

Electrochemical fingerprinting for medical and food research

Aleksandra Tobolska[†], Klaudia Glowacz, Katarzyna Biernat, Aleksandra Kędzierska, Wojciech Wróblewski, Nina E. Wezynfeld, Patrycja-Ciosek Skibińska

Chair of Medical Biotechnology, Faculty of Chemistry, Warsaw University of Technology,
Noakowskiego 3, 00-664 Warsaw, Poland

[†] corresponding author's email: aleksandra.tobolska@pw.edu.pl

Electrochemical fingerprinting has emerged as a powerful approach for the rapid, low-cost analysis of complex samples [1–3]. Instead of focusing on individual analytes, this method captures the overall electrochemical response, forming a unique “chemical signature” and interprets it using multivariate statistical tools such as Principal Component Analysis (PCA) and Partial Least Squares Discriminant Analysis (PLS-DA). This strategy offers a fast and information-rich alternative for quality assessment, authenticity verification, and comparative analysis across various fields.

In this lecture, the fundamental principles behind electrochemical fingerprinting will be introduced and discussed in their practical implementation using voltammetric techniques. Drawing from both the literature and the work of our research team, selected case studies from two domains will be presented: electrochemical profiling of metal-peptide complexes relevant to medical diagnostics, particularly for recognizing biomarkers associated with Alzheimer's disease, as well as detecting biologically relevant anions [4,5], and real-world samples from the food industry, including tea beverages, fruit extracts, and dietary supplements.

These examples will illustrate that electrochemical fingerprints, when analyzed through chemometric modeling, allow for the detection of subtle chemical differences and group-related trends that often are difficult to trace applying classical analytical methods focused on respective, single analytes. The talk will also reflect on the strengths and limitations of this approach and highlight its potential as a versatile analytical strategy for both research and practical applications.



Figure 1: Applications of Electrochemical Fingerprinting in food and medical analysis.

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