UNDERSTANDING GLOBAL OLIVE OIL QUALITY, GRADING AND LABELLING REQUIREMENTS

A BRIEF SUMMARY OF VOLUNTARY INDUSTRY STANDARDS AND GOVERNMENT/STATE REGULATIONS; AND AN OUTLINE OF COMMON ISSUES RELATING TO ADULTERATION AND CONTAMINATION

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ABSTRACT

The purpose of this white paper is to provide an overview of the voluntary industry standards and government/state regulations. The aim is to promote an understanding of the grading, quality, regulatory and labelling requirements of the olive oil industry; and outline some of the current issues relating to adulteration and contamination.

CONTENTS

I. EXECUTIVE SUMMARY

The olive oil industry faces increased pressure to prove that its products live up to the quality and origin on the bottle. Consumers are now more aware than ever, that olive oils may not always be what is claimed or advertised. Recent poor harvests and increasing demand for olive oil once again raise the risk of olive oil adulteration or fraud for short-term financial gain. To protect olive oil's long-term reputation, all those involved in the supply chain must remain vigilant at this time against such activity – and ensure consumer confidence and demand for olive oil remains high.

Worldwide, there is growth in emerging economies for premium olive oils, and established markets, which show no signs of waning in their appetite for high quality products.

Manufacturers, producers and retailers need to ensure they have in place a comprehensive testing, inspection and verification programme to meet the parameters and requirements of each individual market. Stricter controls from country-to-country on grading, quality and labelling are making access to existing and new markets more difficult.

This white paper can help in understanding the differences between voluntary and mandatory standards, and the limits set for quality, grading and labelling in certain key markets.

By establishing a monitoring programme, manufacturers, producers and retailers can mitigate the risks of adulteration, contamination and fraud – and pass on the message that they are committed to supplying only the highest quality product to consumers worldwide.

II. INTRODUCTION

The extraction of olive oil – the commodity once named 'liquid gold' by the Greek epic poet, Homer – appears in records as far back as the 24th century BC.

Forecasts from the International Olive Council (IOC), the world's only international intergovernmental organisation in the field of olive oil and table olives, keep track of production and lay down guidelines on quality and grading. IOC figures show that historically, Spain and Italy are responsible for nearly two-thirds of global olive oil production. Greece is the third largest producer of olive oil globally. But many other countries now significantly add to the olive mountain waiting for extraction: Tunisia, United States (i.e. California), even Australia are all rising on the olive oil production tables.

Today, the reports of adulteration have led to tougher standards and calls for better labelling. However, even in ancient Rome the olive oils of the day were clearly marked for content, olive variety, place of origin, producer, weight and quality. Olive oil is, and always has been, one of those consumer products faked in return for higher prices. Studies in the United States (US) found 69% of imported extra virgin olive oils – the highest priced and most common of olive oil grades – did not meet international standards. While reports in Australia, New Zealand, Europe and China all confirmed fraudulent olive oils on consumer shelves.

Olive oil quality, grading and labelling remain voluntary in many countries. The European Union (EU) has strict, legally enforced regulations, and many other countries have similar, albeit voluntary, standards (i.e. Australia Olives Association (AOA)) that meet or exceed EU limits on quality and grading.

This whitepaper outlines some of the various chemical and sensory testing, and labelling, recommendations or regulations under IOC standards, the EU, US and AOA. There are also case study sections highlighting some current other issues affecting the olive oil industry worldwide.

III. GRADES AND REQUIREMENTS

Olive oil grades and requirements are defined by the various agencies in chemical terms and by titles which all use as a reference point the most common grades of olive oil: extra virgin olive oil, virgin olive oil, ordinary/lampante virgin olive oil, refined olive oil, olive oil, olive-pomace oil, refined olive-pomace, and crude olive-pomace oil.

EXTRA VIRGIN OLIVE OIL

Extra virgin olive oil offers the highest quality and most expensive grading of all olive oils. However, extra virgin olive oil only appeared after stainless steel milling techniques were introduced in the 1960s and 1970s.

The new technology allowed a much higher grade of olive oil than had been previously possible.

By far the largest percentage of olive oils is extra virgin olive oils which account for around 50% of world production. Extra virgin olive oil must pass certain chemical analysis, and even more importantly sensory evaluations by a panel of testers before it receives classification.

OLIVE OIL GRADES

Olive oil grades must meet the technical characteristics and regulations of the intended market/country. Each market/country may name and/or grade olive oil differently.

In the table below a comparison of olive oil grades/titles is presented from the various agency/countries mentioned in this white paper.

