Microfluidic implementation of electrophoretic analysis, using electrokinetic injection of the sample

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***Abstract*— Capillary electrophoresis is a well-established technique for the analysis and separation of molecules or colloids in solution/suspension based on their differential mobility in an electric field. The classical technique uses a long glass capillary in which the flow of the carrier liquid ("buffer") is also driven electrically by electroosmotic flow. Recently there has been much interest in implementing the technique in fast, portable devices: for these, microfluidic technology is useful. In both cases, the sample injection into the flowing buffer stream is critical to achieving a good balance between sensitivity and resolution. We have fabricated several different geometries of double-T injection regions in polydimethylsiloxane (PDMS)/glass microfluidic devices, and then assessed their separation efficiencies when used for electrokinetic sample injection followed by electrophoretic separation. Fluorescence detection of naphthalene-2,3- dicarboxyaldehyde (NDA)-labelled amino acids (arginine, valine and glycine) was used. Initial work concentrated on the formation of a reproducible sample plug, with the flows in all four channels of the double-T region monitored by video fluorescence microscopy (Fig. 1). The sample was restrained to the double-T region by applying a push-back flow. The minimum loading time required to make sure all analytes were present in the sample plug at maximum concentration could also be estimated. The influence of changes in sample plug length, and in channel width, on the efficiency of the separation were also investigated. While the plug length was found to have little influence on the resolution (the peak separation efficiency), the signal to noise ratio (SNR, a measure for the sensitivity of the separation) increased with increasing plug length. The SNR also increased with channel width, but at the cost of the separation resolution.**