Green flow analysis
Description for the general public

Project is dealing with a very important aspect of harmful influence of chemical processes on human health and life. Not without reason (although it is controversial) the term “chemistry” has a pejorative sense in the common reception and it is even used as a synonym of everything that could be a human danger in the present-day world. One of activities undertaken by chemists in order to change this opinion is the policy of “green chemistry”, which in a broad sense is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances.

The aim of this project is an extensive introducing of the rules of green chemistry to analytical chemistry, particularly to its perspective and developing branch – the flow analysis.

In analytical chemistry the analyzed material (sample) has to be properly prepared and measured in accordance to well-defined procedures. They encompasses such steps as: sample collection, addition of reagents, sample dilution or preconcentration, calibration with the use of standards and measurements. In flow analysis all above steps are realized in the flow mode, automatically, with the use of dedicated flow systems consisting of special modules which replace common laboratory equipment. However, it is obvious that the same analytical procedure can be realized in different ways. Therefore, the crucial thing is to design and use the green-friendly flow systems, i.e. relatively small (miniaturized) and simple, minimizing required amounts of sample, reagent and standards, reducing wastes as well as consuming as little energy as possible.

Unfortunately, in spite of increasing awareness of the aspects of green chemistry, the authors of flow analytical procedures published in the literature do not take them, as a rule, into account. This situation is just the main motivation to initiate the present research.

To improve flow systems in terms of “greenest” it is planned to design, test and use novel instrumental flow modules, which will serve for “reagentless” sample preconcentration, separation of the sample components and direct sample measurement. A miniaturized flow system (μTAS) will be also designed. Furthermore, some unconventional calibration approaches will be applied using a single standard solution instead of a set of standards (as commonly used). In the further step of research it is planned to modify selected analytical procedures taken from literature and to create several novel green-oriented flow analytical methods. Some of these methods will allow two or more sample components to be determined simultaneously. Finally, a new metric scale will be developed for estimation of “greenest” and analytical quality of procedures and methods in flow analysis.

The results of the proposed examinations are to be helpful – according to the applicants’ intention – to recognize better the significance of the rules of green chemistry in analytical chemistry and the importance of complying with these rules in analytical practice.