MICROFABRICATED CAPILLARY ELECTROPHORESIS CHIPS FOR *IN SITU* ORGANIC ANALYSES ON MARS

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Microfabricated LAB-ON-A-CHIP devices now permit the rapid analysis of biomolecules on small portable devices (*Micro Total Analysis Systems '98*, Kluwer, 1998). This rapidly evolving technology provides tremendous opportunities for the analysis of chemical and biological signatures in extraterrestrial environments with small and inexpensive *in situ* probes. For example, analyses to detect the presence of biogenic amino acids and their homochirality provide an approach to search for evidence of extraterrestrial life. Our goal is to develop a microfabricated capillary electrophoresis system for a second generation Mars Organic Detector (MOD) that can detect such chemical signatures by chirally resolving optically active amino acids. The current test system consists of a folded, 19.0 cm long, 150 mm by 20 mm channel that was photolithographically fabricated in a 10 cm diameter wafer. Fluorescein isothiocyanate labeling of amino acids and laser induced confocal fluorescence detection provides sub-attomole sensitivity. Using a SDS/g-cyclodextrin pH 10.0 electrophoresis buffer and a separation voltage of 550 V/cm, baseline resolution of Val, Ala, Ser, Glu, and Asp enantiomers has been accomplished in under 200 s. Enantiomeric ratios were determined for protein amino acids extracted from the Murchison meteorite, and these values closely matched others determined by HPLC and GC-MS methods, thus proving the feasibility of our analytical technique on an extraterrestrial sample. For *in situ* analyses, more portable systems are desired that do not employ lasers and complex optical systems. We have thus developed a portable microfabricated CE system with on-chip electrochemical detection and shown that it is as sensitive as fluorescence detection in nucleic acid analyses (Anal. Chem. **70**, 684-688, 1998). Future work will focus on the development of labeling schemes that permit the chiral analysis of amino acids with a portable analysis system to fully demonstrate the feasibility of *in situ* analyses on Mars.