

Listing of Analyses



Quality . Research . Innovation

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ITERG provides analytical services and develops Research and Development programs to meet the needs of industries working with fats and oils as well as other products made of or containing added fat and oil.

Target sectors: agri-food, pharmaceutical, cosmetic, animal feed, chemical and oil industries...



Our objectives :

- Providing analytical solutions adapted to the needs of our clients
- Developing new analytical methods to help our clients elaborate innovative products



Technology:

As the biggest analytical laboratory in Europe dedicated to the analysis of fats and oils, ITERG offers a full range of facilities to its clients. On-site technology includes some of the following: GC/FID, GC/ECD, GC/NPD, GC/MS, SPME/GC/MS, HPLC/MS/MS, HPLC/DDL, HPLC/UV, Fluorescent HPLC, atomic absorption, NMR, spectrophotometer, Rancimat, Oxipres...



Guarantees:

- ISO 9001 certified: 2000 version for conceiving and carrying out analyses, studies and technological operations on fats and oils.
- Accredited by COFRAC
- Presiding body of the Fats and Oils Commission (AFNOR)
- An active supporter of European (CEN TC 275, CEN TC 307) and international (ISO/TC34/SCII) standardization.
- Accredited by FOSFA (Federation of Oils, Seeds and Fats Associations), member in the *Analyst, Oils and Fats* category.



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Analyses

• Characterization:

- Standard controls (applications: all matrices)

Analyses	Objectives
Oil content using Soxhlet NF EN ISO 659	
Fat content V 03-030	
Fat content Folch Method	Advised method for meat and sea products.
Unsaponifiable matter content determined by hexane extraction NF EN ISO 18 609	Making the most of unsaponifiable matter.
Unsaponifiable matter content determined by diethyl ether extraction NF EN ISO 3596	
Fat extraction for qualitative analysis In-house method	
Moisture and volatile matter NF EN ISO 662	Quality criterion.
Moisture content (Karl Fischer) NF ISO 8534	Quality criterion, Compliance with current regulations.
Impurities NF EN ISO 663	Quality criterion, Compliance with current regulations.

-Chemical index:

Analyses	Objectives	Applications
Oleic acid NF EN ISO 660	Quality criterion, Compliance with current regulations.	All matrices.
Peroxide index NF EN ISO 3960 or ISO 3967-FIL 74	Evaluate the state of conservation of fat during storage. Compliance with current specifications and regulations.	All matrices.
Iodine index -Oil: NF EN ISO 3961 -Biodiesel: NF EN 142/4 April 2009 (120).	Quality criterion.	All matrices.
Saponification index NF ISO 3657	Making the most of unsaponifiable matter.	Oils and fats.
Oxirane index AOCS Cd 9-57	Measure bonded oxygen present in epoxidized compounds.	Epoxidized oils. Epoxidized compounds in general.
Hydroxyl index ASTM D1957-86	Measure hydroxyl groups present in compounds.	Fats and oils containing primary and certain secondary alcohols with a high melting point (hydrogenated castor oil, dihydroxystearic acid).
Amine index AOCS Tf 1b-64 et AOCS Tf 2b-64	Determine total primary, secondary and tertiary amines (1b-64) present in compounds (2b-64).	Betaines, amino derivatives, fatty amines...
Refractive index NF ISO 6320	Measure sample purity.	Animal and vegetable fats.

Analyses	Objectives	Applications
Free fatty acid, monoglyceride, diglyceride and triglyceride composition determined by GC In-house method	Determine the distribution of partial glyceride and triglyceride typically generated by fatty acid hydrolysis.	Oils and fats.
Triglyceride composition determined by HPLC IUPAC 2.324	Determine the distribution of different triglyceride structures according to esterified fatty acids.	All matrices.
Triglyceride composition per molecular weight determined by GC IUPAC 2.323 + réglementation européenne	Detect dairy fat adulteration by foreign fat.	Dairy fat.
Presence and quantification of cocoa butter equivalents in cocoa butter and cooking chocolate ISO 23275-1 et 2	Detect vegetable fat in cocoa butter.	Cocoa butter, chocolate.
Fatty acid composition at positions 2 and 1+3 on glycerol NF EN ISO 6800	Determine the distribution of a given fatty acid on the glycerol backbone of a triglyceride.	Food matrices (oils and fats) and biological tissue.
Individual free fatty acid content (C2 to C24) In-house method		
Fatty acid composition NF EN ISO 5509 & NF EN ISO 5508 -saturated, monounsaturated and polyunsaturated fatty acid composition -distribution of omega 6/omega 3 -separation of cis/trans isomers -quantification using in-house standards		vegetable oil, ► animal fat, ► dairy fat, ► seafood oil ► extracted fat ► other (CLA)