TABLE 1: COMPARISON OF TITLES FOR OLIVE OIL GRADES BY AGENCY/COUNTRY

UNITED STATES	IOC	EU	AUSTRALIA	CODEX
U.S. Extra Virgin Olive Oil	Extra Virgin Olive Oil	Extra Virgin Olive Oil	Extra Virgin Olive Oil	Extra Virgin Olive Oil
U.S. Virgin Olive Oil	Virgin Olive Oil	Virgin Olive Oil	Virgin Olive Oil	Virgin Olive Oil
U.S. Virgin Olive Oil Not Fit For Human Consumption Without Further Processing	Ordinary Virgin Olive Oil	Lampante Virgin Olive Oil	Lampante Olive Oil	Ordinary Virgin Olive Oil
U.S. Olive Oil	Lampante Virgin Olive Oil	Refined Olive Oil	Refined Olive Oil	Refined Olive Oil
U.S. Refined Olive Oil	Refined Olive Oil	Olive Oil - composed of refined olive oils and virgin olive oils	Olive Oil - composed of refined and virgin (or extra virgin) olive oils	Olive Oil
U.S. Olive-Pomace Oil	Olive Oil	Olive Pomace-Oil	Olive-Pomace Oil - composed of refined olive pomace oils and virgin (or extra virgin) olive oils	Olive-Pomace Oil
U.S. Refined Olive-Pomace Oil	Olive Pomace-Oil	Refined Olive-Pomace Oil	Refined Olive-Pomace Oil	Refined Olive-Pomace Oil
U.S. Crude Olive - Pomace Oil	Refined Olive-Pomace Oil	Crude Olive-Pomace Oil	Crude Olive-Pomace Oil	–
–	Crude Olive - Pomace Oil	–	–	–

STANDARDS SETTING

Governments, independent national bodies and international organisations set different standards for olive oil quality and purity according to their own specific criteria.

INTERNATIONAL OLIVE COUNCIL (IOC) & EUROPEAN UNION (EU)

The International Olive Council (IOC) mentioned previously, is by far the most influential global standards setting agency. The IOC is made up predominately of members from the European Union (EU) but it has no enforcement body so standards are still at the discretion of the individual member countries. However, this close relationship means EU and IOC olive oil standards and recommendations are similar on many aspects including grading, but significantly different on others such as olive oil marketing.

US DEPARTMENT OF AGRICULTURE (USDA)

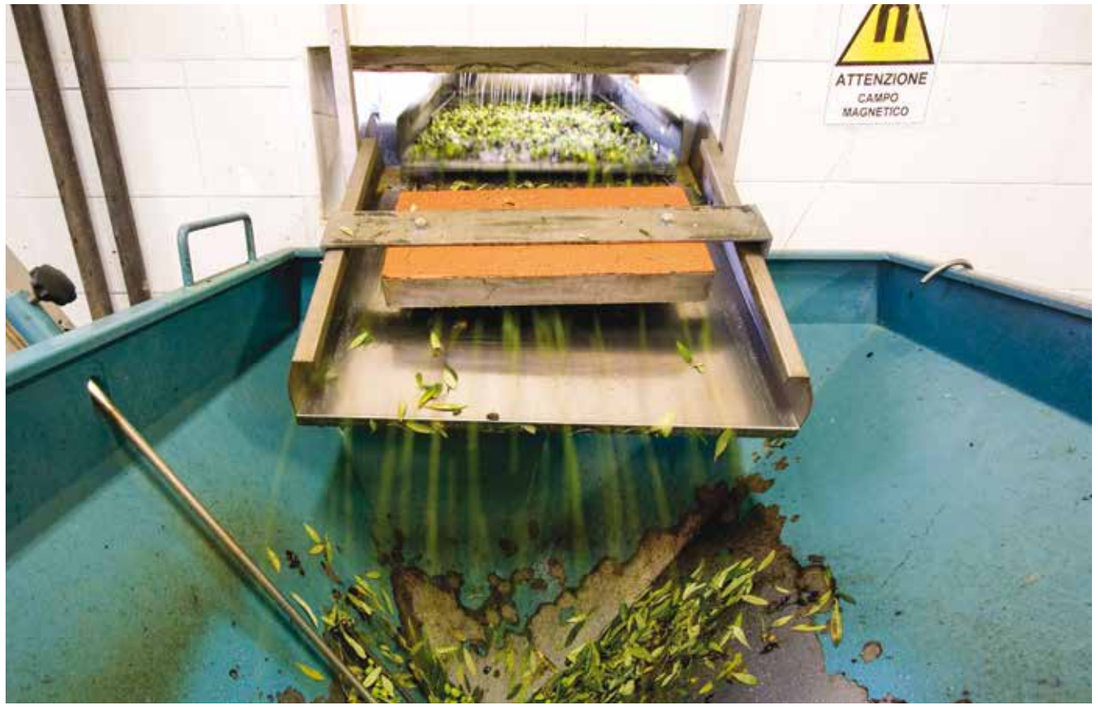
In the US, the US Department of Agriculture (USDA) is responsible for olive oil standards. The USDA defines olive oil grading in much the same way as the IOC, but again the standards are voluntary unless there is claim of USDA grade on the item or case.

STANDARDS AUSTRALIA

Standards Australia is an independent non-profit organisation and has for the first-time published olive oil standards in the country. The standards in Australia for olive oil have the most variation from the agencies listed so far, but the standards are viewed as some of the most stringent to be set anywhere in the world.

CODEX ALIMENTARIUS COMMISION (CODEX)

The Codex Alimentarius Commission (CODEX), an international body established to further international food standards, guidelines and codes of practices, has its own set of olive oil standards.

