A Molecularly Imprinted Polymer Sensor Developed by using an Amino acid Based Functional Monomer for the Sensitive Determination of Bisphenol S

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The trace-level concentration of endocrine disruptors contained in complex sample matrices requires highly sensitive platforms with good stability and reproducibility. This study reports the molecularly imprinted polymer which is an ideal surface-sensitive technique that creates recognition sites on the electrochemical sensor with high sensitivity and selectivity.

In line with this, the porous polymeric film was synthesized using N-methacryloyl-L-tyrosine (MA-Tyr) as the functional monomer in the presence of ethylene glycol dimethacrylate (EGDMA) as the cross-linker by photopolymerization. After the characterization of the developed sensor (MA-Tyr@MIP/GCE), the experimental conditions affecting MIP (dropping volume, monomer:template ratio, removal process of the template, rebinding process of the template) was optimized and then the evaluation of the analytical performance cyclic voltammetry (CV), differential pulse voltammetry (DPV) and electrochemical impedance spectroscopy (EIS) methods were carried out by utilizing 5 mM ferri/ferro cyanide solution as the redox probe. Under the optimum experimental conditions, the calibration graph of MA-Tyr@MIP/GCE showed a linear response in the concentration range of BPA between 1×10^{-15} M and 1×10^{-14} M. The limit of detection (LOD) and limit of quantification (LOQ) values were found as 0.171 fM and 0.569 fM, respectively.

The applicability of the MA-Tyr@MIP/GCE was assessed by applying it to human serum and plastic bottled water samples. The LOD and LOQ values were calculated as 0.229 fM and 0.762 fM for the serum sample, respectively. Imprinting factor and interference studies were also carried out using similarly structured compounds (bisphenol A, bisphenol B, bisphenol F, and 4-aminophenol) and the most common interfering agents (ascorbic acid, dopamine, NaCl, etc.) showing the selectivity of the MA-Tyr@MIP/GCE sensor. Finally, the non-imprinted polymer (NIP)-based sensor was prepared to control the MA-Tyr@MIP/GCE performance.