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Abstract of the Ph.D. thesis

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Title: **“Chemical” sensors with molecularly imprinted polymers as recognition units for determination of selected compounds of health importance”**

The present Ph.D. thesis describes research on development, preparation, and characterization of four chemosensors for selective determination of chosen compounds of health importance. These compounds are, namely, inosine, human lipocalin-2 (NGAL), as well as D- and L-phenylalanine. In these chemosensors thin films of molecularly imprinted polymers (MIPs) were applied as recognition units, while extended-gate field-effect transistors (EG-FETs) served as transduction units. Stability of pre-polymerization complexes of templates/analytes with dedicated functional monomers were first estimated. For that, the Gibbs free energy gains due to complex formation were calculated using quantum chemistry computing with the density functional theory (DFT) at the B3LYP level of approximation and the 3-21G* or 6-31G* data basis set. All the functional and cross-linking monomers were derivatives of *bis*(2,2'-bithienyl)methane. Chosen monomers were electrochemically polymerized under potentiodynamic conditions in the presence of templates to form recognition units dedicated to one of the above mentioned compounds of health importance. After the polymerization, templates were extracted from MIPs. In order to prove the template removal, such techniques were applied as differential pulse voltammetry (DPV), UV-vis spectroscopy, and polarization-modulation infrared reflection-absorption spectroscopy (PM-IRRAS). Morphology of deposited MIP films were characterized and imaged with AFM and SEM spectroscopy. Such analytical parameters of chemosensors were estimated as sensitivity, selectivity, and limit of detection (LOD), as well as, in case of D- and L-phenylalanine chemosensors, also enantioselectivity. Moreover, the influence of surface enhancement with sacrificial metal-organic frameworks (MOFs) on analytical chemosensor performance was investigated for the NGAL chemosensor. Sensitivity of resulting chemosensors was sufficiently high to determine the chosen analytes of health importance in body fluids. Selectivity of the resulting chemosensors reached allowed discriminating the analytes from their common interferences as well as compounds with similar chemical structures.