COURSE: New technologies implementation in RIS regions' olive oil mills for healthier olive oil extraction.

1. Introduction to *PHENOILS* project - EIT Food (*Prof. Giancarlo Cravotto*)

2. From history to new technologies in the EVOO supply chain (*Prof. Giancarlo Cravotto*)

- EVOO a millenary history of the Mediterranean basin

- New technologies and equipment to improve quality standards. The advantages of ultrasound and pulsed electric fields.

3. Productive technologies for EVOO processing and production (*Dr Giorgio Grillo*)

- The process through the production phases: from olives to EVOO.

- Technologies and industrial applications: state of the art.

4. IOC International Reference methods for EVOO analyses (*Dr Luisa Boffa*)

- Classification and characteristics of oils, virgin oils definition

- Quality parameters: free acidity, peroxide value, UV specific extinctions, sensory analyses and fatty acids ethyl esters

-Purity and authenticity parameters: acidic and sterolic composition, *trans* fatty acids, waxes, tocopherols, polyphenols

5. Advanced analytical methods for the determination of essential and potentially toxic elements in extra-virgin olive oils (*Prof. Ornella Abollino*)

The steps necessary for the determination of essential (e.g. Cr, Cu, Fe, Mn and Zn) and potential contaminants (e.g. As, Cd and Pb) in samples of extra virgin olive oils by inductively coupled plasma optical emission spectrometry (ICP-OES) and mass spectrometry with ICP source (ICP-MS) will be illustrated. Initially, a procedure for the pre-treatment of oil samples before analysis will be described, and the problems related to the complexity of the starting matrix will be addressed. Next, the principles and applications of ICP-OES and ICP-MS and the criteria of choice of instrumental parameters for analysis will be illustrated. Finally, the processing and interpretation of the experimental results will be discussed.

6. Advanced analytical methods for the determination of redox properties of extra-virgin oils (*Dr Agnese Giacomino*)

An innovative method for assessing the oxide-deductive profile of oils by voltammetric analysis will be presented. The principles and applications of voltammetric methods of analysis will be illustrated. The preparation of carbon paste electrodes will be described; such electrodes are obtained by mixing graphite powder with aliquots of extra virgin oils or oils deriving from other plants. The features observed in the voltammograms reflect the redox reactions of electroactive compounds (such as polyphenols), which are present in the oils mixed with the carbon matrix. The voltammograms deriving from the analysis of EVOO having different geographical origin (different Italian regions and other foreign countries) will be presented and compared with those obtained from vegetable oils of different botanical origin (seed oils, almond oils, ...). The chemometric treatment carried out on the voltammetric signal) and the conclusions that may emerge from it will be presented.

7. Extra Virgin olive oil: a functional food? (*Prof. Erica Liberto*)

Olive oil is the main source of fat in the Mediterranean area and is a food that distinguishes the Mediterranean diet from other diets. Due to its nutritional characteristics, it has been recognized as having favourable effects on long-term well-being and health. Very recently, FDA and a worldwide experts's consensus established to have a role in the primary prevention of chronic diseases, when included within a balanced diet. In this webinar, the available data on the effects of olive oil consumption as functional food will be critically summarized.

8. Dynamic sensory profile and nose-space analysis during tasting of extra-virgin olive oils (*Prof. Eugenio Aprea*)

Sensory perception during food consumption is a dynamic process requiring appropriate tool to be studied. In the last decades, several dynamic sensory methods have been developed. The possibility to couple these dynamic sensory techniques with analytical methods able to measure volatile compounds directly in the nose (close to the olfactory receptors) creates a new horizon for studying the phenomena involved in flavour perception during food consumption. In this webinar will be reported, as case study, the coupling of sensory and instrumental dynamic techniques for studying the interaction between volatile compounds and flavour during the eating of olive oil, tasted alone or in combination with other food matrices (bread or chickpeas).

9. The chemical signature of quality: omics strategies applied to extra-virgin olive oil valorization (*Prof. Chiara Emilia Cordero*)

The webinar will focus on omics analytical strategies for detailed profiling and chemical fingerprinting of volatile organic compounds (volatilome) and non-volatiles components (sterols and waxes) from high-quality extra-virgin olive oil. In the challenging context of product's valorisation, traceability and sensory qualification, relevant applications based on omics principles will be presented with emphasis on the potentials they have for industrial research and new-products development. Sample preparation by fully automated solvent-free techniques and their on-line coupling with multidimensional chromatography (2D GC and 2D LC) and mass spectrometry will be presented in light of advanced data processing tools provided by artificial intelligence.

Extra contents: Basics of multidimensional chromatography, Basics of 2D data processing, Basics of data mining by multivariate statistics

10. Valorization of waste and by-products from EVOO industry and their added-value applications: a circular approach (*Dr Silvia Tabasso and Dr Emanuela Calcio Gaudino*)

Recovery of bioactive compounds from olive mill waste and their applications in health care and food products:

- Valorisation of olive stones: recovery of antioxidants and sugars as preliminary steps in the biorefinery context
- Extraction and purification of phenolic compounds from olive pomace and leaves: green extraction processes
- Purification of olive fibers

Biorefinery based on olive biomass. State of the art and future trends.

11. Final remarks and test