

Development of a new and innovative electrochemical sensor for 5-HMF in foodstuff

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ABSTRACT (250-300 words)

Background: 5-(hydroxymethyl)-2-furfural is an organic compound, soluble in water and in organic alcohol. In fine chemical it can be used as a building block to obtain molecules with high added value or it can be used as additives in biofuels. It is produced by Maillard reaction that leads to degradation of carbohydrates. For this reason, it can be present in many foodstuffs particularly in sweet food products. This reaction is catalyzed by high temperatures and low pHs. Thus it can be found at different concentration in honey, coffee, vinegar and fruit juice. Being a degradation reaction, its concentration in fresh food is very low and start to increase during conservation, particularly if it is stored in extreme conditions (i.e high temperature or very long period). For this reason, HMF content can be used as freshness index of various foodstuff.

Objective: To develop a fast, cheap and easy to use sensor for 5-(hydroxymethyl)-2-furfural quantification

Methods: The active sensor layer is made of silver and has been obtained from CD modified with silver NPs and reduced graphene oxide. Both fabrication and quantification were optimized and then the sensor was used to quantify HMF-5 in real samples and the results was compared with a standard HPLC analysis.

Results: The deposition of silver NPs and reduced graphene oxide leads to an increase in sensitivity and a decrease of the limit of detection. The sensor shows excellent reproducibility and repeatability and a mean sensitivity of $2.3 \mu\text{A cm}^{-2} \text{ ppm}^{-1}$ with a limit of detection of 1.86 ppm. Finally, the sensor was used to quantify the analyte in real foodstuff like honey and fruit juice with excellent results in terms of recovery.

Conclusion: The results of this work showed that it is possible to fabricate an HMF-5 electrochemical sensor using a zero cost material. The sensor is cheap, easy to use and fast and can be used to analyze real foodstuff with good results.

BIOGRAPHY (100-150 words)

Bernardo Patella is a chemical engineer and received his Ph.D in 2019 at the University of Catania. Nowadays he is an assistant professor at the University of Palermo and his research interest mainly focuses on two aspect: 1) the development of electrochemical sensors for clinical and environmental analysis and 2) the development of innovative 3D nanostructures made of nickel and nickel alloy for hydrogen evolution from water splitting reaction in alkaline electrolyzers. From 2016 he has published 48 peer-reviewed papers and own one patent for the fabrication of electrochemical sensors made of silver from old and disused compact discs.

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