HPLC



GC

-Minor constituents:

	Analyses	Objectives
	Unsaponifiable matter content NF EN ISO 18609 (hexane) or NF EN ISO 3596 (diethyl ether)	Making the most of unsaponifiable matter.
	Sterol content and composition NF EN ISO 12 228	Cholesterol and phytosterol quantification
	Free and esterified sterol profile after fractionation In-house method	
	Oxysterol content In-house method	Degradation compounds of sterol oxidation.
NEW	Glycosylated sterol and glycosylated sterol ester content In-house method	Oil minor compounds with a negative effect on the cold flow properties of biodiesel.
	Tocopherol, tocotrienol and Alpha tocopherol acetate determined by HPLC (vitamin E) NF EN ISO 9936	Natural antioxidants.
	Vitamin A content determined by HPLC NF EN 12823-1	
NEW	HPLC MS/MS quantification of coenzymes Q9 and Q10	Natural antioxidants.
	Total carotenoid content determined by visible spectrophotometry In-house method	
	Total carotenoids determined by HPLC Selon NF EN 12823-2	
	Chlorophyll content determined by visible spectrophotometry AOCS Cc 13d-55	
	Phosphorus content High content (> 80 mg/kg) ISO 10540-1 Low content (< 80 mg/kg) NF ISO 10540-2	Quantify phospholipids by measuring total phosphorus.
	Phospholipid analysis by HPLC In-house method	Phospholipid content and composition.
	Total polar lipids determined by the acetone insoluble portion AOCS Ja 4-46	
	Fatty acids at position 1 and 2 on phospholipids In-house method	
	Ceramides and cerebrosides by HPLC In-house method	
	Other unsaponifiable matter constituents: fatty alcohols, terpene alcohols, squalene In-house method	
	Digalactosyl diglycerides (DGDG) determined by HPLC In-house method	
	Waxes determined by GC ISO CD 23647 project	

- Fine structure characterization

	Analyses	Objectives	Applications
NEW	Infrared Characterization	Fine structure analysis: bioproduct chemical structure.	All matrices.



Infrared spectrometer



Atomic absorption



HPLC/MS

• Contaminants

Analyses	Objectives
Hydrocarbon content – Mineral oil detection In-house method	QL (quantification limit): 50 mg/kg
Ochratoxin A and aflatoxins B1, B2, G1, G2 contents	Compliance with current regulations.
Benzo[a]pyrene in oil and fat determined by HPLC (marker of Polycyclic Aromatic Hydrocarbons (PAH)) NF ISO 15302	Compliance with current regulations.
Pesticide detection in fat ▶ organochlorine pesticides (ECD detection) ▶ organophosphate pesticides (NPD detection) ▶ pyrethroids (ECD detection) In-house method	Health and safety standards.
Polychlorinated Biphenyls (PCBs) in fat In-house method	Health and safety standards.
NEW Phthalate quantification (DMP, DEP, DIBP, DBP, BBP, DEHP, DNOP) In-house method	QL: 0.5 mg/kg.
Chlorinated solvents trace levels (perchloroethylene...) regulation (EEC) No: 2568/91 annex XI – L248/48	Compliance with current regulations.
Aromatic solvent trace levels determined by Dynamic headspace/GC/MS (benzene, toluene, xylene, styrene) In-house method	
Hexane content in refined oils, Scope of application: 2 to 10 mg/kg (ppm) NF T 60-257	Compliance with current regulations.
Hexane content in refined oils, Scope of application: 10 to 1500 mg/kg (ppm) NF EN ISO 9832	Compliance with current regulations.
Residual hexane content in oilseed cakes NF EN ISO 8892	
Arsenic In-house method	Compliance with current regulations. QL: 0.010 mg/kg
Cadmium NF EN ISO 15774	Compliance with current regulations. QL: 0.002 mg/kg
Chromium In-house method	QL: 0.005 mg/kg
NEW Copper NF EN ISO 8294	QL: 0.005 mg/kg
Tin In-house method	QL: 0.010 mg/kg
Iron NF EN ISO 8294	QL: 0.005 mg/kg
Nickel NF EN ISO 8294	QL: 0.015 mg/kg
Lead NF EN ISO 12193	QL: 0.010 mg/kg