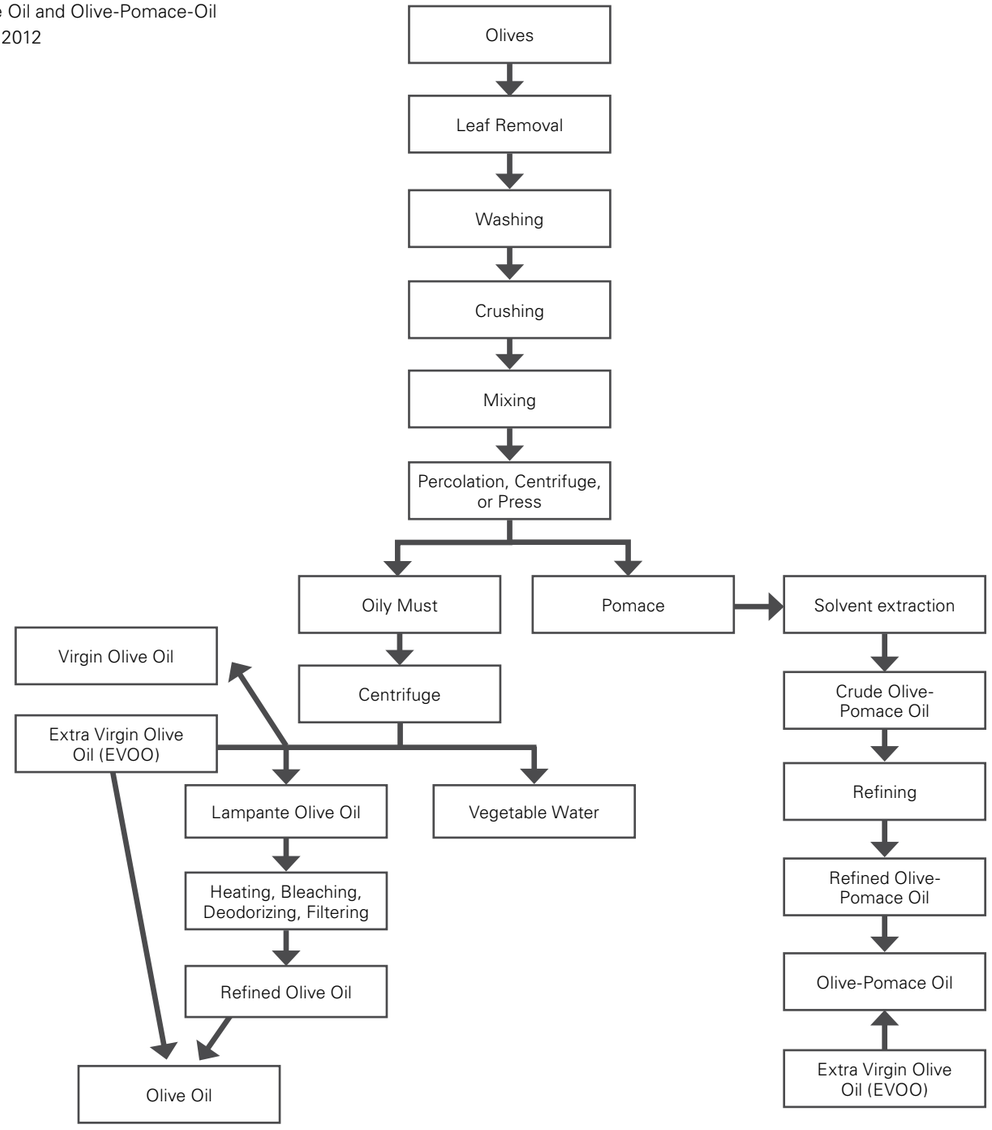


OLIVE OIL PRODUCTION PROCESS

The diagram below illustrates the olive oil production process for the various grades.

OLIVE OIL AND OLIVE-POMACE OIL PRODUCTION

Olive Oil and Olive-Pomace-Oil
May 2012



IV. QUALITY PARAMETERS AND GRADING OF OLIVE OIL

Olive oil quality and grading is evaluated on the basis of certain limits set for chemical and sensory testing. Most agency/country testing criteria follow limits set by the IOC (Table 2 gives a complete comparison for limits of the agency/country in the scope of this whitepaper).

CHEMICAL TESTING

Due to advances in analytical processes such as gas chromatographic, high-pressure liquid chromatographic, and spectrometric methodologies many tests exist to give growers, producers, exporters and importers accurate information on the quality, authenticity, shelf life and overall characteristics of oil extracted from olives.

Some of the more common chemical tests for olive oil are outlined briefly below, along with a list of other tests used for authenticity and/or export requirements.

Oil content

Three types of tests for oil content can establish which trees are the most/least productive – allowing growers to know precisely where to cultivate and harvest crops:

- Solvent extraction: determines the absolute amount of oil in the fruit, offers accurate comparison between trees, but does not extract oil to extra virgin requirements so oil cannot be used for further tests
- Cold press method: extracts oil to extra virgin requirements so can be used for further testing, gives better results than solvent extraction, but is harder to compare between trees
- Near infra-red analyser (NIR): testing in laboratory or onsite at processing plant via infra-red light to measure absorbed energy for assessing the concentration of oil, moisture and fatty acids

Moisture content

Moisture content determines whether the oil concentration will be diluted and oil extraction restricted. There are daily changes to moisture content but not oil content, so it is essential to test both at the same time so sample comparison is accurate. Moisture content alters throughout the life cycle of the fruit, and can range from 55% or higher (developing fruit) to 50% or less (ripening fruit) in certain fruit varieties, seasonal conditions, etc. Ongoing measurement of moisture content allows for better indication of optimal timing for harvesting and extraction/separation processing.

