

ISSC

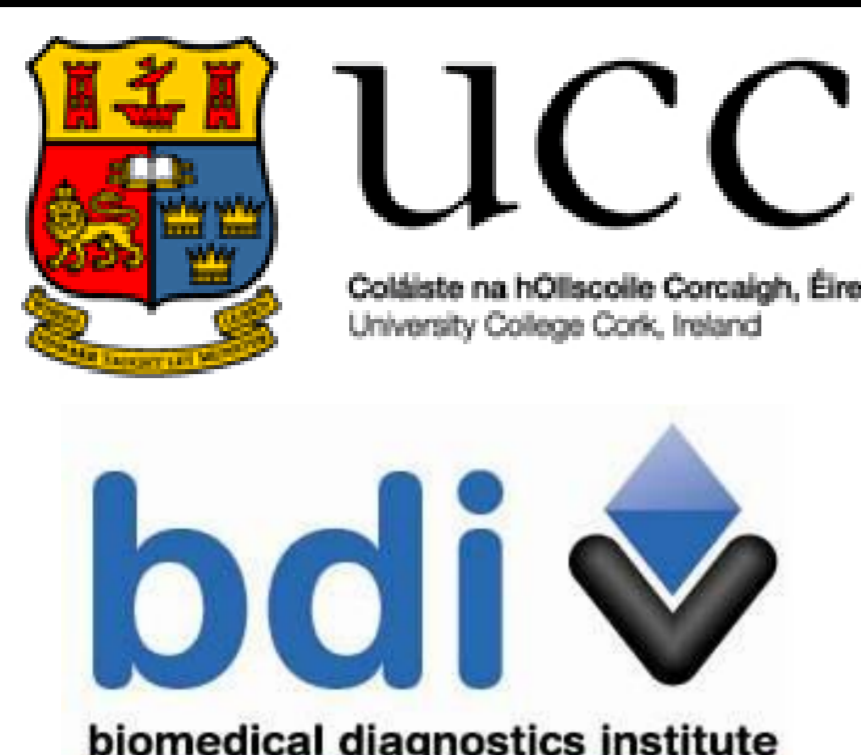
Irish
Separation
Science
Cluster

APPLICATIONS OF MICRO-FLUIDIC PLATFORMS INTEGRATING PACKED STATIONARY PHASES

