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A Fused-Silica Microfluidic Chip for Automated Sample Preparation in SERS-Based Antibiotic Detection

Phenotypic antibiotic susceptibility testing relies on bacterial growth and typically requires 18-24 hours [1]. Surface-enhanced Raman scattering (SERS) gives label-free fingerprints at low analyte concentrations and is an attractive readout for faster assays [2]. We present the design and fabrication of a fused-silica microfluidic chip for SERS measurements on liquid samples. A femtosecond laser modifies a 1 mm-thick fused-silica plate along the designed path and the irradiated regions are removed by wet etching in NaOH [3]; a second 1 mm plate carrying the inlet and outlet holes seals the channels, bonded with UV-curable adhesive outside the channel area, so the fluidic path is bounded by fused silica alone. Two inlets merge at a Y-junction into a serpentine mixer of nominal cross-section 200x200 μm followed by an enlarged chamber for Raman interrogation, dimensioned from finite element simulations of the flow. A syringe pump merges colloid and sample automatically at fixed intervals, ensuring consistent colloid-sample mixing conditions across measurements and thus addressing a known limitation of colloid-based SERS [4]. We present the chip fabrication process, its characterization, and preliminary SERS measurements, highlighting its potential for automated antibiotic analysis.

References

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Figures

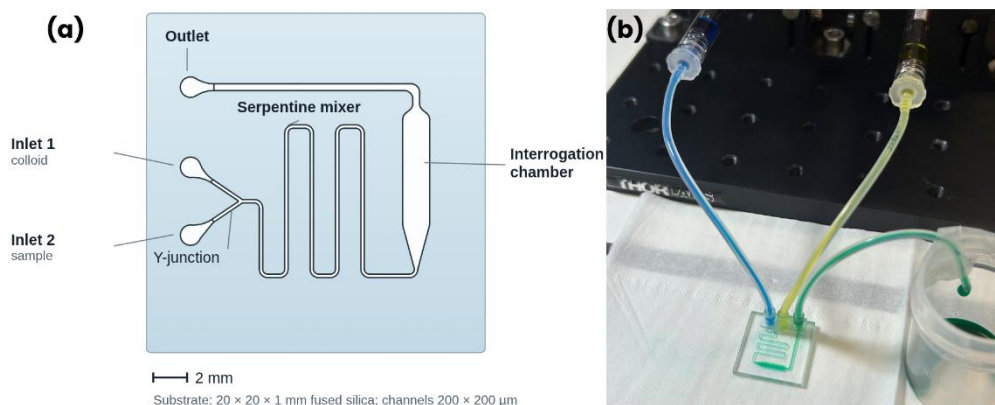


Figure 1: (a) Layout of the fused-silica chip: two inlets, Y-junction, serpentine mixer, enlarged interrogation chamber and outlet. (b) On-chip mixing of two dye streams, showing operation of the passive mixer.