Electrochemical Readout of Molecularly Imprinted Polymers: Potentials and Challenges

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Molecularly imprinted polymers (MIPs) are one of the most frequently studied alternative recognition elements in chromatography and sensorics. They are prepared by polymerizing the target analyte (so-called template) and functional monomers (in the presence or absence of cross-linkers). Subsequent removal of the template from the polymer network results in the formation of cavities with a molecular memory, which is complementary in size, shape and functionality to the template [1].
Depending on the analyte of interest, three main approaches have been presented in literature for the electrochemical readout of MIP sensors [1]. Herein we present examples for each approach.
i) Electroactive analytes: For both low- and high-molecular weight targets, faradaic current is measured, which is based on the direct redox transformation of the analyte at the electrode. The analytical performance of MIPs for the anticancer drug tamoxifen and the enzyme hexameric tyrosine-coordinated heme protein will be demonstrated [2,3].
ii) Catalytically active analytes: In the second approach redox active products of enzymes, catalytically active MIPs or enzyme-labelled tracers can be directly measured. In this regard, MIPs for the Alzheimer´s disease biomarker butrylcholinesterase and the melanoma biomarker tyrosinase will be illustrated here [4,5].
iii) Redox-inactive analytes: The most frequently studied method relies on the modulation of diffusional permeability of the polymer MIP-layer by target binding of a redox marker. MIPs for the peptide drug daptomycin and the anticancer drug tamoxifen will be presented [3,6].
In this presentation the potential and challenges of electrochemical readout of MIP sensors will be summarized: Electrochemical methods are straightforward for the preparation of MIPs and analyte determination. However, up to now there has been no commercial example yet.

References

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