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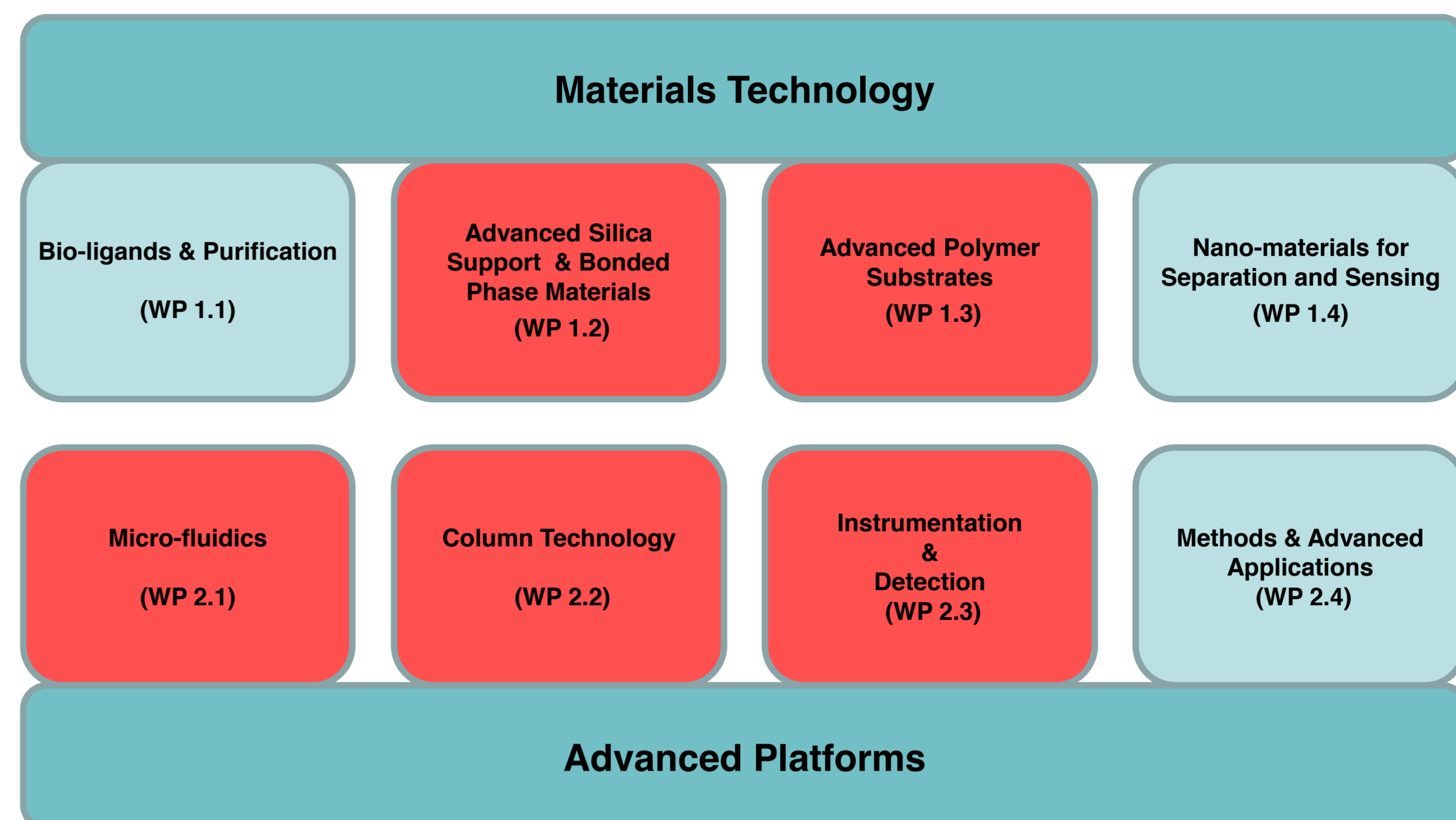
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AIMS:

