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Colorimetric plasmon sensor for mercury ion detection using gold nanoparticles

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In this research, we demonstrate a colorimetric plasmon sensor for the determination of mercury ions, which are toxic heavy metal ions. Colorimetric detection by the naked eye is certainly the most simple and convenient diagnostic method, especially when it does not require any complex optical or electrical systems. Colorimetric method using gold nanoparticles (AuNPs) is based on changes in the resonance wavelengths of localized surface plasmon resonance (LSPR) that exhibit different colors depending on their size and shape. AuNPs in an average size 18 nm are mixed with urea in a proper ratio, which exhibits selective response to mercury ions as a result of color change from red to violet. The reason for the color change is due to the aggregation of AuNPs induced by the coordination complex between mercury ions and urea on the surface of nanoparticles. The results in an inter-particle plasmon coupling effect are followed by a shift in the LSPR absorption band in the visible region of spectra from 521 nm to 547 nm. Therefore, the change in the color of the LSPR band of AuNPs is used as a colorimetric sensing probe to monitor the concentration of mercury ions in the samples. The results show a linear relationship between absorbance intensity of AuNPs and the concentration of mercury ions which can be translated the detecting behaviors into color changes discernible by the naked eye. In addition, the detection limit of our method is 250 μM.

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