Free fatty acids (FFA)

One of the oldest and simplest tests to indicate good harvesting and handling is for the presence of free fatty acids (FFA). If higher levels of FFA are present it indicates degradation during processing – possibly through poor handling – and this can affect the organoleptic value of the oil.

Peroxide value (PV)

This test determines whether storage has resulted in any reaction with oxygen, and subsequent rancidity of the oil. Oxidisation occurs very quickly after onset. It may be due to high temperature, visible light, oxygen, contact and/or storage with certain metals (i.e. copper). Fruit damage and/or delays after harvest and before processing can all increase PV. Low PV oils – meaning longer shelf life for the end product – can be encouraged by good practices in harvest/processing and storage (cool temperatures, inert containers (i.e. stainless steel, glass), avoiding light sources, etc.). Mixing high and low peroxide value (PV) oils will negatively affect the entire batch.

Absorbance in ultraviolet region (K value)

Testing for absorbance in ultraviolet region (K(UV-Vis)) identifies the changes in the structure of fatty acids due to oxidation, which allows old or refined oils to be determined. This test can help importers better assess the age and/or possibility of adulteration with refined olive oil.

Fatty acid profile (FAP)

Measurement of the individual fatty acids in oil is a fingerprint that can be used for determination of authenticity, quality, stability and nutritional value of the oil. Fatty acids such as oleic acid are considered beneficial (i.e. high in nutritional value) and fatty acids like linolenic acid detrimental to the oil (i.e. three double bonds, high chemical reactivity affects stability). Oleic acid and linoleic acid content are inversely proportional. Climate and seasonal conditions, plus fruit variety all play a part in determining the FAP, as it is common for higher altitudes/cooler temperatures to produce oil with high oleic acid content.

Wax content

Testing for wax content gives an indication of adulteration by determining the individual waxes (i.e. GC-FID analysis of FAMEs and FAEEs) in order to identify the presence of pomace oil or seed oil.

Other tests

A whole array of other tests to determine the chemical parameters for oil quality, authenticity, adulteration and/or contamination exist, some of which include:

- Pyropheophytines
- Diglycerides
- Triaclglycerols
- Total sterols
- Trans isomers
- Fatty acid methyl esters (FAMEs)
- Fatty acid ethyl esters (FAEEs)
- Equivalent carbon number (ECN)
- Contaminants (e.g. plasticizers)
- Mineral oil components (MOSH/MOAH)
- Halogenated hydrocarbons
- Trace metals
- Pesticides
- Etc.

COMPARISON OF CHEMICAL REQUIREMENTS

Each agency/country sets their own limits for chemical parameters, which are compared in the table on the following page.

TABLE 2: COMPARISON OF CHEMICAL REQUIREMENTS FOR OLIVE OIL GRADES BY AGENCY/COUNTRY*

INGREDIENTS	UNITED STATES	IOC	EU	AUSTRALIA	CODEX
Total sterol content (mg/kg)	≥1000	≥1000	≥1000	≥1000	≥1000
Wax Content (mg/kg)	≤250	≤150	≤150	≤250	≤250
Stigmastadienes Content (mg/kg)	≤0.15	≤0.05	≤0.05	≤0.10	≤0.10
Trans Fatty Acid Content	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05
Content of 2-glyceryl monopal-mitate	C16:0≤14%; 2p≤0.9%;C16:0 >14%; 2P≤1.0%	C16:0≤14%; 2p≤0.9%;C16:0 >14%; 2P≤1.0%	C16:0≤14%; 2p≤0.9%;C16:0 >14%; 2P≤1.0%	≤1.5%	C16:0≤14%; 2p≤0.9%;C16:0 >14%; 2P≤1.0%
Fatty Acid Composition					
Arachidic Acid (%)	≤0.6	≤0.6	≤0.6	≤0.6	≤0.6
Behenic Acid	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2
Gadoleic Acid (Eicosenoic)	≤0.4	≤0.4	≤0.4	≤0.5	≤0.4
Heptadecanoic Acid	≤0.3	≤0.3	≤0.3	≤0.3	≤0.3
Heptadecenoic Acid	≤0.3	≤0.3	≤0.3	≤0.4	≤0.3
Lignoceric Acid	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2
Linoleic Acid (C18:2)	3.5-21.0	2.5-21.0	2.5-21.0	2.5-22.0	3.5-21.0
Linolenic Acid (C18:3)	≤1.5	≤1.0	≤1.0	≤1.5	N/A
Myristic Acid	≤0.05	≤0.03	≤0.03	≤0.05	≤0.05
Oleic Acid	55.0-83.0	55.0-83.0	55.0-83.0	53.0-85.0	55.0-83.0
Palmitoleic Acid	0.3-3.5	0.3-3.5	0.3-3.5	0.3-3.5	0.3-3.5
Pelmitic Acid	7.5-20.0	7.5-20.0	7.5-20.0	7.0-20.0	7.5-20.0
Stearic Acid	0.5-5.0	0.5-5.0	0.5-5.0	0.5-5.0	0.5-5.0
Sterol Composition (% of total sterols)					
Brassicasterol	≤0.1	≤0.1	≤0.1	≤0.1	≤0.1
Campesterol	≤4.5	≤4.0	≤4.0	≤4.8	≤4.0
Cholesterol	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5
Delta - 7 Stigmasteriol	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5
Apparent beta-sitosterol	≥93.0	≥93.0	≥93.0	≥92.5	≥93.0
Sigmasterol	<Campesterol	<Campesterol	<Campesterol	≤1.9	<Campesterol
Trace Metals					
Iron (mg/kg)	≤3.0	≤3.0	N/A	≤3.0	≤3.0
Copper (mg/kg)	≤0.1	≤0.1	N/A	≤0.1	≤0.1
Quality Criteria					
Free fatty Acid Content (% m/m)	≤0.8 (EVOO) ≤2.0 (VO)	≤0.8 (EVOO) ≤2.0 (VO)	≤0.8 (EVOO) ≤2.0 (VO)	≤0.8 (EVOO) ≤2.0 (VO)	≤0.8 (EVOO) ≤2.0 (VO)
Peroxide Value (mo/kg)	≤20(EV/VO)	≤20(EV/VO)	≤20(EV/VO)	≤20(EV/VO)	≤20(EV/VO)