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

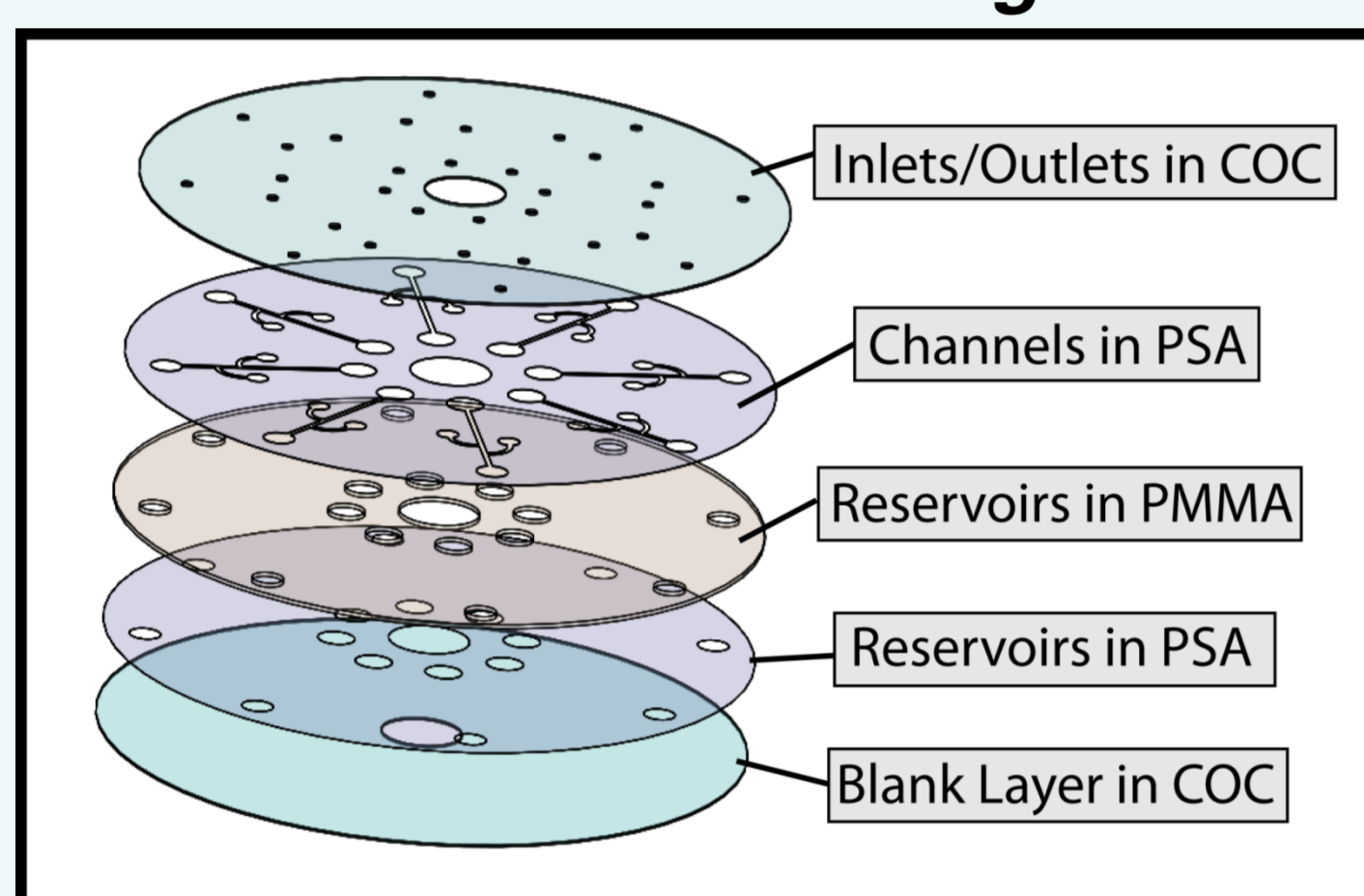


Figure 1: Top-to-bottom layer composition of the centrifugal micro-fluidic platform.

