

Antibiotics represent a major part of modern life, used in both medicine and agriculture. In recent decades, they started being considered as environmental pollutants and became a subject of an investigation into their presence in environmental waters. In the antibiotic-contaminated environment, bacteria encounter sublethal doses of the antibiotics, causing the development of antimicrobial resistance (AMR). AMR is a source of concern for the medical community, making it increasingly difficult to treat patients with infectious diseases. Thus, environmental monitoring for the presence of antibiotics must become a regular activity in order to prevent the formation and spreading of AMR. Currently used monitoring methods show great precision and reproducibility. However, they require resources and conditions often unattainable in remote areas and therefore, can not be employed in routine monitoring of the environment. A promising method of monitoring the presence of pollutants in the environment is the employment of sensors modified with synthetic receptors as recognition elements.

Synthetic receptors, generated through “molecular imprinting”, so-called Molecularly Imprinted Polymers (MIPs), are known for their excellent recognition of the target molecules while being cheap and reproducible, demonstrate excellent physical and chemical stability. MIPs are generated through the polymerization of a mixture of functional monomers in the presence of an analyte, that acts as a template. In the process of the polymerization, the analyte molecules are fixed in the growing polymeric matrix and after their removal binding sites capable of selectively recognizing the analyte-similar molecules are formed. MIPs have shown great stability and operability for environmental monitoring and recognition of small molecules.

The purpose of this thesis was to develop a robust and highly selective MIP film interfaced with a screen-printed electrode (SPE) for electrochemical detection of erythromycin in a label-free manner. Erythromycin (Ery) was selected as the target analyte due to its consistent presence in the EU's Surface Water Watch List (SWWL) as part of the macrolide class of antibiotics. SPE was selected as a cost-effective platform for real-time monitoring of molecular binding events happening in the MIP. The thesis describes in detail the preparation of the Ery-MIP/SPE and its characterization in terms of selective detection of Ery. The prepared Ery-MIP/SPE showed encouraging data in terms of recognition of Ery demonstrating nanomolar LoD and considerable selectivity versus similarly structured antibiotic molecules. The described method for the preparation Ery-MIP shows great promise for the future development of a portable device for real-time monitoring of antibiotic pollutants in aqueous environments.