INGREDIENTS	UNITED STATES	IOC	EU	AUSTRALIA	CODEX
Ultraviolet (UV) Absorbance					
232nm	≤2.5 (EVOO) ≤2.6 (VO)	≤2.5 (EVOO) ≤2.6 (VO)	≤2.5 (EVOO) ≤2.6 (VO)	≤2.5 (EVOO) ≤2.6 (VO)	≤2.5 (EVOO) ≤2.6 (VO)
270nm	≤0.22 (EVOO) ≤0.25 (VO)	≤0.22 (EVOO) ≤0.25 (VO)	≤0.22 (EVOO) ≤0.25 (VO)	≤0.22 (EVOO) ≤0.25 (VO)	≤0.22 (EVOO) ≤0.25 (VO)
Delta K	≤0.01	≤0.01	≤0.01	≤0.01	≤0.01
Moisture and volatile matter (% m/m)	≤0.2	≤0.2	N/A	≤0.2	≤0.2
Insoluble Impurities	≤0.1	≤0.1	N/A	≤0.1	≤0.1
Organoleptic Analysis					
Median of Defect	=0(EVOO) 0≤Md≤2.5(VO)	=0(EVOO) 0≤Md≤2.5(VO)	=0(EVOO) 0≤Md≤3.5(VO)	=0(EVOO) 0≤Md≤2.5(VO)	=0(EVOO) 0≤Md≤2.5(VO)
Median of Fruitiness	>0	>0	>0	>0	>0
Color	Yellow to Green	N/A	N/A	N/A	Yellow to Green
PPP (%)	N/A	N/A	N/A	≤17 (EVOO)	N/A
DAG	N/A	N/A	N/A	≥35 (EVOO)	N/A
Max difference between actual and theoretical ECN 42 triacyl-glycerol content	≤0.2 (EVOO/ VO)	≤0.2 (EVOO)	≤0.2 (EVOO)	≤0.2 (EVOO) ≤0.3 (VO)	≤0.2 (EVOO/ VO)
Erythrodiol and uvaol content (% total sterols)	≤4.5	≤4.5	≤4.5	≤4.5	≤4.5
Halogenated Solvents	Maximum con-tent 0.1 mg/kg of each solvent Madimum content of ALL solvents 0.2 mg/kg	Maximum con-tent 0.1 mg/kg of each solvent Madimum content of ALL solvents 0.2 mg/kg	Maximum con-tent 0.1 mg/kg of each solvent Madimum content of ALL solvents 0.2 mg/kg	N/A	Maximum con-tent 0.1 mg/kg of each solvent Madimum content of ALL solvents 0.2 mg/kg
Heavy Metals (Lead, Arsenic)	0.1 mg/kg	0.1 mg/kg	N/A	*Comply with Australia New Zealand Foods Standards Code*	0.1 mg/kg
Pestcide Residues	Comply with U.S. Environ-mental Protec-tion Agency	Comply with Codex	N/A	*Comply with Australia New Zealand Foods Standards Code*	Comply with Codex
Unsaponifiable matter (g/kg)	≤15	≤15	N/A	N/A	≤15

Note: Highlighted areas signifies there is a difference between the standards

**Only related to the minimum standards for chemical quality parameters. All types of olive oil referenced except when EVOO (extra virgin olive oil) or VOO (virgin olive oil) is noted.*

SENSORY TESTING

Sensory testing or organoleptic assessment is the evaluation of olive oil quality via a panel test (PT). PTs follow strict methodologies and members of the panel must be trained in how to accurately assess specific sensory characteristics.

Panel test (PT)

PTs have clearly defined guidelines that indicate how each trained (normally to IOC standards) tester, led by a panel leader, should assess within specific vocabulary olive oil according to olfactory, gustatory, tactile and kinesthetic characteristics.

The sensory aspects commonly assessed are:

- Fruitiness
- Pungency
- Bitterness

Positive versus negative attributes

Detection of positive and negative attributes, and their intensity, are noted for each tester in the PT. This data is collated into an official profile sheet, which is then statistically evaluated to provide a final classification (minimum PT size for statistically valid result: 8 persons).