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

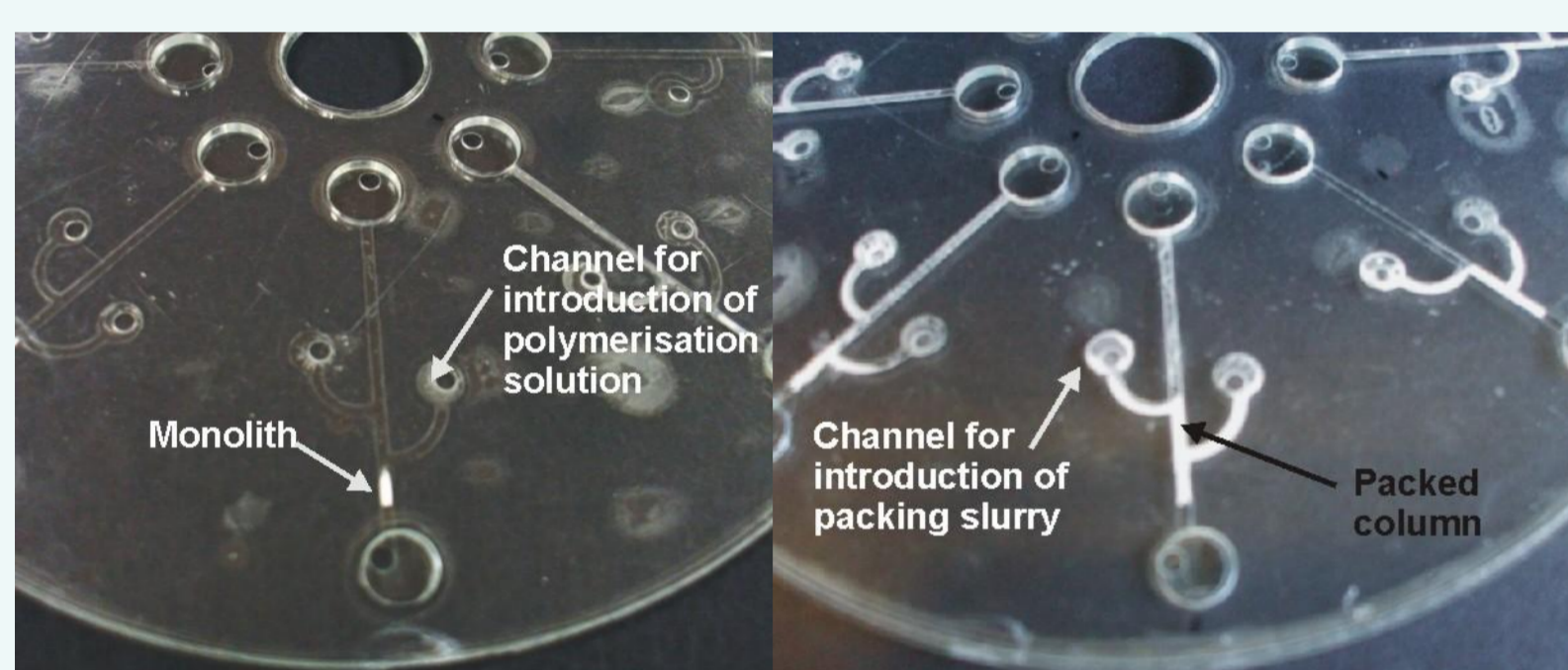


Figure 2: The monolithic frit (left) and the packed column (right) in one of the micro-channels. Channel cross-section: 1 mm x 50 μ m.

