MILLER'S GUIDE TO SENSORY AND CHEMISTRY

Dan Flynn
Dr. Selina Wang

Overview

- Grades and standards driven by the IOC
- What standards reveal about oil quality
- Efforts to improve upon IOC standards

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Grades and standards are driven by the IOC

Grades and Standards: Who

International Olive Council (IOC or COI)

Grades and Standards: Why

- Facilitate trade
- Higher quality = better price
- Prevent fraud
- Assure consumers

Grades and Standards: How

- Voting: Based on production
- Periodic updates based on review by expert committees
- Member countries represent most of the world's olive oil production
- Decisions driven by the interests of member countries

Grades and standards: What

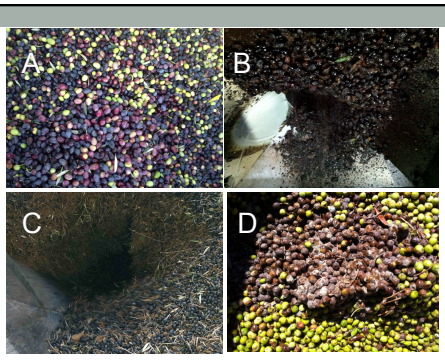
Olive oil is the oil solely obtained from the fruit of the olive tree, to the exclusion of oils obtained with solvents.

Olive-pomace oil is the oil obtained by treating olive pomace with solvents.

Classifications

A. **Virgin olive oil** (Extra Virgin, Virgin)
B. **Refined olive oil (A that is refined)**
C. **Olive oil (B + A)**
D. **Olive-pomace oil (D + A)**

In this course, we focus on virgin olive oil



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What sensory and chemistry standards reveal about virgin olive oil quality

Quality v. purity

	TESTS
Quality (i.e., does this olive oil meet the grade standard?)	Sensory Panel Free Fatty Acidity Peroxide Value UV Absorbency
Purity (i.e., is this oil 100 percent olive oil?)	Fatty Acid Profile Trans-fatty Acid Profile Sterol Profile Stigmastadiene Content Triacylglycerol Content Wax Content Unsaponifiable Matter Content of 2-glyceryl Monopalmitate

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Quality tests: sensory

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Sources of sensory defects

Cause	Defect
Fruit condition	Rancidity Fusty Winey/Vinegary Musty Frozen Dried Grubby
Processing/Storage	Rancidity Fusty Metallic Heated/Burnt Muddy Sediment

Sensory evaluation of virgin olive oils

- Trained panel of at least 8 tasters
- Evaluate **positive** attributes (fruity, bitter and pungent)
- Evaluate **defects** (rancid, fusty, musty, frozen, winey, etc.)
- Sensory key to understanding quality

Sensory standards of virgin olive oils

Grade	IOC	USDA/Codex
Extra Virgin	Defects = 0 & Fruity > 0	Defects = 0 & Fruity > 0
Virgin	Defects > 0 ≤ 3.5 & Fruity > 0	Defects > 0 ≤ 2.5 & Fruity > 0
Ordinary	Defects > 3.5 ≤ 6.0 & Fruity > 0, or Defects ≤ 3.5 & Fruity = 0	
Lampante	Defects > 6.0	Defects > 2.5

Sensory quality; EVOO is pass/fail

Excellent (extra virgin)

Very good (extra virgin)

Good (extra virgin)

Acceptable (extra virgin)

Defective (virgin, ordinary virgin, lampante)

Sensory analysis has limitations

- Few panels worldwide
- Do not evaluate much of world production
- Sometimes inconsistent results between panels
- Regulators reluctant to use for enforcement

Quality tests: chemistry

Free Fatty Acidity (FFA)	A crude indicator of initial oil quality. Oils processed promptly from healthy fruit have low FFA. High level in young oils leads to a short shelf life.
Peroxide Value (PV)	A crude indicator of oil quality. Increases with oxidation but decreases as the oil becomes rancid. High level in young oils leads to a short shelf life.
UV Absorbency (K232, K270, ΔK)	A indicator of oil oxidation. High levels are associated with old oils.

