**Abstract**

The extensive application of monolithic columns for HPLC is severely hindered by a lack of column-to-column reproducibility. EMµ (Electroactive Monolithic µChip) is a new concept that solves the significant reproducibility problems, as well as allowing miniaturization and improving overall efficiency through electrochemically controlled dynamic separations. This novel µ chip has a micro-structured monolith fabricated from intelligent, electroactive polymer. By application of a specific potential, conducting polymers such as polyaniline (PANI) can be reproducibly grown and readily fine-tuned in terms of porosity, hydrophobicity and ionic capacity. This unique chip provides for an Electroactive Monolithic µ chip capable of multi-dimensional chromatographic separations.

Additionally, EMµ can exploit on-chip electrodes permitting incorporation of contactless conductivity detection (C4D). The monolith microstructuring (provided by templating) will provide reproducibility and improve efficiency by decreasing the A-term of the Van Deemter equation. Furthermore, the use of these intelligent materials will enable gradient control and redox reactions to be exploited during separations of large biomolecules.

**General Concept**

The microstructured PANI monolith will provide reproducibility as the electrochemical polymer growth is well controlled through templating. Thus no radial heterogeneities are observed once the template can be deposited so that it is defect-free. As PANI properties such as volume, hydrophilicity, ionic capacity can be tuned by applying a potential onto it. Morphological and chemical control of the PANI monolithic stationary phase before and during separations is enabled by EMµ.

**Electrochemical Monolith fabrication**

The fabrication of the reproducible microstructured polyaniline monolith is a 3 step process. The choice of electrochemical technique used for polymerisation (potentiostatic or potentiodynamic) had no influence on the final structure. (1) SEM of the bare template (2) Scan rate study of PANI/PS composite (3) PANI inverse opal

**Conclusion**

EMµ provides an alternative to conventional silica and inert polymer monolithic stationary phases as this monolith is reproducible. Studies are underway looking at approaches to improve packing of the PS template. Separations of large biomolecules will be demonstrated in the coming months.