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

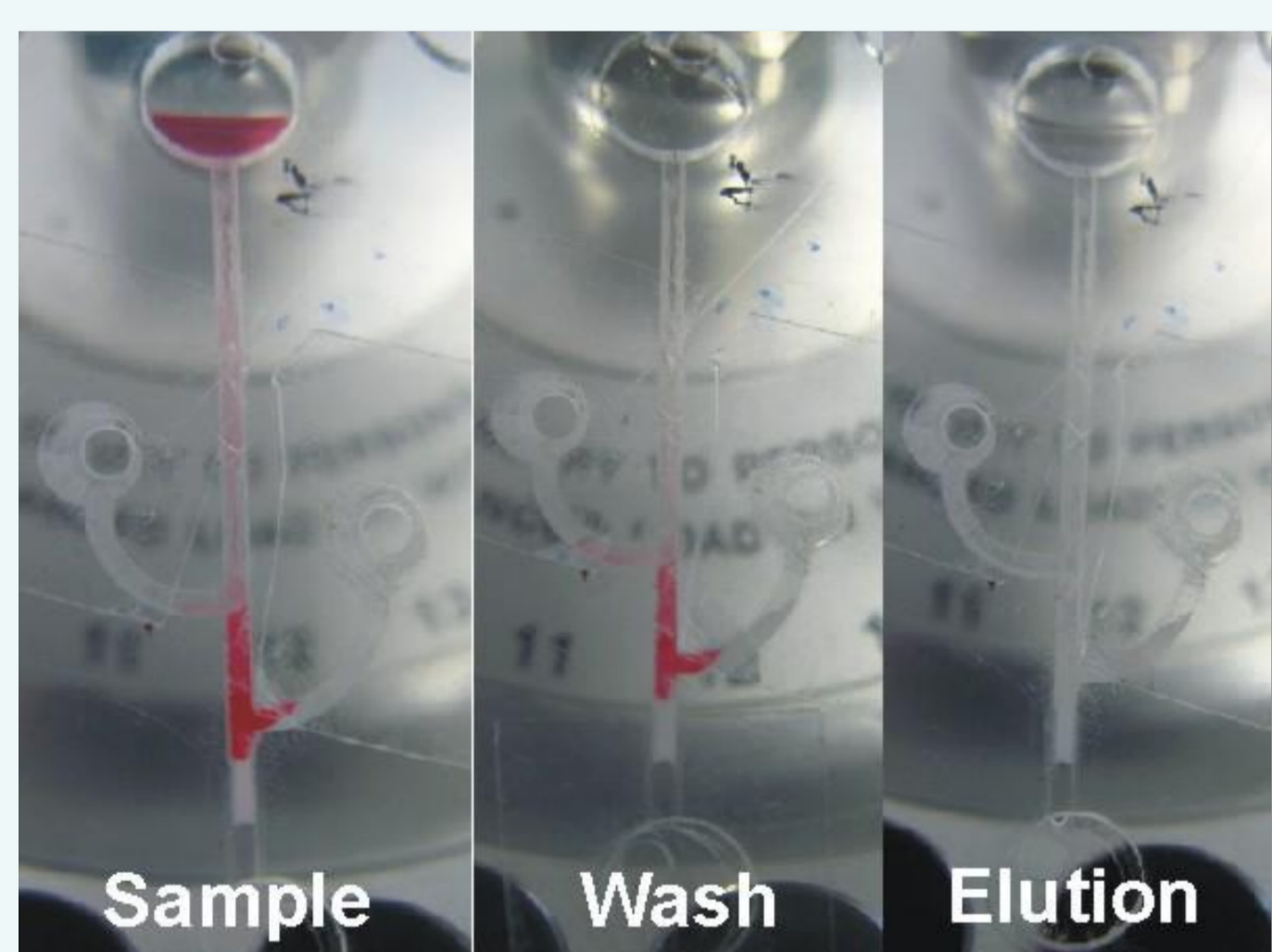


Figure 3: Pictures showing the column after vitamin B₁₂ extraction, washing and elution steps at 4600 rpm.