Some common descriptors used in PT include:

- Positive:
  - Fruitiness
  - Pungency
  - Bitterness
- Negative:
  - Rancid
  - Fusty/muddy sediment
  - Musty
  - Further attributes

Advanced methodology

One area to note is the addition in certain countries for PTs to include assessment for:

- Aroma description
- Harmony
- Persistency

These new parameters give testers a more accurate way to determine the overall complexity of olive oils, making it possible to better discriminate at the extra virgin grading level (which is almost 50% of olive oil production). For more information see: 'Case Study: Valuing 'Harmony' in Extra Virgin Olive Oils'.

V. REGULATIONS AND STANDARDS SETTING

EUROPEAN UNION

During recent years, the European Union (EU) has issued several new legislations to combat olive oil fraud, in addition to the prior standard EEC 2568/91, which established the EU characteristics of olive oil, olive residue oil and the relevant methods of analysis.

EU regulations include:

- Regulation (EEC) 2568/91: sets out the characteristics of olive oil and olive-pomace oil and the relevant methods of analysis. Defines the physical, chemical and organoleptic characteristics of olive oils and olive-residue oils and the methods for evaluating these characteristics.
- Regulation (EU) 1308/2013: establishes the commercial definitions of olive oils, such as extra virgin, virgin, ordinary, lampant, olive oil (refined and virgin) and kernel oil. This regulation also defines requirements, characteristics, production and free fatty acid content. These new regulations coupled with others have changed the way the determination of quality and purity of olive oil is performed.
- Regulation (EU) 29/2012: establishes the marketing standards for olive oil (codification), including specific labelling rules.
- Regulation (EU) 1151/2012: lays down the rules on the protection of designation of origin and geographical indications.
- EU regulations require trained sensory panellists to perform the sensory evaluation, testing each batch at each point of the processing and distribution chain for K values (K232, K270), free fatty acids, peroxide value, diglycerides, triglycerides, pyropheophytines, waxes, alkyl esters, fatty acid composition, (and other required tests) to assure compliance with the regulations and confirm that no economic adulteration has taken place.

UNITED STATES

In the United States – excluding the exceptions as noted below – there exists only voluntary standards known as 'the United States Standards for Grades of Olive Oil' since 1948. The second issue came into effect on 25 October 2010 and supersedes the first issue.

The standards serve a dual purpose: a) to facilitate orderly marketing by providing a convenient basis for buying and selling, for establishing quality control programs, and for determining loan values; and b) as a basis for the inspection and grading of commodities by the Federal inspection service, the only activity authorised to approve the designation of US grades as referenced in the standards, as provided under the Agricultural Marketing Act of 1946 (under which authority the standards are issued).

This latter inspection and grading service b) is available to interested parties, upon application, on a fee-for-service basis, as on-line (in-plant) or lot inspection and grading of all processed fruit and vegetable products; where in all instances, a grade is assigned based on final product factors or characteristics. Grading manuals or instructions for inspection, which contain detailed interpretations of the grade standards and step-by-step procedures for grading, are also available for a nominal fee.

Exceptions to the above are the states of Connecticut, New York, Oregon and California. The former – Connecticut – became the first state in the US to set quality standards to protect the purity of olive oil which closely mirror IOC standards. The latter – California – is the most recent state to pass legislation. More on California regulation is below.

California

Effective from 26 September 2014 the California Department of Food and Agriculture approved grading and labeling standards for California olive oil. The recently formed California Olive Oil Commission has established the new standards in recognition of the regions fast-growing olive oil industry. Guidelines are California-specific and apply to handlers producing 5,000 gallons or more of olive oil made from olives grown in California. Importers and distributors of bulk and bottled olive oil produced outside of California as well as smaller-scale in-state millers are exempt from the standards.

As the standards are unique to California production – i.e. extra-virgin olive oil production only – their aim is to establish a more stringent limit for free fatty acids, a negative attribute that signals a breakdown of olive oil quality due to exposure to heat, light and oxygen.

Of note is that these standards are the first in the world to require testing of every lot of oil produced.

The standard defines the following:

- Different grades of oil – natural or refined – including the requirements for the designation 'Extra Virgin Olive Oil'
- Up to date testing methods for quality and authenticity
- Technical basis for 'best before' dates
- Labeling requirements and specifically wording
- Verification of wording for country/region of origin
- Accommodate the most common natural variations (i.e. country-to-country, olive varieties, regions) without compromising the ability to detect test and verify quality and/or adulteration
- Substantiation of processing methods

AUSTRALIA

The Australian Standard for Olive Oils and Olive Pomace Oils – AS 5264-2011 – came into effect on 20 July 2011. Developed and owned by Standards Australia, the new standard has been formed in parallel with a 'Australian Olive Industry Code of Practice' and a 'Consumer Awareness and Education Campaign' with the overall aim being to protect the integrity of the entire olive oil supply chain, with particular focus on the consumer.

The Australian Olive Association (AOA) has been instrumental in the new standard, funding world-leading research (in partnership with Rural Industries Research Development Corporation (RIRDC)), as has the Department of Agriculture, Fisheries and Forestry (DAFF) through its long-term work on international trade standards.

