

Integrated Approach to Automation of STR Analysis System

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In the search of next generation forensic technologies² to meet the requirement of automated human identification in sexual assaults, low cost plastic integration and miniaturization of all fluidic and detection components stand out as a promising approach.

This paper reports our recent accomplishments in developing a low cost automated STR system. Here is reported the design and fabrication processing onto plastic substrates of a disposable cartridge for differential DNA extraction based on magnetic particles protocol. This cartridge was tested with mock-up biological samples representative of sexual assault cases.

Separation of STR loci is also demonstrated using on chip electrophoresis devices. A customized deconvolution software, developed in-house, is used to separate the dye signals and assign alleles to each peak. Other experimental results from an integrated PCR/CE device, which allows the reproducible injection of small amounts of PCR product into the electrophoresis channels, were successfully achieved for separation and analysis. A first prototype of an integrated cartridge that includes sample preparation from cells, PCR amplification and CE separation will also be shown. Experimental data obtained with the Identifier STR kit, using some commercially available thermo-cycler instruments, were compared with the measurements performed on an injection molded plastic PCR chip. Furthermore, the latest experiments performed with a fully automated sample preparation plastic cartridge platform will also be reported.

Low cost integrated microsystems (Loci-m) are providing autonomous and integrated human identification methods and platforms. These platforms will significantly contribute to the reduction of the current large backlog of sexual assault samples in many forensic DNA laboratories.

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