APPLICATION OF VOLTAMMETRIC METHODS IN ELECTROCHEMICAL ANALYSIS OF CANNABINOIDS

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INTRODUCTION & AIM

The advantages of voltammetric analysis as simple, rapid, sensitive and inexpensive methods contributed to their versatile applications: detection of cannabinoids in biological samples, quality control of cannabis product and analysis of their antioxidant properties.

The purpose of this research was to review the results obtained in relation to the application of different voltammetric methods in the electrochemical testing of cannabinoids.

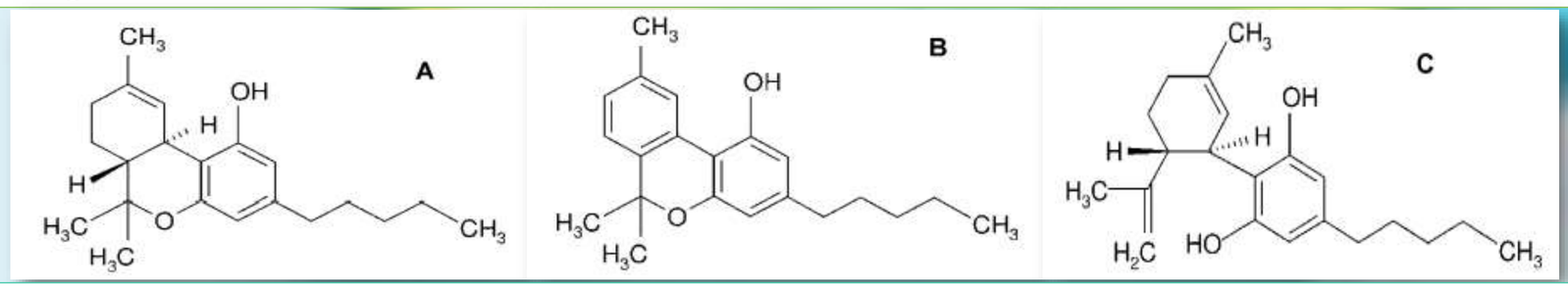

Figure 1. *Structural formulae of delta-9-tetrahydrocannabinol-THC (A), cannabinol-CBN (B) and cannabidiol-CBD (C).* [2]

MATERIAL & METHODS

This research was conducted by gathering and reviewing relevant scientific in a few databases: PubMed, Science Direct and Web of Science.

Search keywords: voltametric method AND cannabinoids; electrochemical analysis AND cannabinoids, tetrahydrocannabinol, cannabidiol.

RESULTS & DISCUSSION

A carbon-based electrode modified by initial electrodeposition of Δ^9-tetrahydrocannabinol (THC) has been established to amplify the affinity of the examined THC molecules to the sensing electrode surface and to improve the final square-wave voltammetry (SWV) signal. The sensor performances have been optimized in phosphate buffer and simulated saliva so it can finally be applied for detection of THC in real saliva samples.[1]

SWV method for detection of cannabinoids in food products has been developed based on voltammetry of immobilized microparticles of cannabinol and cannabidiol at a paraffin-impregnated graphite electrode. At SW F = 100 s^{-1}, A_p = 50 mV and I_v = 2 mV, at pH 7 cannabinoids have exhibited net peak potentials at 0.538 V and 0.556 V, for CBN and CBD respectively.[2]

This peak was attributed to electro-oxidation of a phenolic group to a phenoxy radical. Cyclic voltammetry and differential pulse voltammetry have been used in examination of the antioxidant properties of isolated cannabinoids or Cannabis extract.[3]

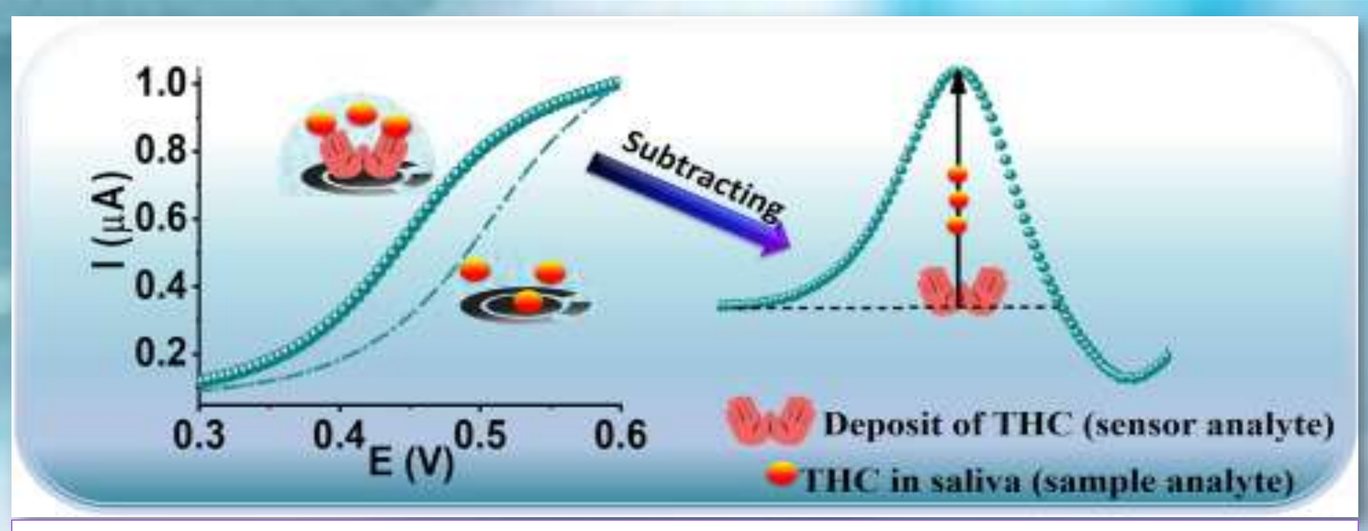

Figure 2. *Detection of ultra-low concentration of Δ⁹-THC in saliva by turning a sample analyte into a sensor analyte by SWV.* [1]