• Alteration

- Oxidation analysis

Analyses	Objectives
Peroxide index NF EN ISO 3960	Determine primary oxidation compounds.
Para-anisidine index NF EN ISO 6885	Determine secondary oxidation compounds.
TBA Test IUPAC 2.531(direct method)	Determine secondary compounds. Advised for matrices rich in LC-PUFA.
Volatile oxidation compounds determined by SPME-GC /MS In-house method	
OXIPRES	Compare the resistance of different fats to oxidation.
Rancimat accelerated oxidation test NF ISO 6886	
Accelerated aging chamber test with ventilation and controlled lighting In-house method	Product stability test.
Synthetic antioxidants determined by HPLC (BHT, BHA, gallates) IUPAC 2.642	Quantify synthetic antioxidants.
Vitamin E content determined by HPLC NF EN ISO 9936	Quantify natural antioxidants.
Total polyphenol content determined by colorimetric analysis (Folin-Ciocalteu method) In-house method	
Polyphenols determined by HPLC Méthode interne	
HPLC quantification of catechins	
Lipase activity measurement	Evaluate the degradation and rancidity of raw material and finished products.

- Thermo-oxidative degradation (heating):

Analyses	Objectives	Applications
Polar compounds content NF EN ISO 8420	Compliance with current regulations.	Frying oil, fried food.
Polymerized triglycerides content (HPLC) NF EN ISO 16931	Compliance with current regulations.	
Oxidized triglyceride composition (HPLC) In-house method	/	
Trans-fatty acid content – Trans-isomer distribution after fractionation with silver nitrate. In-house method	/	
Cyclic fatty acid monomer content In-house method	/	
Oxysterol content	/	

NEW

NEW



Spectrophotometer



PHSTAT : measures lipase activity



Rancimat



Oxipres

Analyses carried out as part of the COFRAC program n°82: « Oils and fats & oilseed and protein crops » for which the laboratory is accredited under number: 1-0171.

● **Physical and Rheological measurements:**

Applications: All types of products: margarine, sandwich spread, yoghurt, mayonnaise..., surfactants, detergents, emulsions, resins, lubricants, polymers, paints, inks...

	Analyses	Objectives
NEW	Viscosity (T : 5°C to 200 °C) Following the same method used for petrol products: NF ISO 2909 petrol products NF EN ISO 3104 transparent and opaque liquids, determination of kinematic viscosity and calculation of dynamic viscosity	Viscosity of fat and fat derivatives evaluated at different temperatures.
NEW	Yield stress (T : 5°C to 200 °C)	Destructive method used to determine the amount of stress applied to fat and fat derivatives in order to initiate flow.
NEW	Creep test (T : 5°C to 200 °C)	The sample is submitted to a low constant stress in order to monitor deformation over time. Measure sample deformation.
NEW	Oscillation (T : 5°C to 200 °C)	Non destructive method used to study fluid structure under 'at rest' conditions.
NEW	Thixotropy (T : 5°C to 200 °C)	Measure the viscosity of a fluid or matter subjected to a constant stress (or a speed gradient) over time.

Analyses	Objectives	Applications
Melting point NF EN ISO 6321	Check sample purity.	Solid matrices, butter, margarine...
Colour determined by spectrophotometry NF T60-224	Compliance criterion.	All oils and translucent oil derivatives at analysis temperature.
Colour determined by LOVIBOND tintometer NF ISO 15305	Compliance criterion.	
Solid fat content determined by NMR ▶ Standard (no pretreatment) ▶ Other: suet and suet fractions, palm fat and palm fat fractions, cocoa butter NF EN ISO 8292	Determine the quantity of crystallized triglycerides at a given temperature.	Oil, butter, fractions and blends.
Flash point ISO 27-19 and NF ISO 15-267	Flash point values are useful for transport, storage, handling and safety regulations as a standard for classification (combustible and flammable products...)	Oil.

● **Cold flow properties:**

	Analyses	Objectives	Applications
NEW	Cloud point ASTM D2500	Measure the temperature at which a product begins to cloud or crystallize.	Vegetable, animal and petrol products (ex: lubricants, biodiesel,...).
NEW	Pour point ASTM D97	Measure the lowest temperature at which an oil will pour or flow when it is cooled down.	Vegetable, animal and petrol products (ex: lubricants, biodiesel,...).



MCR 301 Rheometer
T°C : 5°C to 200°C



Flash point



Ubbelohde viscometer with varying sized tubes

Automatically measures the time required for a liquid to flow through a tube in order to determine relative and kinematic viscosity. T°C : 20 to 60°C



ISL Cold flow properties analyzer (with - 80°C cryostat)

Automatic analyzer used to determine cloud point and pour point, plus Low Temperature Filterability.

Analyses carried out as part of the COFRAC program n°82: « Oils and fats & oilseed and protein crops » for which the laboratory is accredited under number: 1-0171.

