Molecularly imprinted sensory material for monitoring micropollutants concentration in aquatic environment

The problem of micropollutants presented in water is raising the substantial concern, worldwide. Mainly due to fact that the pollutants may have adverse impacts on the aquatic ecosystem and human health. The Polish National Fund for Environmental Protection and Water Management reports that in addition to the previously defined micropollutants, aromatic hydrocarbons, pesticides or halogenated compounds, more and more pharmaceuticals, drugs and over-the-counter medical compounds are found in water now. All these pollutants significantly contributes to the deterioration of quality of water.

It is a particular difficulty to identify and determine the amount of micropollutants, especially before the purification process. Limited number of procedures can been found for determination of selected micropollutants, including antibiotics and pesticides, in the processed water. However, these methods are often expensive and not widely available.

In the presented project the main goal is to synthesis the multifunctional imprinted sorbents for simple and effective method of identification and measurement of micropollutants. Additionally, the new solid phase extraction (SPE) material will have self-regenerating properties.

Advanced sorbents are very interesting research topic. These could be used to removal of various substances. However, purification of loaded sorbents is still a huge challenge for researchers. In effect, obtaining the sorption materials, which can be easy for purification, with low energy input and environmentally friendly operation, becomes fascinating research problem.

In this project, to obtain self-regenereting sorbents the smart polymers containing in their structure the antibiotic or pesticide imprints will be used. Poly(acrylic acid) (PAA) will be use as a pH-sensitive polymer and as a thermo-sensitive – poly(N-isopropylacrylamide) (PNIPAM). The imprints of gentamicin or S-metolachlor will be deposited on microsphere surfaces, forming the core-shell structures. Non-covalent molecularly imprinting will be carried out. In this technique, to form a stable polymerization complex, very important is selection of functional monomers and the ratio monomers:template. The greatest emphasis will be placed on obtaining effective materials by aqueous polymerization at ambient temperature. It is the most desirable option from the point of view of the so-called green chemistry. Additional, the whole created polymer network must depend on pH/temperature changes. The selected micropollutants will be retained on the column during filtration (they will connect with the imprints). In the next step, the water with changed pH / temperature will washed them out from the imprints. The first two milestones will be synthesis of selective and self-regenerating imprinted smart polymer core-shell (thero- and pH-sensitive). The third milestone will concern preparation of selective and self-regenerating SPE cartridges. In effect the development a simple, safe and effective method of measure the amount of antibiotics/pesticides presented in aquatic environment will be achieved.