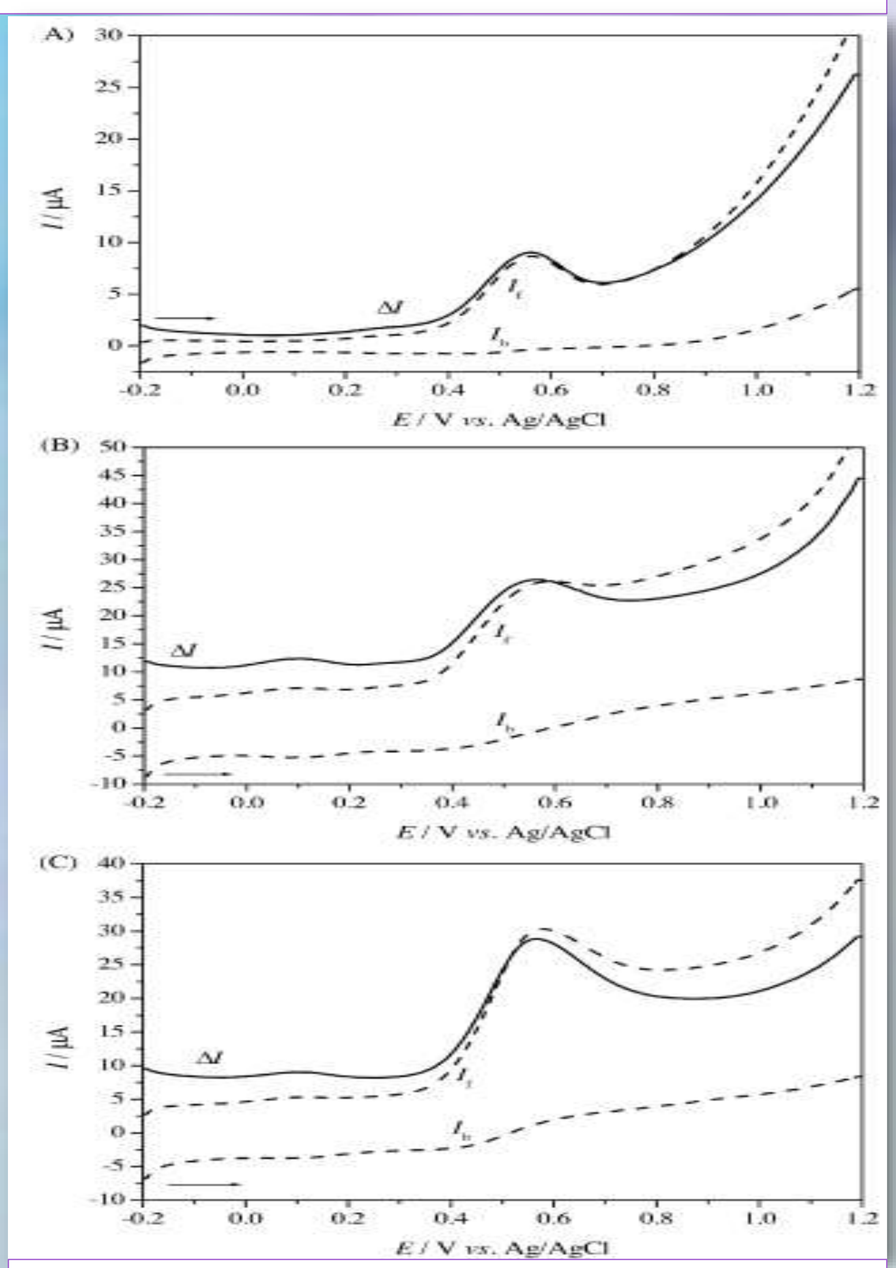

Figure 3. *Square-wave voltammograms of residue of delta-9-THC (A), and microparticles of CBN (B) and CBD (C) immobilized on the surface of a glassy carbon (A) and a paraffin-impregnated graphite electrode (B and C) and immersed into 0.1 M KNO_3, pH 7. Square-wave frequency is 100 s-1, pulse amplitude is 50 mV and the potential increment is 2 mV. A net response (DI) and its forward (If) and backward (Ib) components are shown.* [2]

CONCLUSIONS

Analysis in forensic purposes and development of electrochemical sensors for detection of THC in biological samples have been most widely investigated, by now. Although the development of advanced modified electrodes contributes to diverse applicability, some challenges should be still overcome.

Adsorption of cannabinoids onto the electrode surface affecting the accuracy and repeatability of measurements, selectivity of the methods toward interfering substances in cannabis extract, as well as validation against standard quality control methods.

REFERENCES:

1. Greter A., et al. (2022). *Talanta*; 236, 122863, ISSN 0039-9140.
2. Novak I., et al. (2013). *Electroanalysis*; 25(12): 2631-2636.
3. Mendes Hacke A.C., et al. (2019). *Analyst*; 144: 4952-4961.

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