

A Sensitive Approach on Trace Analysis of Methylparaben in Wastewater and Cosmetic Products Using Molecularly Imprinted Polymer

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Abstract : Parabens are the antimicrobial molecules largely used in cosmetic products as a preservative agent. Among them, the methylparaben (MP) is the most frequently used ingredient in cosmetic preparations. Nevertheless, their potential dangers led to the development of sensible and reliable methods for their determination in environmental samples. Firstly, a sensitive and selective molecular imprinted polymer (MIP) based on screen-printed gold electrode (Au-SPE), assembled on a polymeric layer of carboxylated poly(vinyl-chloride) (PVC-COOH), was developed. After the template removal, the obtained material was able to rebind MP and discriminate it among other interfering species such as glucose, sucrose, and citric acid. The behavior of molecular imprinted sensor was characterized by Cyclic Voltammetry (CV), Differential Pulse Voltammetry (DPV) and Electrochemical Impedance Spectroscopy (EIS) techniques. Then, the biosensor was found to have a linear detection range from 0.1 pg.mL⁻¹ to 1 ng.mL⁻¹ and a low limit of detection of 0.12 fg.mL⁻¹ and 5.18 pg.mL⁻¹ by DPV and EIS, respectively. For applications, this biosensor was employed to determine MP content in four wastewaters in Meknes city and two cosmetic products (shower gel and shampoo). The operational reproducibility and stability of this biosensor were also studied. Secondly, another MIP biosensor based on tungsten trioxide (WO₃) functionalized by gold nanoparticles (Au-NPs) assembled on a polymeric layer of PVC-COOH was developed. The main goal was to increase the sensitivity of the biosensor. The developed MIP biosensor was successfully applied for the MP determination in wastewater samples and cosmetic products.

Keywords : cosmetic products, methylparaben, molecularly imprinted polymer, wastewater

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