Project 3.9 Application of the molecularly imprinted polymer nanoparticles in electrochemical-surface plasmon resonance based sensing

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Background:

According to L. C. Pauling, a two Noble Prize winner, "the secret of life is molecular recognition; the ability of one molecule to "recognize" another through weak bonding interactions". Molecularly imprinted polymers (MIPs) is an example of tailor-made smart materials that can mimic the recognition mechanism of biological receptors. However, MIPs outperform biological receptors in terms of durability, chemical stability, and production costs. Synthesis of these polymeric receptors consists of three steps, namely (i) assembling monomers around template molecule, (ii) polymerization in the presence of cross-linking monomer, and (iii) template removal. Molecular imprinting results in the formation of molecular cavities in the polymer matrix that resembles the target analyte molecules with shape, size, and complementary functionalities. Through weak interactions, such as hydrogen bonds, electrostatic attraction, and π-π stacking. Due to the presence of these cavities, polymer can bind selectively target analyte molecules even in the presence of other similar ones in the tested sample.
Selective and sensitive chemosensing is crucial for numerous aspects of modern civilization and technology. We propose to apply MIP NPs to enhance SPR signal. The aforementioned polymer NPs will contain receptor parts for selective recognition of insulin, peptide C (a side product of insulin production), and glimepiride (an anti-diabetic drug). For that purpose, different approaches to molecular recognition in synthetic polymeric receptors will be applied.

Aim:

The core of the proposed research is the synthesis of novel MIP nanomaterials with in-built recognition sites. We plan to implement these nanostructured imprinted polymers with SPR based sensing.

Requirements:

- Master of Science (or equivalent) degree, preferably in chemistry, physics, biotechnology, or similar sciences, awarded not earlier than five years before the deadline of the current recruitment,
- the average grade obtained in the course of study is not less than 4,
- ability to work independently as well as in a group,
- working experience in the field of synthesis, nanotechnology, material chemistry, or surface and morphology characterization technique,
- experience in the field of electrochemistry and molecular imprinting will be welcome,
- proficiency in English speaking and writing.