Chemistry standards

Virgin olive oil grade	FFA	PV	UV K232	UV K270	UV ΔK
Extra Virgin	≤0.8	≤20	≤2.50	≤0.22	≤0.01
Virgin	≤2.0	≤20	≤2.60	≤0.25	≤0.01
Ordinary	≤3.3	≤20		≤0.30	≤0.01
Lampante	>3.3	No limit			

IOC, USDA, and Australia

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Chemistry standards are too permissive

	FFA	PV	UV K232	UV K270	UV ΔK	Sensory
Passage rate of 260 olive oils	100	99	91	89	99	47

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Efforts to go beyond IOC standards

Quality EVOO wants to stand out

Excellent (extra virgin)

Very good (extra virgin)

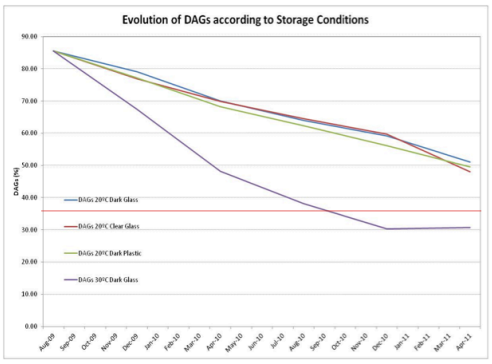
Good (extra virgin)

Acceptable (extra virgin)

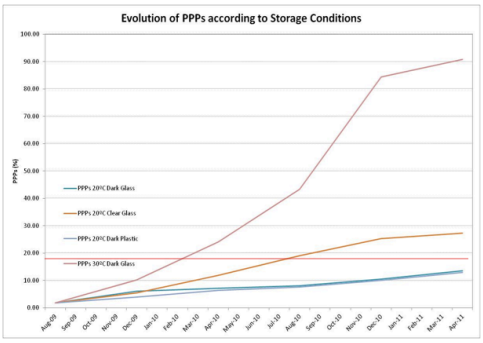
Defective (virgin, ordinary virgin, lampante)

Additional quality tests: DAGs & PPP

Diacylglycerols (DAGs)	A high ratio indicates that an oil is made from healthy fruit and proper process. Decrease over time, especially with inappropriate storage conditions. Equilibrium = ~33%
Pyropheophytins (PPP)	A low ratio indicates that an oil is fresh and has not been stored in excessive warm conditions. Increases over time, especially with inappropriate storage conditions.

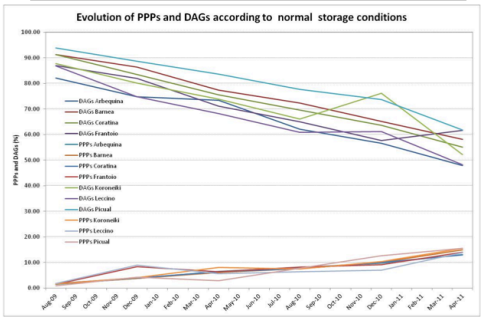


Source: Modern Olives, Australia



Source: Modern Olives, Australia

Results – Australian Varieties



Source: Modern Olives, Australia

Designations of origin or geography

- Common in Europe with many products
- E.g., Kalamata, Siurana, Toscana
- Requirements include geographical boundaries, stricter chemistry standards and mandatory sensory analysis

