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Optimizing and characterizing a home-built Raman spectroscopy optical system using polystyrene microspheres

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Abstract

In the recent decade, Raman spectroscopy has played a key role in photonics as a powerful method suited for detection, diagnosis and screening applications across various industrial fields. In this work, we propose a home built Raman Spectroscopy optical system optimized for polymer detection and characterization. Once fully calibrated, the intended use for the system is to analyse various macromolecules especially biomolecules in assessment of cell based diseases. This system makes use of a 527 nm excitation laser beam of 5 µs pulse duration AT 1 kHz repetition rate and an average power of 10 mW. An Andor CCD camera attached to a grated spectrometer was used for Raman spectrum acquisition and data processing was performed using the Origin software. Polystyrene microspheres (20 µm) were diluted to various concentrations and analysed using the Raman system. The results obtained reveal that all the spectra excluding the control contained Raman peaks consistent with the documented molecular vibrations of polystyrene. Furthermore, the peak intensities and peak areas showed a direct relationship with the polymer concentration in solution. Future work will include testing polymer spheres of different sizes in order to assess the spectral differentiation capabilities of the system. Much of this work will lead to the design of Raman Spectroscopy system to be used as a diagnostic tool for point-of-care detection research.