Specific analyses

- Olive oil:**

The analyses below are carried out as part of regulation (EEC) No: 2568/91 relating to olive oil and pomace olive oil.

Analyses
Peroxyde index Regulation (EEC) No: 2568/91 Annex III (chlorophorm method) & NF EN ISO 3960
Iodine index NF EN ISO 3961
Acid index (or acidity or free fatty acids) NF EN ISO 660 & Regulation (EEC) No: 2568/91 Annex II
Fatty acid composition (preparation and analysis) NF EN ISO 5509 & NF EN ISO 5508 & Method COI/T.20/Doc. 17 & Doc. 24 & Regulation (EEC) No: 2568/91 Annex X
Sterol content and composition Regulation (EEC) No: 2568/91 Annex V & Method COI/T.20/Doc. 10
Absorption characteristics: UV K232, K270 and DK (spectrophotometric analysis) Regulation (EEC) No: 2568/91 Annex IX & Method COI/T.20/Doc. 19
Moisture and volatile matter NF EN ISO 662
Impurities NF EN ISO 663
Erythrodiol and uvaol content Regulation (EEC) No: 2568/91 Annex VI
Refined oil detection in virgin oil (stigmastadiene) Regulation (EEC) No: 2568/91 Annex XVII, & Method COI/T.20/Doc. 11
Iron and copper content NF EN ISO 8294
Waxes determined by GC (method adapted for olive oil) Method COI/T.20/Doc n°18 & Regulation (EEC) No: 2568/91 Annex IV
Unsaponifiable matter content NF EN ISO 3596 & NF EN ISO 18609
Difference between the actual and theoretical triglyceride content determined by ECN 42 Method COI/T.20/Doc. N°20 & Regulation (EEC) No: 2568/91 Annex XVIII
Pyropheophytin in olive oil NF ISO 29841
1,2 and 1,3 diglycerides in olive oil NF ISO 29841
2-glyceryl monopalmitate percentage Method COI/T.20/Doc. 23 & Regulation (EEC) No: 2568/91 Annex VII
Trilinolein content
Volatile halogenated solvent in olive oil Method COI/T.20/Doc. 8 & Regulation (EEC) No: 2568/91 Annex XI
Aliphatic alcohol content Method COI/T.20/Doc. 26 & Regulation (EEC) No: 2568/91 Annex XIX

Sensory analysis



1. SENSORY EVALUATION: ANALYTICAL TRIALS

As part of its services, ITERG carries out exclusive analytical tests (mainly descriptive and discriminative classification tests) with the help of an Expert Jury, as opposed to hedonic tests carried out with a consumer jury. Sensory analysis sessions are carried out by an in-house jury referred to as an Expert Jury.

The sensory analysis laboratory is equipped with 10 individual cabins in conformity with NF ISO 8589 standards.

1 – 1 Virgin olive oil

The organoleptic evaluation of virgin olive oil is carried out in accordance with European regulations (regulation (EEC) No: 2568/91).

1 – 2 Other fats and oils

Analogous trials can be carried out for other types of oil, fat and derived products (refined virgin oil, margarine, butter, sandwich spreads, fried products..., certain types of cosmetics...).

GUARANTEES:

*The ITERG jury is accredited by the International Olive Council (IOC)
for the sensory analysis of Virgin Olive oil.*

*The ITERG sensory analysis laboratory is accredited by COFRAC
in accordance with ISO 17025 standards (Program 133) for the sensory analysis of Virgin Olive oil.*



● **Formulated products / emulsions / surfactants:**

	Analyses	Objectives	Applications
NEW	Required HLB & HLB In-house method	Determine the hydrophile-lypophile balance of a compound.	Products formulated/ emulsions/surfactants.
NEW	CMC (critical micelle concentration) NF T 73-411	Determine the critical micelle concentration of a compound in a solution.	Products formulated/ emulsions/surfactants.
NEW	IFT Interfacial Tension NF EN 14210	Mesure the tension between 2 phases (aqueous phase, oil phase).	Products formulated/ emulsions/surfactants.
NEW	ST Surface tension NF EN 14370	Mesure the tension between 2 phases (oil phase/air and aqueous phase/air).	Products formulated/ emulsions/surfactants.
NEW	Density In-house method		All liquid products.
NEW	Lumifuge (Stability test) méthode interne	Study of accelerated aging in correlation with the stability of emulsions in dispersion mediums.	Emulsions, suspensions, foams.
NEW	Desiccation test (Kofler hot bench) In-house method	The desiccation study is used to determine the different drying phases of a coating product, and associated time.	Paints, inks, varnishes,...

