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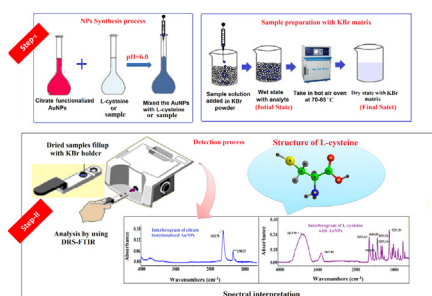
## Citrate functionalized gold nanoparticles assisted micro extraction of L-cysteine in milk and water samples using Fourier transform infrared spectroscopy

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## HIGHLIGHTS

- AuNPs /DRS-FTIR method for detection of L-cysteine was established.
- Method is based on electrostatics interaction of L-cysteine and NPs.
- Peak at  $3415.90\text{ cm}^{-1}$  was used for optimization and quantitative analysis.
- Advantages of present method are simple, sensitive and cost effective.

## GRAPHICAL ABSTRACT



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## ABSTRACT

This paper describes the sensing application of citrate functionalized gold nanoparticles (AuNPs) employing for the determination of L-cysteine in food and water samples. It is established with diffuse reflectance Fourier transform infrared (DRS-FTIR) spectroscopic analysis. The disappearance of the thiol (-SH) band in the FTIR spectra and the shift in the peaks of the amino group ( $\text{NH}_2^+$ ) and carboxylate group ( $-\text{COO}^-$ ) indicated the Au-S interaction and the aggregation of the NPs. The signal intensity of L-cysteine was enhanced due to hot-spots formed by the aggregation of AuNPs producing the effective absorption of electromagnetic radiation in the IR region for molecular vibration. The relationship between AuNPs and L-cysteine was theoretically investigated by the Density Function Theory (DFT) based on LANL2DZ with the aid of the Gaussian 09 (C.01) software. Interaction between AuNPs and L-cysteine molecules resulted to a shift to higher wavelengths in the plasmon bands, further verified by transmission electron microscopes (TEM), which have indicated random aggregated particles. Further dynamic light scattering (DLS) measurements showed a relatively high degree of polydispersity confirming the aggregation of the particles. Under optimized conditions, the calibration curve showed a good linearity range from 20 to  $150\ \mu\text{g mL}^{-1}$  with a correlation coefficient ( $R^2$ ) 0.990. The limit of detection and quantification were  $1.04$  and  $3.44\ \mu\text{g mL}^{-1}$ , respectively by DRS-FTIR. This modified AuNPs sample was used successfully in milk and water samples with adequate results to determine L-cysteine.

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