

Hypothesis what will be verified in the course of the project is to explore the possibility of using basic instrumentation, available in each scientific laboratory (as well as outside the laboratory) for fabrication of analytical devices, useful in real samples analysis of analytes with clinical relevance.

This hypothesis will be verified using the achievements realized in the Team of the Applicant recently. It has been found that it is possible to use ordinary light emitting diodes in dedicated analytical devices not only in the standard emitter role but also as a detector generating an electromotive force as analytical signal. Such analytical signal is easy to measure with an universal multimeter or any laboratory millivoltmeter (pH-meter). With the use of the two light emitting diodes, one of which is supplied with the appropriate current and the other is connected with the voltmeter, construction of a simple measuring system (PEDD - Paired Emitter Detector Diode) for the photometric as well as turbidimetric, fluorometric or nephelometric tests is possible.

Each of these techniques requires a different methodology of measurement and specific design optimization of optoelectronic PEDD detector. Scientific literature contains numerous examples of such detectors – most of them have been presented as a result of a researches carried out in the Applicant's Group. The reports have indicated that such detectors are useful for flow type of analysis thanks to their size, good performance and compatibility with standard equipment for flow analysis.

Until now, various, successfully completed, using of optoelectronic devices of PEDD detectors (or FPEDD, Fluorometric PEDD) have been proposed for determination of many substances such: hemoglobin, phosphate ions, creatinine, calcium ions, riboflavin, proteins etc. These compounds are extremely important in medical diagnostics or the environmental analysis. Proposed miniature detection equipment is characterized by good analytical parameters. The detectors dedicated to a specific analysis could be used not only in chemical laboratories, but also, eg. at the bedside of patients, making the analysis quicker or immediately after collection of environmental samples, avoiding the transport of the samples to the laboratory, during which their composition may change.

However, the proposed detectors operating under flow analysis conditions still need instruments that will ensure the flow of samples/reagents in the system and transportation to the detector. The standard measurement methodology used in flow conditions require the use of tubings, devices forcing the flow of solutions (pumps), changing the direction of flow (valves) and allowing injection of the sample in the desired volume. Although such instruments is not expensive and characterized by small size and growing popularity in various analytical applications, in reality of outside laboratory analysis it is difficult to imagine using such instruments. The concept of PEDD, successfully implemented by the Applicant's Team, is so simple that it is possible to recreate it at low cost, even at home. The aim of this project is to develop methodology for measurement using instruments even simpler than conventionally used in the flow analysis.

"Lab on Paper" (LoP) is a relatively new trend in analytical chemistry. It assumes the use of spontaneous liquid transport in the structure of the paper. This transport occurs due to capillary forces. In order to control the chemical reactions (which are the basis of analytical determinations) the hydrophobic barriers in the structure of the paper have to be produced. The space available for sample, reagents and indicators is the equivalent of tubes in conventional flow systems. Although the concept of LoP is known, the aim of the Project is to make possible to produce such diagnostic strips in the simplest possible way. Complete analytical solution presented as a final achievement of the Project will interconnect the concepts of LoP and PEDD as compatible with each other thanks to simplicity, cost and versatility. For this purpose, it is necessary to conduct a series of tests using different concept of producing the structures of the paper using manual techniques (using crayons, pipettes, stamps) or simple mechanical (solid-ink printing with subsequent post-production process). As a part of the proposed Project innovative way of using light-emitting diodes to detect the reactions' products performed in LoP will be proposed. Despite the popularity of the PEDD concept in analytical literature, nowadays it will be the first study of this kind, and certainly they have character of basic research, because so far nobody in the world has not apply LEDs for measurements on solid media.

The project is interdisciplinary, applies to basic research and in the event of success has potential application with a high degree of feasibility. The results of researches proposed in the project will be the basis for formulating claims if postulated idea can be a help in diagnosis in countries where there is no access to the analytical infrastructure as well as for conducting the Point of Care Testing much easier.