

Electrochemical sensor for HMF based on glassy carbon electrode modified with nickel graphene carboxylate

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Abstract

The product of the Maillard reaction, 5-hydroxymethylfurfural (5-HMF), is formed under acidic conditions by the dehydration of sugars in foods during heating and storage. The concentration level of HMF is not only an indicator of the freshness of honey but also of the duration and conditions of storage. The sensitive and selective voltammetric method using glassy carbon modified with nickel carboxylate graphene showed high performance on determination of HMF. Through the oxidation reaction between HMF and nickel ions on the surface of the electrode, the electrochemical signal was recorded for 5-hydroxymethylfurfural (HMF), and the working conditions for the quantitative determination of HMF were optimized on hydrodynamic amperometry. After studying the electrochemical reaction mechanism at electrode surface using cyclic voltammetry technique, the optimal conditions of sensor operation such as reaction time, pH of the solution, concentration of the modifier, as well as analytical parameters: linear range, and detection limit were found using the hydrodynamic amperometry technique. The linear range of the method is up to 2 μM , with 70 $\text{nA}/\mu\text{M}$ a sensitivity with a correlation coefficient $R^2= 0.9956$. From the tests, it was found that the method is suitable for quantitative determination even in real samples, compared with the reference method for determination of HMF. The electrochemical sensor showed successful application in the determination of HMF in the matrix of real samples.

References

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Figures

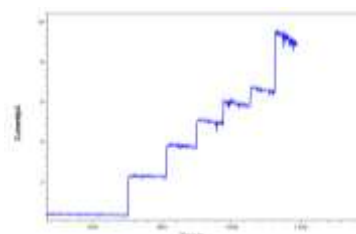


Figure 1. The amperogram obtained at GCE-GrCOONi electrode after injection of the HMF. Operating potential 0.6 V, pH=12 (KCl+NaOH).

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