High Throughput Optofluidic Surface Enhanced Raman Spectroscopy (SERS) Interrogation: Proof of Concept via Lectin Detection of Cancerous Cells

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High throughput surface enhanced Raman spectroscopy (SERS) is a much needed advance to better realize the full potential of the detailed fingerprint information available with Raman spectroscopy. At present SERS, as an analytical technique, is often plagued by a lack of quantification and reproducibility due to the length of time required for individual sample analysis. In this effort we discuss the development of an optofluidic device that combines the high throughput capability of microfluidics with SERS detection. A two-phase microfluidic based platform with droplet storage allows for the rapid screening of over one hundred individual prostate cells. Specifically, the N-acetyl neuraminic (sialic) acid residue overexpressed on cancerous prostate cells (PC3), compared to non-cancerous cells (PNT2), is targeted with carbohydrate (lectin) functionalized nanoparticles. In-house algorithms were developed to automatically process SERS maps and rapidly distinguish cancerous PC3 cells from both non-cancerous PNT2A cells and empty droplets. Furthermore, the computer vision methods employed are scalable. Herein, we demonstrate the novel use of labeled nanoparticles for SERS detection in a high throughput segmented flow optofluidic device.

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