Determination of 5-hydroxymethylfurfural using molecularly imprinted polymer based on electropolymerized β-cyclodextrine

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Abstract

Excessive intake of 5-Hydroxymethylfurfural (5-HMF) has been linked to genotoxicity, organ toxicity and potential carcinogenicity due to its conversion into sulfoxymethylfurfural (SMF), a DNA damaging metabolite. To address the need for reliable detection, we present a molecularly imprinted polymer (MIP) sensor that selectively recognizes 5-HMF and converts chemical interactions into an electrical signal using a screen-printed carbon electrode. The electropolymerized β-cyclodextrin as a response layer of the sensor enhanced selectivity and binding efficiency toward 5-HMF. β-cyclodextrin provides a molecular structure with a hydrophobic inner cavity that can host specific molecules such as 5-HMF, allowing for selective recognition. When electropolymerized onto the electrode surface, it forms a stable and uniform polymer layer that enhances the sensor's sensitivity. The sensor's properties and response were analyzed using cyclic voltammetry (CV), differential pulse voltammetry (DPV), and chronoamperometry.

Key words: 5-hydroxymethyl-2-furfural, cyclic voltammetry, molecularly imprinted polymer, screen-printed carbon electrode.

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