VI. LABELLING REQUIREMENTS

This section presents the generic labelling requirements in the European Union (EU), the United States (US), and Australia.

EUROPEAN UNION

In the EU, regulations have recently been amended to make information clearer and less ambiguous to the consumer. Changes to regulations such as how and where information appears and in what font size have been implemented to make it more obvious what is contained in the bottle (e.g. quality, country of origin) and how to store the olive oil (e.g. information to 'store in cool, dark place'). In addition, harvest year can now only be stated if the olive oil in its entirety comes from the harvest, aimed at ensuring consumers know the freshness of the olive oil before purchase.

UNITED STATES

In the US, the US Food and Drug Administration (FDA), except in a few instances, enforce food labelling regulations in the United States (US): however, one specific exception is the 'country of origin marking requirement' which is enforced by the US Customs Service (the FDA can also enforce this requirement). Nutrition is the major focus on food labelling in the US.

AUSTRALIA

In Australia, for signatories to the Australian Olives Association (AOA), labelling is per the AOA code of conduct (annex 2) which builds on those of the Codex General Standard for the Labelling of Pre-packaged Foods (Codex STAN 1-1985 – Rev 1-1995) and the standards for food intended for direct sale to consumers of the Food Standards Australia New Zealand – Food Standards Code.

VII. CASE STUDIES

CASE STUDY

EXTRACTING THE TRUTH FROM OLIVE OIL CLAIMS

In recent years, there have been many widely publicised reports on olive oil fraud and adulteration. Studies such as those by researchers at the University of California, by authorities in Spain on the olive oil market in China, and blind-taste testing in Australia all lend evidence to the findings that extra virgin olive oil (EVOO) sold worldwide may well not be what is claimed on the bottle.

Statistics from the various reports demonstrate olive oil fraud is not limited to one region or country. In California, 60% of the EVOO samples taken from supermarkets were not as described on the bottle. In Spain, the largest exporting and producing country in the world, adulteration of olive oil bound for the Chinese market prompted a report and the warning that 'malpractice risks tainting the Chinese consumer perception that olive oil is a high quality product' – a worrying prediction as China (along with India) is seen as one of the key markets for growth in EVOO exports. Meanwhile in Australia, from blind-tests of locally produced versus imported EVOO, 9 out of the 10 highest quality scored EVOO were Australian not Mediterranean in origin; and subsequent reports found over half of supermarket imported EVOO failed to meet international standards for the quality/grade.

Concerns about the risks of adulteration are growing in other markets too. In Turkey for instance, which saw its global olive oil exports grow from just 12 thousand tons in 2010/11 to 55.8 thousand tons in 2013/14, the government updated their regulations for the olive oil testing programme in November 2014. To put the significance of such an undertaking into context, it should be noted that exports from Greece in 2013/14 reached just 13 thousand tons.

SGS is helping combat olive oil fraud by working with some of the world's biggest producers, exporters, manufacturers and private label businesses. SGS tests and authenticates samples based on the specifications set down by governments and independent bodies including the IOC, USDA and AOCS (American Oil Chemists' Society). Wherever oil adulteration is suspected, SGS can advise on the development of quality assurance programmes to monitor and guard against the risk of adulteration, focusing on purity as well as analytical tests to determine the real grade and quality of the olive oil in question.

CASE STUDY

VALUING 'HARMONY' IN EXTRA VIRGIN OLIVE OIL

The extra virgin olive oil (EVOO) classification is by far the largest percentage of olive oil grade by production. However, not all EVOOs, despite their classification, are 'equal' in terms of quality. Due to the diversity of origin or olive variety, the harvesting or production process, and of course the final EVOO blend itself, many different 'sensory' olive oils can be merged to create the final EVOO product.

Consumers, and even major buyers in the olive oil industry, can be unaware of the differences within the general category of EVOOs.

One way to differentiate higher quality EVOOs is by including the factor 'harmony' in sensory evaluations. Several oil competitions, the International Olive Oil Award-Zurich (IIOA), the Mario Solinas Award and Premio Biol, already include harmony or complexity as additional sensory factors in judging quality. And academic investigations carried out with trained panel testers from the German Olive Oil Panel (DOP) and the Swiss Olive Oil Panel (SOP) have demonstrated the value of harmony as an objective sensory descriptor – and one which can be used to discriminate different quality levels within the grade of EVOO.

For the olive oil industry, including the quality value harmony in any testing and certification process offers the opportunity account for why EVOOs can often range so dramatically in price. Once buyers and consumers realise not all EVOOs are the same – through the use of a more transparent, and independently verified, testing methodology which subcategorises EVOO into 'standard', 'good' and 'excellent' – then it is possible for sensory evaluation to be an 'added-value' process in EVOO classification.

CASE STUDY

SAFEGUARDING AGAINST CONTAMINATION

Olive oil contamination, unintentional as opposed to any intentional 'adulteration', is also a serious concern for any producer, exporter, manufacturer or private label business seeking to protect their brand and reputation.

Contamination can occur at any time due to poor handling and processing, packaging, storage and even shipping. In the US for example, olive oil contaminated with traces of naphthalene was eventually traced back to pesticide use in shipping containers. This type of supply chain contamination, while not widespread, is something that has the potential to impact profits from loss of product in transit and/or loss of consumer confidence.

