Development of molecularly imprinted polymer-based electrochemical sensor for the selective and sensitive detection of Selexipag

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Persistent and rare pulmonary arterial hypertension (PAH) disease can lead to significant cardiovascular problems and even death. Selexipag, a new non-prostanoid prostacyclin receptor agonist, is used to treat this disease [1]. For the first time, we aimed to develop a molecularly imprinted polymer (MIP)-based electrochemical sensor for selexipag's selective and sensitive quantitative determination. The MIP-based electrochemical sensor was designed to identify the drug selectively and sensitively, and photopolymerization technique was used for MIP formation. The developed sensor optimized the dropping amount, template/monomer ratio, removal solution and time, and rebinding time. Surface and morphological characterizations of the MIP-based electrochemical sensor were performed using cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), scanning electron microscopy (SEM), and energy distribution X-ray spectrometry (EDX) methods. It has also been tested under optimized conditions compared to an unprinted polymer (NIP) based sensor. For the quantitative analysis of selexipag, the tablet dosage form was successfully applied to standard solution and commercial serum samples. The linearity of the MIP-based electrochemical sensor developed for the drug analysis was found in the concentration range of 0.75 pM-7.5 pM. A recovery study was performed to prove the accuracy of the sensor, and it was calculated as 99.7% for the tablet dosage form and 101.3% for the serum solution. Also, the selectivity of the sensor has been proven by experimentation with interference agents (KNO_3, $MgCl_2$, Na_2SO_4, uric acid, ascorbic acid, dopamine, and paracetamol). The imprinting factor was calculated using famotidine, zonisamide, loperamide, and acetazolamide substances with molecular structures similar to selexipag. Based on the results obtained, the developed electrochemical sensor has proven to be sensitive, selective, fast, inexpensive, and specific for the quantitative analysis of selexipag.

Reference

[1] Y. M. Youssef, M. A. Mahrouse, E. A. Mostafa. Microchemical Journal, Volume 185, (2023), 108256.