OPTIMISATION OF INSTRUMENTAL PARAMETERS FOR THE VOLTAMMETRIC DETERMINATION OF CARMOISINE

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Carmoisine (azorubine, E 122) is a synthetic food azo dye used to colour sweets, beverages, and medicines. In our previous work, we highlighted the process of electrochemical reduction of the dye on a stationary silver solid amalgam electrode (AgSAE) [1]. We have carried on our research and optimised the instrumental parameters for the determination of carmoisine using differential pulse voltammetry (DPV).

The DPV method is characterized by a much greater ratio between Faraday currents and capacitive currents compared to linear sweep or cyclic voltammetry, which enables obtaining of an analytical signal with higher sensitivity and lower limit of detection. In addition, the reduction/oxidation peak has a clear shape and can be easily identified in a complex voltammogram.

The intensity of the analytical signal significantly depends on a number of instrumental parameters that need to be optimised. We studied the change in three parameters: the pulse potential (PP), the modulation time (MT, t_1), and the interval time (IT, t_2).

As the PP increases, the peak and background currents increase, as well as the width at half-height of the peak. The $I_p/W_{1/2}$ ratio varies unevenly, with a maximum on the $I_p/W_{1/2}=f(PP)$ dependence at PP 0.06 V. At higher values of PP, the increase in peak width dominates over the increase in peak current, which leads to less clear analytical signal, so the optimal PP value for the determination of carmoisine is 0.06–0.07 V.

As the MT increases, the I_b and I_p decrease and the $I_p/W_{1/2}$ ratio decreases too. We chose 75 ms for a MT value, which is an optimal MT.

Change of the IT slightly affects the appearance of the voltammograms; with an increase of the IT, the current slightly decreases, while the peak width remains almost unchanged. The optimal value of IT is 50 ms, ensuring maximum current values and fast analysis rate.

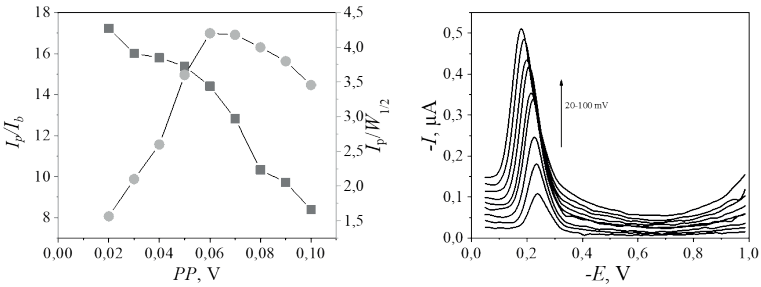

Fig. Voltammograms using AgSAE in carmoisine solution at different modulation time values and the dependence of $I_p/W_{1/2} = f(PP)$ and $I_p/I_b = f(PP)$.
Conditions: c (carmoisine) = $4.0 \cdot 10^{-5}$ mol $\cdot L^{-1}$, pH 5.0.

[1] Dmukhailo A.V., Dubenska L.O. Investigation of the voltammetric behaviour of azorubine on a solid amalgam electrode modified with a mercury meniscus. International scientific conference for students and young scientists “Current chemical problems”: book of abstracts, Vinnytsia, 23-25th March 2021. P. 13. (in Ukrainian).