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# Detection of low concentrations of melamine in aqueous media using Surface Enhanced Raman Spectroscopy

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**Background:** Melamine is a nitrogen-rich compound and has been extensively used in industry for the production of melamine formaldehyde resins. Due to high nitrogen content, melamine has been unethically added to milk products to obtain high protein content readings. In humans and pets, consumption of melamine levels above the recommended safety limits of World Health Organization (WHO) can cause renal failure and even death. Numerous methods to determine melamine in food products are gas chromatography, high-performance liquid chromatography, mass spectrometry, time-of-flight mass spectrometry, enzyme linked immune sorbent assay, capillary electrophoresis, and Raman spectroscopy.

**Objective:** To experiment the feasibility of using Surface Enhanced Raman Spectroscopy (SERS) for identifying and quantifying melamine in aqueous medium using an innovative, rapid and cost effective method.

**Method:** Silver colloids synthesized using Leopold method were used to enhance the Raman signals from the melamine molecule. The obtained colloids were characterized by UV-vis spectroscopy (Thermo Scientific GENESYS 10S Series, Quartz cell 1.7 ml path length 10 mm) and TEM (JEOL JEM-2100 Japan multipurpose, analytical transmission electron microscope). A concentration series of melamine as 1000 ppm, 500 ppm, 250 ppm, 100 ppm, 50 ppm, 10 ppm and 1 ppm were analyzed using Thermo Scientific DXR2 SmartRaman spectrometer at an excitation wavelength of 785 nm.

**Results:** The obtained Raman spectral peaks for aqueous solutions of melamine along with silver nanoparticles (AgNPs) were boosted using NaCl as an aggregating agent. The UV-visible spectra showed peak at 408-412 nm conforming the presents of silver colloids. TEM analysis showed that most particles had a size of about 10-100 nm.

**Conclusion:** This study indicates that SERS method, using AgNPs and NaCl can be used to selectively determine the presence of melamine contamination in aqueous medium. The Limit if Detection of this study is 1 ppm and Limit of Quantitation is 1-100 ppm. With further optimizations this method could be served as a cost-effective novel technique in ultra-low detection of melamine contaminations in dietary items.

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