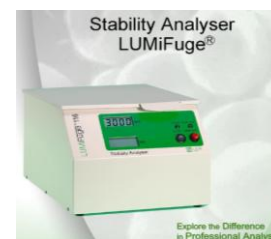


Axiostar microscope

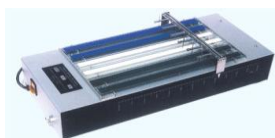
Emulsions or suspensions / integrated camera
3 Achromatic oil immersion brightfield objectives: 10x/0,25, 40x/0,65, et 100x/1,25, infinity corrected, (ICS), brightfield, phase-contrast, trinocular version.



3S GBX Tensiometer
T°C: 10 to 100°C



Lumifuge
T°C: 20 to 60°C



Kofler hot bench with 6 pointers (room T°C)

This appliance has 3 drying times so drying can be evaluated after 6, 12 and 24 hours. The different products (resins, solvents, desiccants, anti-skinning agents, prepolymers) are mixed at room temperature in an open bottle for 5 minutes, then left to rest for 16 hours, away from light in a closed bottle. The mixture is spread in a 76 to 38µm-thick film on a glass plate.

- **Soap analysis (in accordance with SDA standards: Soap and Detergent Industry Association) :**

Applications: All types of soap: solid soap (soda, potassium, lithium, calcium...), liquid soap (soda, potassium), soap bars.

Analyses	
NEW	Sampling NF T60-302
NEW	Moisture and volatile matter quantification (drying) N ISO 672 % moisture in soap
NEW	Chloride quantification (titrimetric method) NF T60-307 / N ISO 457
NEW	Glycerol quantification (titrimetric method) NF T60-304
NEW	Total alkali and fat content NF T60-304
NEW	Free caustic alkali content NF T60-306
NEW	Unsaponified and unsaponifiable matter contents NF T60-309
NEW	Ethanol-insoluble matter content N ISO 673
NEW	Gross total fatty acid content and composition In-house method
NEW	Foaming power NF T73-404 Evaluation of foam stability over time.
NEW	Alkalinity (soap trace levels) NF EN ISO 10539

- **Fatty acid methyl ester analysis (FAME):**

Analyses	Objectives
Moisture content (method used for oil) NF T 60-700	Meet a number of EMAG specifications (product composition tests).
Acid index NF EN 14104	
Ester content NF EN 14103	
Methanol content NF EN 14110	
Iodine index NF EN 14111	
Oxidation stability NF EN 14112	
Phosphorus content (method used for oil = 3 to 80 mg/kg) NF ISO 10540-2	
Glycerol (free and total glycerol content), monoglyceride, diglyceride and triglyceride content NF EN 14105	

- **Evaluation of the nutritional quality of dietary lipids:**

Analyses	Objectives	Applications
Phosphorus quantification using colorimetric analysis	Determine individual and total phospholipid content	Biological tissue.
Profile of fatty acid (qualitative and quantitative) (polyunsaturated fatty acids $\omega 6$ & $\omega 3$, trans-fatty acids, linoleic acid conjugated isomers) tissue biomarkers (total lipids or lipid fractions (triglycerides, cholesterol esters, free fatty acids, phospholipids))	Determine the fatty acid content of blood and tissue lipids according to diet or a specific pathology.	<u>Humans</u> : blood / adipose tissue/ maternal milk. Animals: blood / organs (adipose tissue, brain, liver,.....).
Vitamin E and Coenzyme Q10	Evaluate blood levels of antioxidants according to diet.	Blood.
Quantification of oxidation by-products: MDA (TBA test) and volatile aldehydes (headspace GC)	Measures oxidation/ oxidability.	Biological tissue.
Measurement of the intestinal absorption rate of lipid compounds (fatty acids, sterols, vitamins, micronutrients.....) based on an animal model (Rat) (lymphatic channel fistulation)	<i>In vivo</i> evaluation of the intestinal bioavailability of lipid compounds.	Simple (oil, margarine,...) and complex (formulated products, structured triglycerides, ...) dietary lipids.
Measurement of the enzymatic activity involved in the metabolism of circulating cholesterol (LCAT, ACAT, CETP)	Study the impact of dietary lipids on cardiovascular risk.	Biological tissue: Humans: blood Animals: blood, liver.
Free and esterified cholesterol content determined by GC	Study the impact of dietary lipids on cardiovascular risk.	Biological tissue: Humans: blood Animals: blood, liver.
Fatty acids at position 1 and 2 on phospholipids	Distribution of a given fatty acid on the glycerol backbone of a phospholipid.	Biological tissue.



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