

Investigations on the integrated microdevice for clinical diagnostics of lysosomal storage diseases

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Development of novel, effective diagnostic strategies and procedures based on intracellular components analysis is strongly related with applying micro total analysis systems (μ TAS). Apart from low reagents consumption, short reaction time, integration, automation, versatility, possibility of diagnosis monitoring and stimulation of each step of the procedure, the use of miniaturized microdevices in progressive clinical medicine affects the patients' comfort. However, there are still a few key challenges in this field to be solved before the chips can be accepted for real applications.

Currently more than 3000 congenital metabolic diseases are known (e.g. mitochondrial, peroxisomal, lysosomal). Most of them are caused by the abnormal value of enzyme activity. The problem is that there is no biochemical/enzymatic method that reliably identifies all carriers of many of these disorders. New methods and tools for medical diagnostics are still explored and in request.

The goal of this work is to design and develop a microdevice for clinical diagnostics of lysosomal storage diseases. The microdevice is fabricated using a milled PMMA stamp and a soft replica moulding technique using PDMS as a material. Researches into integration of such modules as: a microflow cytometer, a module for a chemical cell lysis process, a passive micromixer, an optical detection zone, and a temperature control system on one chip, are carried out. The main advantage of microchip presented is possibility for intracellular components analysis directly after the cell lysis process. This approach reduces the effect of proteases released in a lysis process on determined enzymes.

After the validation of the analytical procedure using fibroblasts or leucocytes from patients suffering from Gaucher's and Fabry's diseases and control group (in cooperation with the Institute of Psychiatry and Neurology in Poland) microsystem presented will be ready for preliminary tests in clinical laboratories.