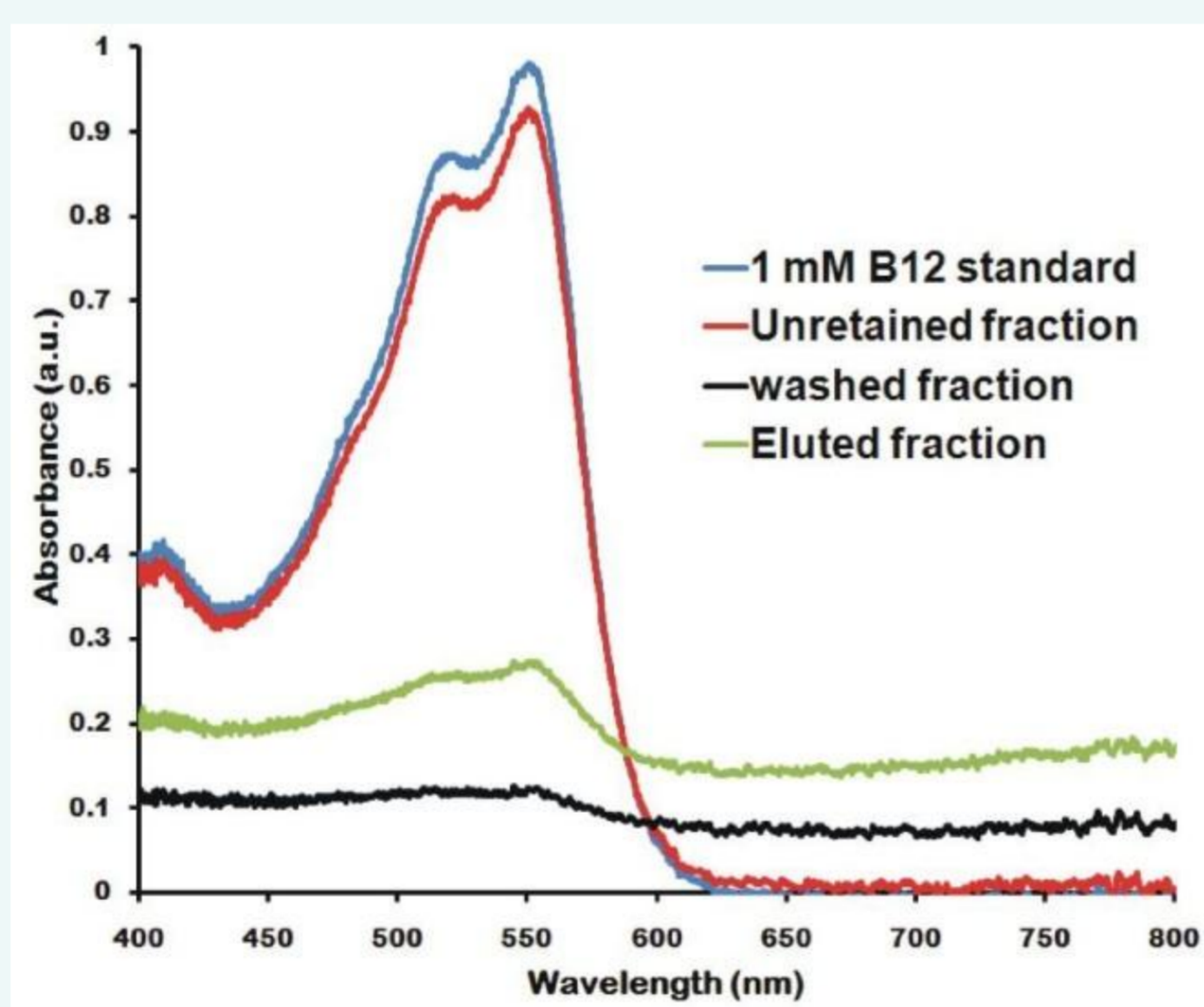


Figure 4: Spectra recorded for fractions collected at the channel outlet after vitamin B₁₂ extraction (red), washing (black) and elution steps (green). Spectra recorded for 1 mM B₁₂ standard (blue) shown for comparison.

