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Silver Nanoparticles as SERS-Active Probes for Detecting Melamine

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Milk is one of the essential food items throughout the world. Intentional adulteration of milk products with melamine falsely increases the apparent protein content in milk and it is a health concern associated with kidney damage. Therefore, developing an effective method for detecting melamine is important. In this research, a highly sensitive SERS (Surface Enhance Raman Spectroscopy) technique was applied to detect lower concentrations of melamine with silver nanoparticles to indicate the potential of Raman spectroscopy to design an optical biosensor. This preliminary investigation can address shortcomings of high-cost and sophisticated detection techniques and enables the applicability in onsite detection of melamine. In the experiment, the nanoparticles and samples were mounted on tsetupan set up using the hanging drop method and drop casting method. The Raman measurements were obtained using a custom-built research-grade Raman spectrophotometer with a laser wavelength of 532 nm. The most sensitive SERS probe was developed when classical silver nanoparticles were drop cast on the glass slide. Therefore, further quantitative analysis including method validation and application into commercial milk samples was performed using the drop-casted sample. The calibration plot for the intensity of the SERS peak at ~691 cm^{-1} versus melamine concentration shows linearity in the range of 0.2 ppm- 50 ppm for the SERS probe developed via drop casting classical silver nanoparticles. The limit of detection and limit of quantification for this method are 3.05 ppm and 10.16 ppm, respectively. This developed SERS probe allows quick, simple, and cost-effective qualitative and quantitative analysis of melamine.

Keywords: *melamine, SERS, adulterant*