

The Use of Scanning Contactless Conductivity Detection for the Characterisation of Stationary Phases in Micro-Fluidic Chips

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Experimental Section

Design and fabrication of the PMMA/PSA micro-fluidic chips

The PMMA/PSA microchip was fabricated by laminating four different layers of PPMA (GoodFellow, UK) and PSA (Adhesives Research, Ireland) containing the channels and the inlet/outlet reservoirs. A CO₂ ablation laser (Laser Micromachining LightDeck, Optec, Belgium) was used to fabricate the channels and inlets/outlets in the different polymeric substrates. A thermal roller laminator (Titan-110, GBC Films, US) set at 40 °C was used for lamination (bonding) of the different layers. First, a 11 mm x 400 μm channel was fabricated in a 80-μm-thick PSA layer, which was then laminated onto another 50-μm-thick PSA layer containing a 15.5 mm x 400 μm channel. This allowed fabrication of microchannels with an embedded weir for entrapment of beads with diameters ≥ 50 μm. (see Fig. S1-A). The inlets of the microchannels were fabricated with a funnel shape for efficient flow-driving of the beads into the channel during packing, minimizing their agglomeration at the channel inlet. The funnel-shaped inlet consisted of a 5-mm-long channel connecting a rounded reservoir (diameter, 2 mm) with the straight channel for column packing (width, 400 μm) (Fig. S1-B). Outlet reservoirs (diameter, 2 mm) were also fabricated on both PSA layers prior to lamination. A top layer of 500-μm-thick PPMA and a bottom layer of 125-μm-thick PPMA were then laminated onto the 80-μm-thick and 50-μm-thick PSA layers, respectively, to close the micro-fluidic structure. Inlet/outlet reservoirs

of 2 mm diameter were previously fabricated on the PMMA top layer with the CO₂ laser.

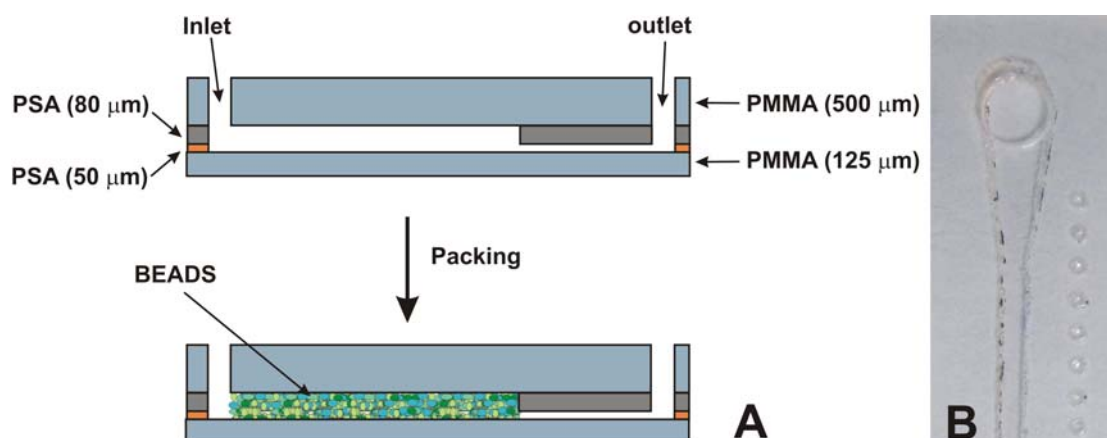


Fig. S1. A) 3D structure of the micro-fluidic channels; B) funnel-shaped channel inlet.

Column packing

Prior to packing, the IMAC resin (Ni Sepharose 6 Fast Flow, GE Healthcare Life Sciences, UK) suspended in 20 % ethanol/water in a ratio of 43 % settled medium to 57 % ethanol/water, was further mixed with water at a ratio of 1:6 (v/v). This bead slurry was then packed in channels 1 and 2 by applying negative pressure at the channel outlet (channel 3 was left unpacked for data comparison). The packed columns, which had different lengths, were further compacted by washing with water for half an hour *via* application of negative pressure. The channels were then filled with 20 mM sodium phosphate buffer (pH 7.5), recommended by the resin manufacturer for good resin stability and optimal binding of target molecules. No other additives such as 0.5 M NaCl (typically used for eliminating ion-exchange effects) were added to the buffer as that would dramatically increase the conductivity of the electrolyte with a subsequent decrease in the C⁴D signal-to-noise ratio.

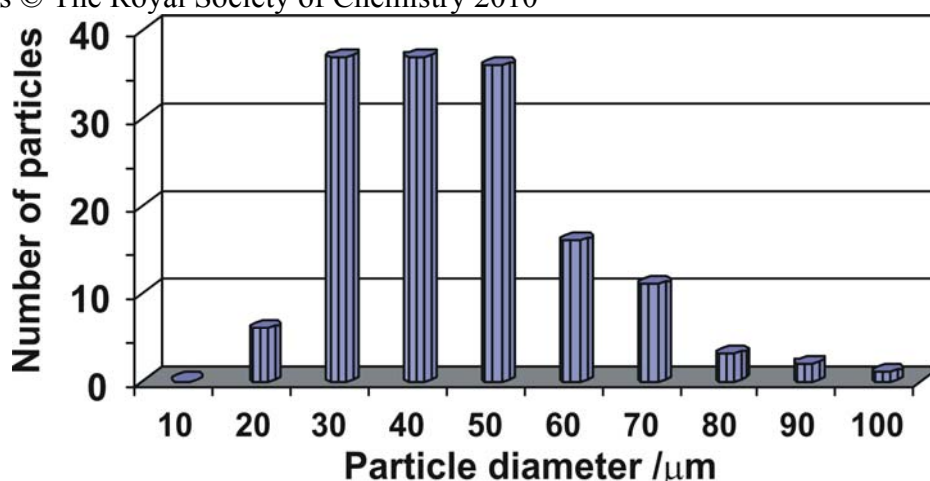


Fig. S2. Particle size distribution in IMAC resins.

Pre-treatment of the COC micro-fluidic chips

Prior to the *in situ* polymerisation, the channels were washed with methanol and dried under N_2 flow. A solution of 0.02% benzophenone in a 3:1 mixture of *t*-butanol:water was prepared and sonicated for 30 min. The channels were filled with the solution with the aid of a glass syringe, the channels were sealed and irradiated for 5 min at 254 nm (11 mW/cm^2). The channels were then flushed again with methanol and dried under N_2 flow.

In situ preparation of the poly(styrene-co-divinylbenzene) monolith within the COC channel via photo-initiated polymerisation

1 wt% camphorquinone, 5 wt% ethyl-4-dimethylamino benzoate and 5 wt% *N*-methoxy-4-phenylpyridinium tetrafluoroborate (all % per weight of monomers) were added to a prepolymer solution comprised of 17.5% styrene, 17.5% divinylbenzene, 12% acetonitrile, 24% 1-propanol and 30% 1-decanol (all v/v). After sonication the mixture was introduced in the channels with the aid of a glass syringe and the inlets/outlets were sealed with PEEK stoppers. The channel was positioned over a 470 nm LED array and irradiated for 2 h. After polymerisation the monolith was flushed with acetonitrile to remove porogens.