2. Silicon/glass chips for high pressure applications

Fabrication of silicon/glass chips

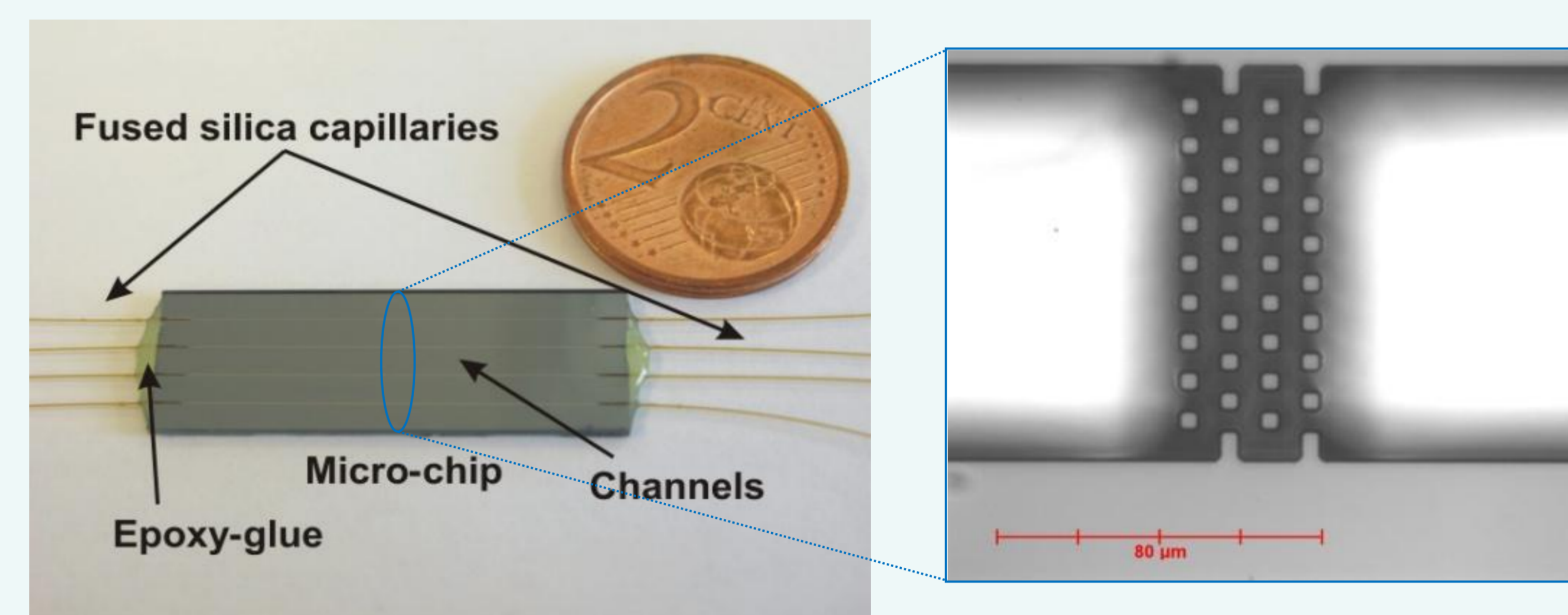
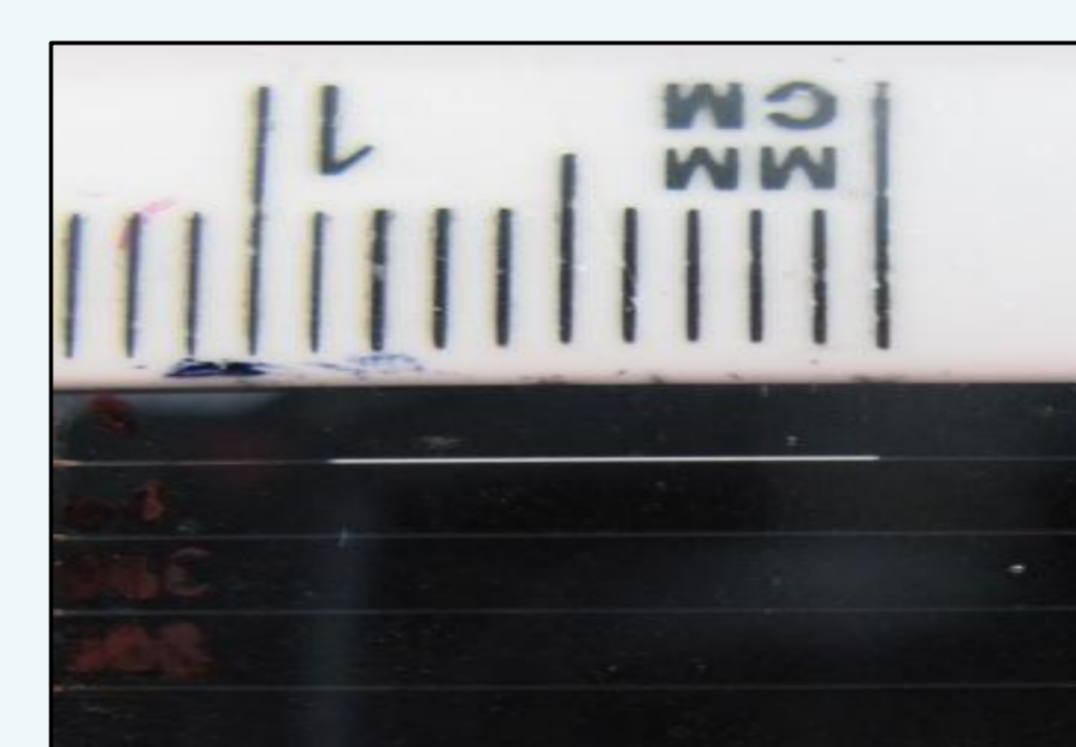


Figure 5: Silicon/glass micro-fluidic device (left) and array of pillars fabricated in the middle of the channel (right). Channel dimensions: 50 x 100 μ m; pillars: 5 x 5 μ m spaced 5 μ m apart.

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



Particles: 1.2 μ m 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.