Quality seal programs

	NORTH AMERICAN OLIVE OIL ASSN @BBD	CALIFORNIA OLIVE OIL COUNCIL @BBD	EXTRA VIRGIN ALLIANCE @BBD	QVEXTRA at packaging prior to July	QVEXTRA at packaging after July	QVEXTRA at BBD
FFA	≤ 0.8	≤ 0.5	≤ 0.5	≤ 0.3	≤ 0.3	≤ 0.4
PV	≤ 20	≤ 20	≤ 15	≤ 8	≤ 11	≤ 15
K232	≤ 2.50	≤ 2.50	≤ 2.50	≤ 2.00	≤ 2.00	≤ 2.50
K268	≤ 0.22	≤ 0.22	≤ 0.22	≤ 0.15	≤ 0.15	≤ 0.18
Δ K	≤ 0.01	≤ 0.01				
DAGs			≥ 40			
PPP			≤ 15			
Fruity	> 0	> 0	≥ 1	≥ 4.5	≥ 4.5	≥ 1
Defect	0	0	0	0	0	0

Stricter chemistry standards

	IOC and USDA	AUSTRALIA	CALIFORNIA
FFA	≤ 0.8	≤ 0.8	≤ 0.5
PV	≤ 20	≤ 20	≤ 15
K232	≤ 2.50	≤ 2.50	≤ 2.40
K268	≤ 0.22	≤ 0.22	≤ 0.22
Δ K	≤ 0.01	≤ 0.01	≤ 0.01
DAGs		≥ 35	≥ 35
PPP		≤ 17	≤ 17

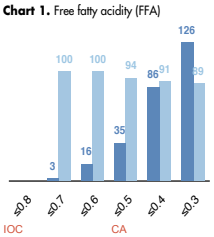
Relationship of sensory and chemistry

260 samples
141 failed sensory

failing chemistry standard

% also failing sensory standard

Chart 1. Free fatty acidity (FFA)



Source: UC Davis Olive Center, *Correlating Olive Oil Sensory and Chemistry Results*, 2014

Relationship of sensory with chemistry

Chart 2. Peroxide value (PV)

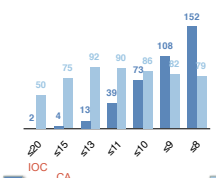
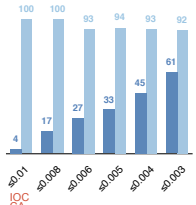


Chart 3. Ultraviolet absorbency (ΔK)



failing chemistry standard

% also failing sensory standard

Source: UC Davis Olive Center, *Correlating Olive Oil Sensory and Chemistry Results*, 2014

Relationship of sensory and chemistry

Chart 4. Ultraviolet absorbency (K232)

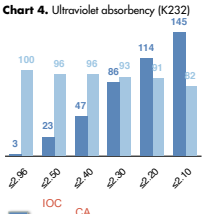
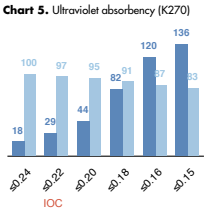


Chart 5. Ultraviolet absorbency (K270)



failing chemistry standard

% also failing sensory standard

Source: UC Davis Olive Center, *Correlating Olive Oil Sensory and Chemistry Results*, 2014

Relationship of sensory and chemistry

Chart 6. Diacylglycerols (DAGs)

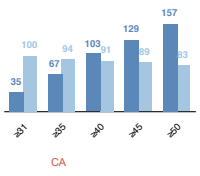
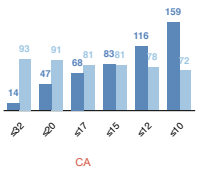


Chart 7. Pyropheophytin (PPP)



failing chemistry standard

% also failing sensory standard

Source: UC Davis Olive Center, *Correlating Olive Oil Sensory and Chemistry Results*, 2014

California's new olive oil standards

- Stricter chemistry
- Mandatory testing
- Prohibition of "light" and "pure" (CA requires "refined" and "refined olive oil blend")
- Traceability
- Applies to producers of at least 5,000 gallons

What miller's should understand

1. Standards are set at minimal levels of quality
2. IOC chemistry standards have a poor relationship to IOC sensory standard
3. Still, existing chemistry tests can offer useful information about the quality of olive oil
4. Existing chemistry can be tightened to have a better relationship to sensory quality (e.g., CA)
5. Research goal: Better, faster and cheaper methods for analyzing olive oil quality