Determination of 5-hydroxymethylfurfural using molecularly imprinted polymer in combination with carboxylic graphene-Ni nanocomposite

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Abstract

Maintaining controlled levels of 5-hydroxymethylfurfural (5-HMF) is crucial for overall health, due to its potential toxicity and its association with various diseases. In order to determine the concentration of this furanic compound we present a sensor based on a molecularly imprinted polymer functioning as a receptor, converting chemical interactions into electrical signals on a screen-printed electrode (SPC). The screen-printed electrodes were modified with carboxylic graphene-Ni nanocomposite. Graphene provides electrical conductivity, which is essential for efficient charge transfer in electrochemical sensors, while its high surface area increases the interaction with the analyte, which leads to higher sensitivity. Due to their catalytic properties to further enhance the electrochemical response, nickel ions were incorporated in carboxylic graphene. The molecularly imprinted polymer was prepared using methacrylic acid as a monomer, divinylbenzene as a crosslinker and azobisisobutyronitrile (AIBN) as an initiator in the presence of 5-hydroxymethylfurfural as the template molecule that impregnates the polymer. The sensor's properties and response were analyzed using cyclic voltammetry (CV), differential pulse voltammetry (DPV), and electrochemical impedance spectroscopy (EIS). The electrochemical sensor exhibits a linear range for concentration range from 0.1 to 5 mM.

Key words: 5-hydroxymethyl-2-furfural, cyclic voltammetry, honey, carbon paste electrode.

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