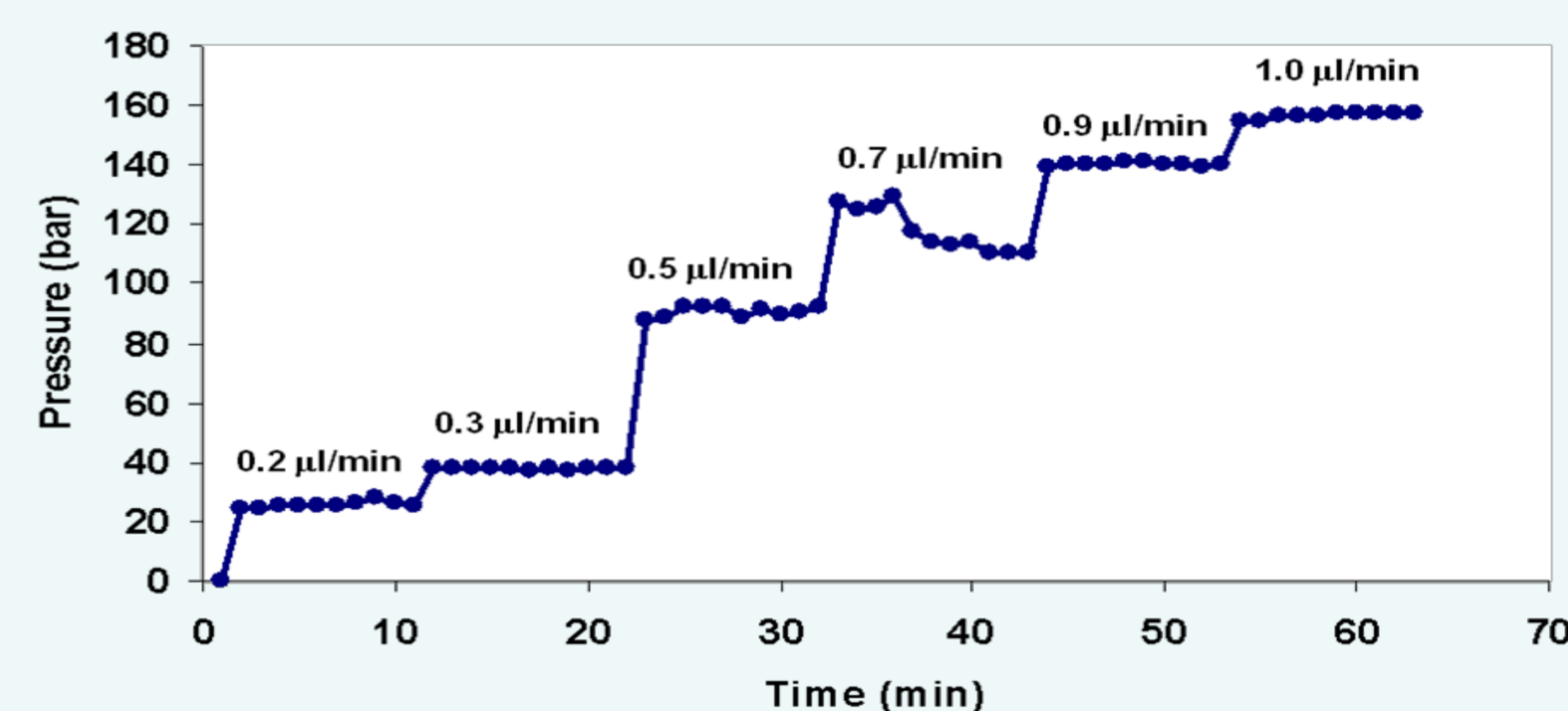


Figure 7: Stability of the column back pressure versus the flow rate after column consolidation at 1-5 μ l/min for 2 h.

3. Project outputs

Journal Articles

- M. Vázquez, D. Brabazon, F. Shang, J. Omamogho, J. Glennon, B. Paull, *Trends in Analytical Chemistry (TrAC)*, under review.
- M. Vázquez, B. Paull, *Anal. Chim. Acta*, **2010**, 668, 100.
- D. Collins, E. Nesterenko, D. Connolly, M. Vázquez, M. Macka, D. Brabazon, B. Paull, *Anal. Chem.*, Web publication date: April 30, **2011** (DOI: 10.1021/ac2004955).

Oral Presentations

- 28th International Symposium on Chromatography (ISC 2010), Valencia, Spain, Sept 2010.
- Hamilton/Beaufort Symposium, DCU, Aug 2010.
- 2nd International Workshop on Analytical Miniaturization (WAM 2010), Oviedo, Spain, June 2010.

Poster presentations

- United National Centre for Sensor Research (UNCSR) 2nd Annual Symposium, DCU, Sept 2010.
- Hamilton/Beaufort Symposium, DCU, Aug 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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