Abstract

This thesis has two parts. In the first part we present design and development of molecular imprinted polymers (MIPs) that are useful for the estimation of small molecule markers, such as glutathione, adrenaline and caffeine. The second part of the thesis describes the synthesis and metal sensing properties of two newly designed fluorescence sensors based on small peptides as the recognition element.

At first gold nanoparticles were considered as the signal transducers of analyte binding events of MIPs. For this we prepared near-monodispersed gold nanoparticles. The produced gold nanoparticles embedded MIPs show systematic changes in their absorption spectra in the presence of three analytes studied. Additionally, we have seen more profound and visible color changes of the films in the presence and absence of the analytes. These color changes were quantified using image analysis software to estimate RGB intensity. Observed RGB intensities were changed systematically with increasing concentrations of the analytes.

Subsequently, we explored the feasibility of organic probes as signal transducers. Probes NPM and NBD-Cl were immobilized to the molecular imprinted polymer surface. NBD-Cl was post-grafted on to the polymer surface, whereas the NPM was co-polymerized. MIPs using both of these probes show consistent and expected results. NBD labeled MIP shows high selectivity to its template molecule 3-succinimido)-S-glutathione, (SSG) over several other structurally similar analytes.

For the second part of thesis, we successfully synthesized two new probes using glutathione as the metal recognition moiety. NBD and pyrene derivatives were used as the signaling units. NBD-SG in water with Hg^{2+} shows consistence decrease in fluorescence intensity along with red shift in the band maximum. None other metal ions show any effect on the spectral features of the NBD-SG. Contrary to this NPS-SG shows response to a few metal ions, such as Cr^{3+}, Hg^{2+} and Fe^{3+}. However, its response to Fe^{3+} is more distinguishable.

Keywords

Polymers, Molecular Imprinted Polymers, Nanotechnology, Spectroscopy, Optical Sensors, Gold nanoparticles, glutathione, adrenaline, caffeine, SSG, NPM, NBD-Cl, NBD-SG, NPS-SG, Hg^{2+}, Cr^{3+}, Fe^{3+}, Metal ion sensors, Fluorescence sensors.