Other contaminates such as phthalates, the major group of plasticizers, have also been detected in a wider range, and higher average totals, in olive oils versus other oil species.

Contamination can be detected with an effective testing regime, which safeguards contaminated products getting to market.

Good manufacturing practices, effective communication and collaboration across the supply chain (including end-to-end supply chain visibility), transparency and traceability, and knowledge of current and emerging risks are commonly considered to be the three top prerequisites to effective supply chain risk management. SGS is a leading independent third-party service provider of effective solutions that safeguard quality, safety and sustainability at all stages of the global food supply chain.

CASE STUDY

AUTHENTICATING THE ORIGIN OF OLIVE OIL

With so much media attention being given to whether olive oils come from where they claim, authenticating olive oil origin is increasingly under the spotlight.

Over many years, analytical data has been gathered from all of the producing countries in Mediterranean basin, which provides for a bank of established ranges of stable isotope ratios for each region. In practice, this means each region can now be authenticated due to its particular characteristics for carbon, hydrogen and oxygen. Geographical parameters such as altitude, latitude, temperature, precipitation and others all allow for the identification of 2H/1H and 18O/16O ratios of olive oils. The stable isotope ratio determined by a local trace element in the soil such as strontium (87Sr/86Sr) can further help authenticate an olive oil's origin.

From a decade of research and development it is now possible to authenticate whether oils carrying a declared origin, did in fact come from the geography claimed. From a decade of research and development it is now possible to authenticate whether oils carrying a declared origin, did in fact come from the geography claimed. Isotope testing can be conducted by various Mass Spectrometry (MS) techniques, such as Isotope Ratio Mass Spectrometry (IRMS) or Inductively Coupled Plasma – High Resolution Mass Spectrometry (ICP-HRMS). SGS through its network of laboratories can now inform producers, exporters, manufacturers or private label businesses whether their olive oil really does originate from where it claims.

VIII. CONCLUSION

Olive oil is a staple of the Mediterranean diet. Consumers around the world are drawn to its many presumed health benefits, and of course the 'premium' nature of the product.

If manufacturers, producers and retailers are to continue successfully selling olive oil at a premium-price, the words 'extra virgin olive oil' may no longer be enough to convince consumers of authenticity. The many well-documented media exposés have placed a greater emphasis on testing – both chemical and sensory – to determine quality, grade and origin/variety.

Labelling has come under increased scrutiny for the role it plays in clearly identifying the product contained within the bottle. Not just in terms of quality, but also origin and freshness.

As voluntary standards and regulatory requirements are becoming stricter in terms of what is expected of the final product, it is up to manufacturers, producers and retailers to ensure they can not only demonstrate the product meets all quality/grading and labeling requirements; but it is also prudent to have transparency and traceability throughout the entire supply chain.

Risk of contamination, adulteration and fraudulent product are all significant threats to consumer confidence in olive oil. Only by establishing stringent controls that address testing, verification and good practice can the olive oil industry protect its reputation – and the trust of the consumer.

ABOUT THE AUTHORS

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James Cook received his Bachelor of Science in Chemical Engineering from the Newark College of Engineering in the United States of America. He has over 34 years of industry experience, serving as expert in areas of quality assurance, quality control, auditing, product inspection, laboratory management, and regulatory affairs within retail, distribution, manufacturing and contract testing service industries. He has extensive experience in food products, food packaging, cosmetics, personal care and household products and medical devices; and working knowledge of AOAC, SQF, HACCP, ServSafe, GMP, Six Sigma, and regulatory compliance. James chairs one technical committee for SGS and participates on two other technical committees.

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Claudia Koch studied food chemistry and has worked as a State-certified (Germany) food chemist, and also as an auditor for the food and feed industry. She has been working with SGS for more than 15 years. Her roles have spanned product development, auditor and sales representative. The main focus of her current role is developing SGS' independent services in the segments for food and feed with plant origin: including services for lab analysis, auditing (e.g. IFS, BRC, HACCP, GMP) and consulting. She is a member of several organisations and a panelist of the DOP (German Olive oil panel).

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SGS Agriculture & Food

ABOUT SGS

SGS is a leading independent third-party service provider offering producers, exporters, manufacturers or private label businesses efficient solutions across a wide range of olive oil testing, certification, technical assistance, audit, inspection and verification needs.

SGS is the world's leading inspection, verification, testing and certification company. SGS is recognised as the global benchmark for quality and integrity. With more than 80,000 employees, SGS operates a network of over 1,650 offices and laboratories around the world.

Enhancing processes, systems and skills is fundamental to your ongoing success and sustained growth. We enable you to continuously improve, transforming your services and value chain by increasing performance, managing risks, better meeting stakeholder requirements and managing sustainability.

With a global presence, we have a history of successfully executing large-scale, complex international projects. Our people speak the language, understand the culture of the local market and operate globally in a consistent, reliable and effective manner. We have a harmonised approach to delivering services to our customers, leveraging the largest independent network of consumer product experts in the world.

FOR MORE INFORMATION ON SGS SERVICES AND SOLUTIONS FOR OLIVE OIL VISIT WWW.SGS.COM OR CONTACT FOODSERVICES@SGS.COM

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