DEVELOPMENT OF PLASTIC MICROFLUIDIC DEVICES FOR AUTOMATED PREPARATION OF SAMPLES FOR STR TYPING*

Ralf Lenigk, Jianing Yang, Mark Richards, Sameer Venugopal, Chia-Fu Chou and Frederic Zenhausern Center for Applied NanoBiosciences, Biodesign Institute, Arizona State University, Tempe, AZ 85287, USA

Conventional short tandem repeat (STR) typing is comprised of several laborious and time-consuming steps: sample solubilization, DNA extraction, DNA quantification, PCR amplification, capillary electrophoresis, and data analysis. We have developed microfluidic lab-on-a-chip solutions to automate and accelerate the process. Microfluidic modules were developed using a polymeric fabrication platform. The modular approach will facilitate the integration into a single device at a later stage. Modules for DNA extraction of buccal cells, differential extraction of sexual assault samples, and PCR amplification were fabricated and tested using the AmpFlSTR® Profiler PlusTM ID and COfilerTM multiplex PCR amplification kits (ABI). For the differential extraction process immunomagnetic cell-capture, electrode-less dielectrophoresis, and a microfluidic cartridge design that is based on a conventional differential lysis protocol were evaluated. The QuantifilerTM Human DNA and QuantifilerTM Y Human Male DNA quantification kits (ABI) were used to measure the success of separating the male and female fractions. All of the microfluidic modules were controlled and operated by in-house built instrumentation and software. Experimental data was generated that compares the performance of the microfluidic system with that of conventional bench-top equipment. It is concluded that integrated microfluidic systems can greatly facilitate and accelerate the STR typing process and could be instrumental in reducing the backlog of cases requiring STR DNA marker analysis. *This work was supported by the U.S. Department of Justice, Federal Bureau of Investigation under contract J-FBI-03-085. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.