

Identification of almond's variety based on FTIR spectra of ground samples

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Introduction and objectives

- Almonds' traceability is of utmost relevance.
- Like for other food matrices, disclosing the almonds' cultivar/variety is important for producers, authorities and consumers.
- Minimal invasive and fast analytical tools are needed to identify the almonds' cultivar.
- Attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR) was applied aiming to develop multivariate discriminant models for the identification of almonds' cultivar.

Material and methods

Almond cultivars (Fig. 1):

- 7 cultivars studied.
- 30 independent samples evaluated per cultivar.
- 3 matrices evaluated: epicarp, kernel and ground almonds.

ATR-FTIR analysis (Fig. 2):

- MB300 FTIR (ABB, Zurich, Switzerland).
- Spectra acquired in duplicate, at 32 scans/min at wavenumbers (wn) from 4000 to 500 cm^{-1} (interval: 4 cm^{-1}).

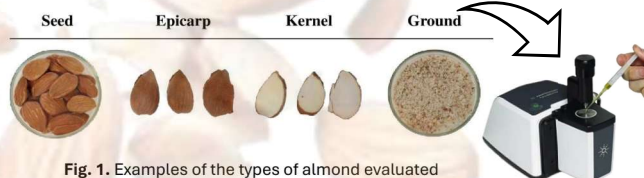


Fig. 1. Examples of the types of almond evaluated matrices (epicarp, kernel and ground almonds).

Fig. 2. FTIR apparatus.

Results and discussion

Distinct transmittance spectra unveiled: bands at 3700-2750 cm^{-1} and 1800-600 cm^{-1} (Fig. 3).

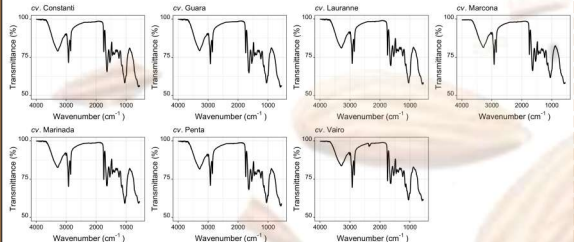


Fig. 3. FTIR spectra (4000 to 500 cm^{-1}) for ground almonds (cultivars: Constanti, Guara, Lauranne, Marcona, Marinada, Penta and Vairo).

Multivariate LDA model (raw transmittance at 30 selected wn recorded for ground almonds) enabled the correct classification of:

- 100% training (Fig. 4)
- 99.2% LOO-CV
- 98.9% repeated K-fold-CV

Predictive performances similar to those previously reported in the literature but for a smaller number of cultivars^{1,2,3}.

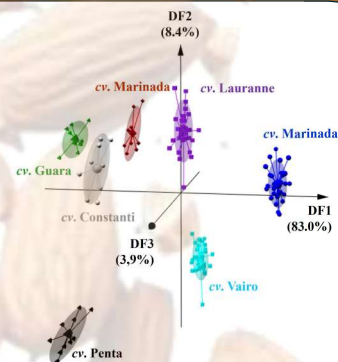


Fig. 4. 3D-LDA-SA plot: discrimination of the 7 studied cultivars using FTIR raw data (transmittance %).

Conclusion

- The proposed FTIR-LDA-SA classification approach based on raw transmittance spectra recorded for ground almonds was a fast, accurate, cost-effective, and minimally invasive tool for almond cultivar traceability.
- This tool could be used as a routine cultivar identification tool by producers and industrial stakeholders for ensuring almonds' cultivar genuineness throughout the almond processing chain.

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