APPLICATIONS OF MICRO-FLUIDIC PLATFORMS INTEGRATING PACKED STATIONARY PHASES

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AIMS:
To design and fabricate novel centrifugal micro-fluidic platforms integrating packed stationary phases for solid-phase micro-extraction in a wide range of (bio)analytical applications.

To design and fabricate novel micro-fluidic platforms integrating packed stationary phases capable of withstanding significant high pressures.

1. Centrifugally driven micro-extraction on a micro-fluidic disc

Fabrication of the centrifugal micro-fluidic platform

Figure 1: Top-to-bottom layer composition of the centrifugal micro-fluidic platform.

Polymer monoliths were fabricated in situ by photo-polymerisation to produce frits for packing of 5-μm C18-silica beads.

Figure 2: The monolithic frit (left) and the packed column (right) in one of the micro-channels. Channel cross-section: 1 mm x 50 μm.

> Solid-phase extraction (SPE) of vitamin B₁₂ with absorbance detection

Figure 3: Pictures showing the column after vitamin B₁₂ extraction, washing and elution steps at 4600 rpm.

Figure 4: Spectra recorded for fractions collected at the channel outlet after vitamin B₁₂ extraction (red), washing (black) and elution steps (green). Spectra recorded for 1 mM B₁₂ standard (blue) shown for comparison.

2. Silicon/glass chips for high pressure applications

Fabrication of silicon/glass chips

Figure 5: Silicon/glass micro-fluidic device (left) and array of pillars fabricated in the middle of the channel (right). Channel dimensions: 50 x 100 μm; pillars: 5 x 5 μm spaced 5 μm apart.

> Packing of micro-fluidic channels with silica micro-particles

Particles: 1.2 μm mono-disperse bare silica Packing solvent: methanol Packing pressure: ca. 300 bar Compacting pressure: 290-320 bar

Figure 6: An 8.5-mm-long column packed with silica micro-particles in one of the micro-fluidic channels.

Figure 7: Stability of the column back pressure versus the flow rate after column consolidation at 1-5 μl/min for 2 h.

3. Project outputs

Journal Articles

Oral Presentations
- 2nd International Workshop on Analytical Miniaturization (WAM 2010), Oviedo, Spain, June 2010.
- United National Centre for Sensor Research (UNCSR) 2nd Annual Symposium, DCU, Sept 2010.
- 35th International Symposium on High Performance Liquid Phase Separations and Related Techniques (HPLC 2010), Boston, USA, June 2010.
- 2nd International Workshop on Analytical Miniaturization (WAM 2010), Oviedo, Spain, June 2010.

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