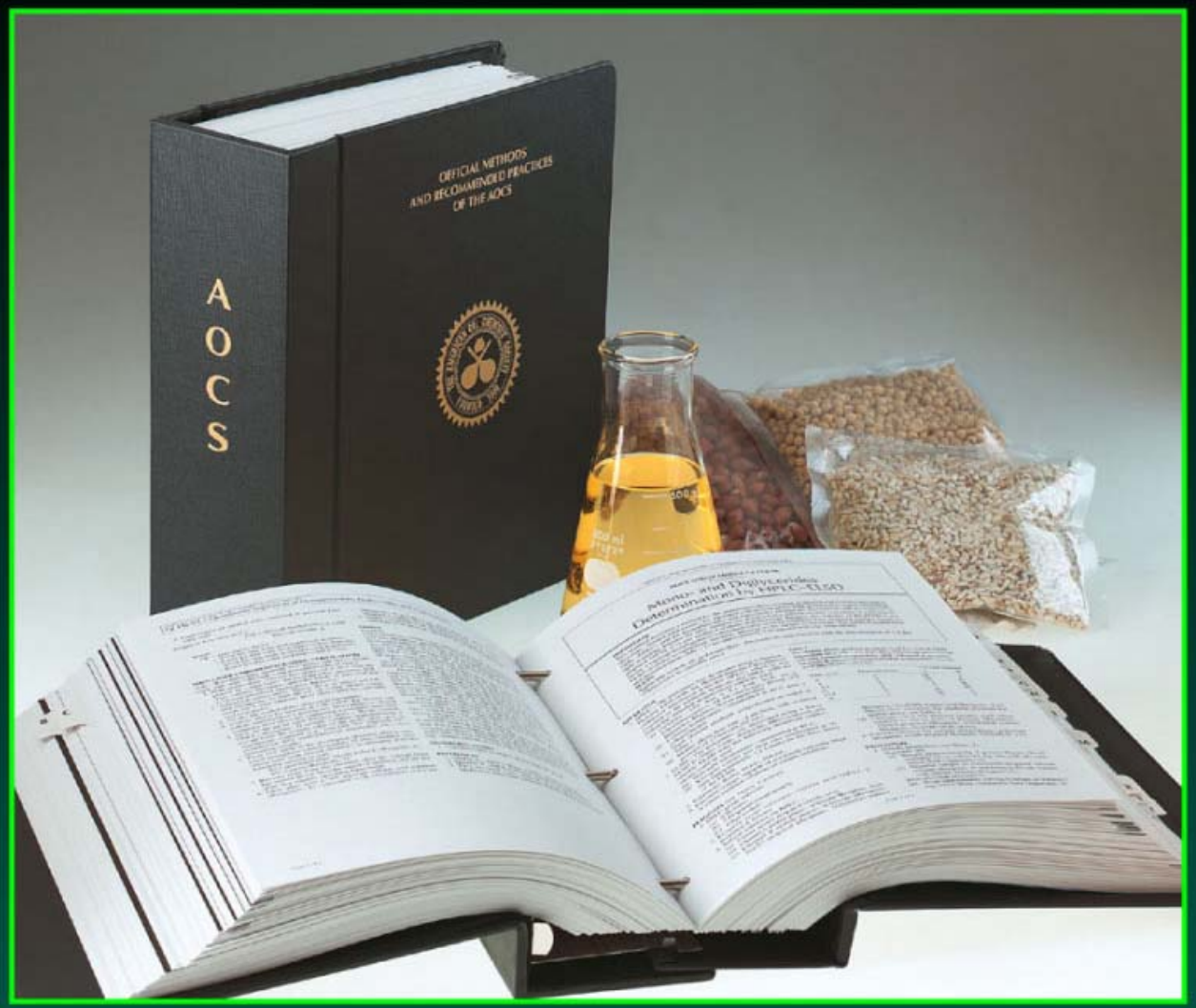
Official Methods AOCS (5th Edition)



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