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Detection of melamine in milk using nanopillar filters and Raman spectroscopy

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We present a simple, robust, and automated method for detecting trace amounts of melamine in milk using nanostructured surface enhanced Raman spectroscopy (SERS) substrates integrated in centrifugal microfluidic platform [1]. Fast and facile extraction of the food adulterant (melamine) from milk on a SERS substrate was demonstrated down to 10 ppm within 10 minutes. The unique characteristic of the detection method is a "filter paper/chromatographic" effect which combines centrifugal forces and wetting properties of the SERS substrate to remove lipids and larger particles and leave a purified area for melamine detection. The work addresses issues related to SERS-based detection of analytes in complex media, which is important for realizing next generation SERS platforms applicable for a fast and affordable while at the same time sensitive sensors within food safety.

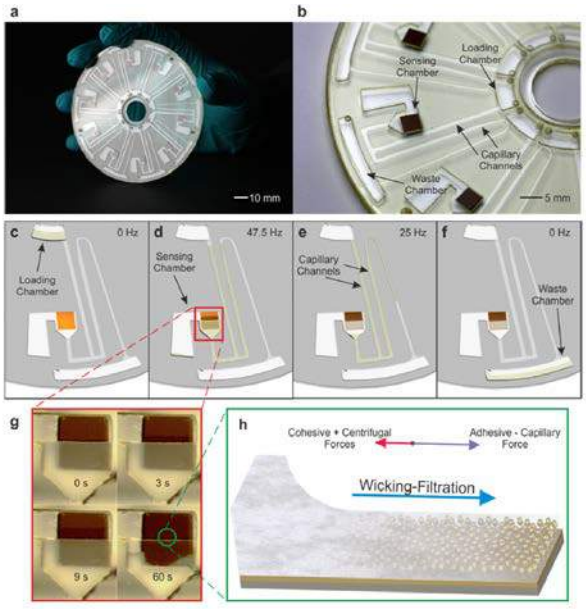

Figure 1. (a,b) Photographs of fabricated microfluidic disc. (c,d,e,f) Schematic illustration of the three-step filtration procedure: (c) the sample is injected, the disc is at rest; (d) the rotation frequency of the disc is 47.5 Hz, the sample under the action of centrifugal force is transferred to the sensing chamber and partially covered the SERS substrate; (e,f) the sample removal process with the help of pneumatic chamber and capillary channels under 25 Hz rotational frequency. (g) Real-time image series recorded during the filtration stage (d), the wet area is gradually increased and covered the whole chip in 60 s through the capillary wicking effect. (h) Illustrative drawing of capillary based wicking-filtration phenomenon on AuNP structures at the immersion boundary. [1]

[1] O. Durucan, T. Rindzevicius, M. S. Schmidt, M. Matteucci, A. Boisen, *Nanopillar Filters for Surface-Enhanced Raman Spectroscopy*, ACS Sensors, 2, 10, 1400-1404, 2017