Stage 3 – Project Results Summary/2024

Task 3.1: An image of contaminating species. The identification of contaminants in extra virgin olive oil (EVOO) is crucial to ensure authenticity, quality and regulatory compliance. Impurities can occur due to the incorporation of oils from different vegetable sources, intentional adulteration or unintentional cross-contamination. Various analytes such as oleic acid, linoleic acid, caffeic acid, coumaric acid, arachidonic acid, α-tocopherol and hydroxytyrosol were analysed to determine whether they could interfere with the analysis process of real samples.

Task 3.2: Investigation of the matrix effect of the analysed oils. The matrix effect in the context of analysing extra virgin olive oil (EVOO) refers to the influence that the complex composition of the oil has on the precision and reliability of the analytical measurements. This effect can alter the response of the analytical method, resulting in either amplification or suppression of the signal of the analytes of interest. Understanding and mitigating matrix effects is critical for accurate quantification and identification of compounds in EVOO, especially when analysing impurities and quality control. The method for the determination of matrix effects in oil samples, using matrix samples added after extraction, showed very good results by increasing the analytical signal in samples of Greek extra virgin olive oil and Sotirelis extra virgin olive oil. The matrix effect of over 40% in complex oil samples gives a good insight into the actual performance of the sensors developed for the determination of oleuropein and into possible interactions with the sample matrix.

Task 3.3: Determination of the degree of contamination of the olive oils tested. To determine the degree of contamination of olive oil, the presence of components of other vegetable oils or adulterants must be identified and quantified. This process requires a combination of analytical techniques to accurately detect and measure impurities. The main compounds in EVOO samples (oleic acid and linoleic acid) showed no significant changes in the signals for the detection of oleuropein (Figures 3-A and 3-B). Of all the interferents analysed, only coumaric acid caused an increase in the signal of the NNCG3 electrodes by about 11% at a concentration of 50 μM interferent. The other potentially interfering substances led to insignificant changes in the analytical signal. These results show that the investigated potentially interfering substances have only minor effects on the electrode response in the determination of the analyte of interest, especially if we also consider their relatively low concentration in real EVOO samples. The relative standard deviation (RSD) calculated for 3 consecutive measurements in the working cell did not exceed 2% for all determinations investigated with potential interfering analytes.

Task 3.4: Classification and prediction models based on electroanalysis and chemometrics. A single faradaic anode peak and one or two faradaic cathode peaks were observed. The distance between the anode and cathode peaks of about 0.6 V can be explained by different electrochemical mechanisms, for example by a mechanism of adsorption/desorption of compounds at the electrode followed by electron transfer. A second possible mechanism is related to the simultaneous transfer of heterogeneous protons on the surface of the electrode. The two compounds OL and HT show similar voltamograms, indicating that the same OH groups are active.

Task 3.5: Dissemination of the results. The results obtained in this phase were disseminated at an international conferences, by submitting an article in a journal in the Q2 quartile and a patent request.