Nanobiosensing of Small Molecules: Challenges and Prospects for Molecular Imprinting

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Abstract

Biomedicine, environmental monitoring, and nanobiosensing are just some areas where molecularly imprinted polymers (MIPs) have shown their potential as synthetic receptors that can tell the difference between large and small molecules with high molecular specificity. Antibodies and enzymes, for example, have shown intrinsic issues with temporal stability and may be denatured under extreme conditions [1]. MIPs, however, are more robust in complex media, have better long-term stability, and a more straightforward and reproducible fabrication procedure. Nevertheless, there is a lack of publications in the literature investigating the quantitative analytical capabilities of MIPs in real-world applications. While there has been progress in commercializing biosensors based on MIPs [2,3], various issues must be investigated.

Researching the binding interactions between monomers and between the monomer and the template in a porogenic solvent is the most pressing issue in MIPs development since the template-monomer complex must form spontaneously and be stable. Using kynurenic acid as a model small molecule template, we investigated its ionic form in different matrices and its complexation with o-phenylenediamine. Additionally, further studies encompass an adaptation of the MIP layer onto nanomaterial-based electrodes due to their ease of tuning and fabrication. MIPs have been found to have greater sample loading capacity, sensitivity, and selectivity for small compounds than traditional immunoassays [4,5], making them appealing for quantitative small molecule biomarker detection.

References

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