Abstract of the doctoral dissertation of MSc. Hanna Lis entitled „Application of phosphonium ionic liquids as selective acceptor phases in passive extraction of selected pharmaceuticals”

The presented work deals with a number of issues in the field of analytical chemistry, including in particular separation techniques and monitoring the level of water pollution in terms of the presence of medicinal substances. The aim of the conducted research was to investigate the possibility of using phosphonium ionic liquids as alternative acceptor phases in passive extraction (PASSIL) of pharmaceuticals. The attached publications present experimental research, the effect of which was the preparation of the first kinetic passive sampler containing a liquid acceptor phase.

In the first stage, selected ionic liquids (IL) were tested for the effectiveness of passive extraction of pharmaceuticals, using IL as an acceptor phase in the passive sampler (PASSIL technique). Then, the possibility of using nylon, Teflon and polyethersulfone membranes as carriers of ionic liquid in the PASSIL sampler was assessed. At this stage, in addition to the measurements of the extraction efficiency and changes in the physicochemical parameters of the water phase, micrographs of membranes covered with an ionic liquid were taken. For this purpose, a scanning electron microscope (SEM) was used. After this part of the work was done, the ionic liquid [P666-14][$N(CN)_2$] was selected as the acceptor phase, and polyethersulfone (PES) membranes were selected as the carrier for IL.

The next step was to conduct an extensive study of the influence of physicochemical factors on the efficiency and calibration of the PASSIL sampler. The selected physicochemical variables were pH, salinity, humic acid concentration, temperature and the flow of the donor water phase. On this basis, it was determined that the extraction with the PASSIL sampler is a negatively selective process towards positively charged pharmaceuticals (e.g. beta-blockers).

The influence of the applied calibration system on the calibration of the PASSIL sampler and the (comparative) POCIS sampler (Polar Organic Chemical Integrative Sampler) was also assessed. For this purpose, a continuous water phase flow system and a static system (with the use of a magnetic stirrer) were used. In both cases, for most of the tested substances, the use of donor phase flow implies| an increase in the value of the sampling rates (R_s), but this dependency is not reflected for chemical compounds with high hydrophobicity (eg CBZ). Therefore, the influence of the flow on the calibration of passive samplers was determined as individual to the properties of the analyte, therefore it requires each time verification in the sampler calibration process, carried out before the planned environmental exposure.

The last stage of the research carried out as part of this doctoral dissertation was the use of the PASSIL sampler to monitor selected pharmaceuticals in treated wastewater. The high recovery of IL and the received level of analytes concentrations comparable to the POCIS technique and to the values obtained on the basis of grab sampling allows for the conclusion that it is possible to use the PASSIL sampler in real environmental conditions.

Keywords: *ionic liquids, passive extraction, calibration, pharmaceuticals, water monitoring*

WYDZIAŁ CHEMII Katedra Analizy Środowiska
ul. Wita Stwosza 63, 80-308 Gdańsk