Evaluation of olive oils components by thermal treatment, fluorescence spectroscopy and chemometrics methods

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INTRODUCTION

• Olive oil is obtained from the fruit of the olive tree (*Olea europaea L.*). Being the most commonly used cooking fat in Mediterranean countries, it is subjected to culinary practices that entail heating processes. During this operation the oil undergoes a series of chemical reactions due to high temperature and the absorption of oxygen and water. These reactions can include for example hydrolysis, oxidation and isomerisation.

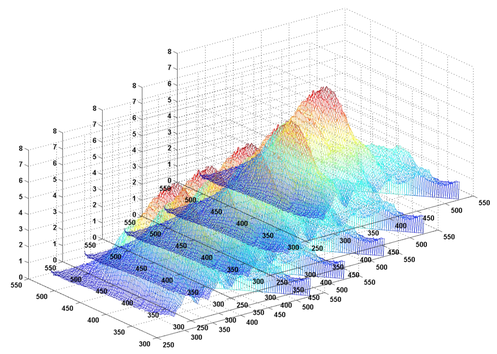
• Olive oils have been analyzed using techniques such as chromatography, mass spectrometry, infrared and Raman spectroscopy, Nuclear Magnetic Resonance and fluorescence spectroscopy.

•In this work, 3D-Front-face fluorescence spectroscopy associated to chemometrics methods is used to evaluate the evolution of naturally occurring and neo-formed fluorescent olive oil components during thermal treatment.

MATERIAL AND METHODS

Olive oil

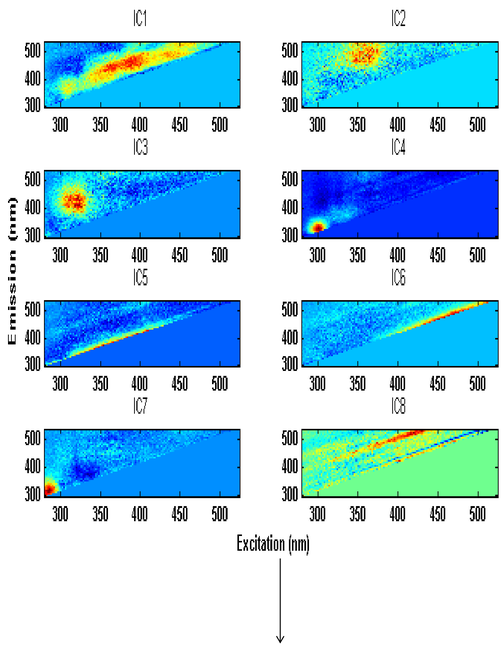
Heated 140, 170 & 190°C
3 aliquots were taken every minute up to 5 minutes and then every 5 minutes up to 180 minutes



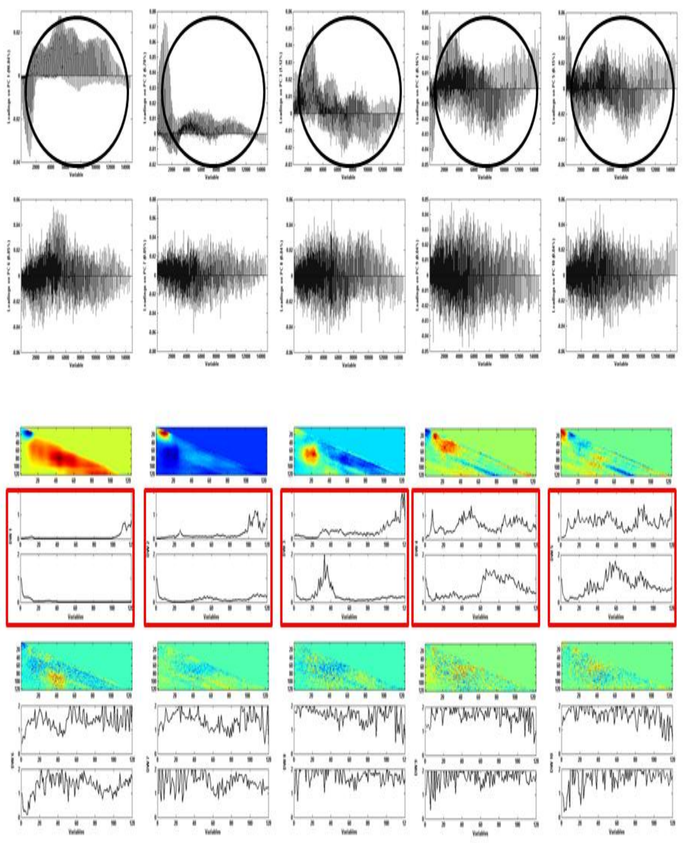
exc 280 - 524 nm
emc 300 – 540 nm

1°) ICA – remove artefacts peaks
2°) MPCA and DW – choice factor numbers
3°) PARAFAC (Non Negativity)

RESULTS AND CONCLUSION

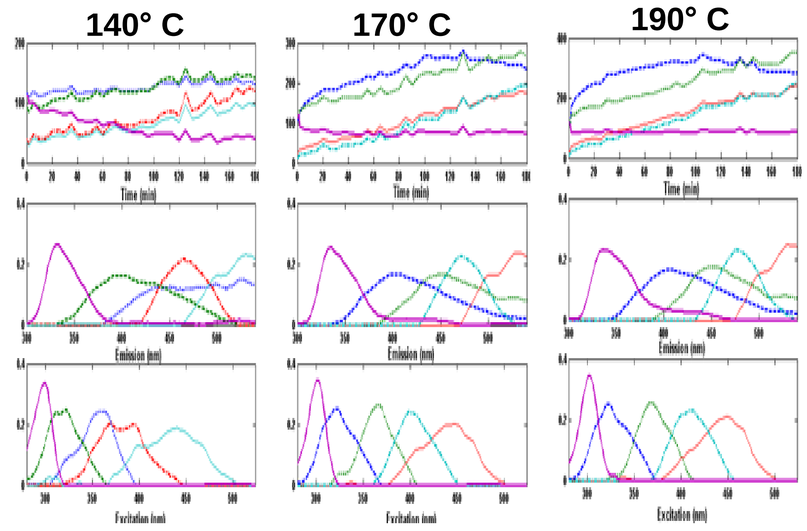


ICA remove artefacts peaks



The first 5 MPCA components contain information and the last 5 components are noise.

DW statistic to the lines and columns of the MPCA loadings folded back into matrices. The first 5 component show large regions of DW values close to zero, while the last 5 factors show DW values close to 2.



PARAFAC with 5 factors
Loadings of the emission and excitation modes are very similar, indicating robust models.
Loadings of the sample mode ressemble kinetcs profiles that change with the temperature and the nature of the fluorescent component responsible for the factor.

The number of factors found as significant was the same to the olive oil samples heated at all 3 temperatures. The PARAFAC emission and excitation loadings are in good agreement with previous studies and the kinetics showed that tocopherol concentration decreases and oxidation products increases with time and temperature. The combination of Front-face 3D-fluorescence excitation/emission measurements, ICA, Durbin-Watson and PARAFAC facilitates the evaluation of olive oil thermal deterioration.

ACKNOWLEDGEMENTS