PDMS/glass microfluidic cell culture system for cytotoxicity tests and cells passage

In this paper, hybrid (PDMS/glass) microfluidic cell culture system (MCCS) integrated with the concentration gradient generator (CGG) is presented. PDMS gas permeability enabled cells' respiration in the fabricated microdevices and excellent glass hydrophilicity allowed successful cells' seeding. The human lung carcinoma cells (A549) were cultured in the microdevice for several days. The growth and proliferation of cells was monitored using an inverted fluorescence microscope. After the cells' confluence was achieved in the microchambers, the novel method of cells' passaging in the designed microdevice was developed and successfully tested. The MCCS microdevice is fully reusable, i.e. it can be used several times for various cell culture and cytotoxic experiments. The suitability of designed MCCS for cell-based cytotoxicity assay application was verified using 1,4-dioxane as a model toxic agent. The series of cytotoxicity tests in the microdevice as well as in classic way using 96-well cell culture plates were performed to compare results obtained in micro- and macroscale. Fluorescein dibutyrate (FDB) and iodide propidine (PI) were used as viable and dead cells' markers, respectively. Fabricated MCCS microdevices were reproducible and apart from cell culture for long period of time, including cell passaging, it allowed cell-based cytotoxicity assays performance. The MCCS can be applied in high-throughput cell-based assays providing important informations on potential drug targets, substances' bioactivity, defining the lowest toxic level of tested substances etc.

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Contributors: Ziolkowska, K., Jedrych, E., Kwapiszewski, R., Lopacinska, J. M., Skolimowski, M., Chudy, M.
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