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Synthesis of Highly Sensitive Molecular Imprinted Sensor for Selective Determination of Doxycycline in Honey Samples

Authors : Nadia El Alami El Hassani, Soukaina Motia, Benachir Bouchikhi, Nezha El Bari

Abstract : Doxycycline (DXy) is a cycline antibiotic, most frequently prescribed to treat bacterial infections in veterinary medicine. However, its broad antimicrobial activity and low cost, lead to an intensive use, which can seriously affect human health. Therefore, its spread in the food products has to be monitored. The scope of this work was to synthetize a sensitive and very selective molecularly imprinted polymer (MIP) for DXy detection in honey samples. Firstly, the synthesis of this biosensor was performed by casting a layer of carboxylate polyvinyl chloride (PVC-COOH) on the working surface of a gold screen-printed electrode (Au-SPE) in order to bind covalently the analyte under mild conditions. Secondly, DXy as a template molecule was bounded to the activated carboxylic groups, and the formation of MIP was performed by a biocompatible polymer by the mean of polyacrylamide matrix. Then, DXy was detected by measurements of differential pulse voltammetry (DPV). A non-imprinted polymer (NIP) prepared in the same conditions and without the use of template molecule was also performed. We have noticed that the elaborated biosensor exhibits a high sensitivity and a linear behavior between the regenerated current and the logarithmic concentrations of DXy from 0.1 pg.mL^{−1} to 1000 pg.mL^{−1}. This technic was successfully applied to determine DXy residues in honey samples with a limit of detection (LOD) of 0.1 pg.mL^{−1} and an excellent selectivity when compared to the results of oxytetracycline (OXy) as analogous interfering compound. The proposed method is cheap, sensitive, selective, simple, and is applied successfully to detect DXy in honey with the recoveries of 87% and 95%. Considering these advantages, this system provides a further perspective for food quality control in industrial fields.

Keywords : doxycycline, electrochemical sensor, food control, gold nanoparticles, honey, molecular imprinted polymer
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