利用半胱胺酸修飾金奈米棒偵測銅離子
Sensing of Cupric Ions Based on Cysteine-Modified Gold Nanorods

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Abstract

As an essential element in human body, copper plays an important role in various metabolic pathways. However, long-term excessive copper intake can lead to Alzheimer's disease and inflammatory diseases. In addition to using expensive instruments as a method of copper detection. A fast, convenient, and simple-to-operate method in aid of on-site analysis or household detection is needed. For household detection, the sensor which can be distinguished by naked eye will be the primary choice. Therefore, this study demonstrates an eye-observable detection method that can also adjust the analyte concentration.

For copper content, there are different water quality standards depending on the water body. It has been previously reported that cysteine and Cu(I) produce flocculates $((R)S\text{-}Cu^{+})_n$, which can be detected semi-quantitatively by the molar ratio of cysteine to copper ions. In this study, the properties of the localized surface plasmon resonance of gold nanorods were introduced for quantification.

This study focuses on the detection of copper concentration ranges in drinking water quality standards and the development of methods for immediate detection and quantification. The flocculation substance could be formed by adjusting the concentration ratio of cysteine and copper ions to reach the phase separation and could be observed with the naked eye. The quantification is achieved by ultraviolet-visible light spectroscopy. This study requires a specific buffer solution to aggregate gold nanorods with Cys-Cu(I) and form precipitation. In this case, we will explore the effect of different types of buffer solutions on the polymerization efficiency and deduce the reaction mechanism. Lastly, the optimization of the gold nanorods, buffer, and cysteine concentration is achieved. For the optimization, we also investigated the effect of pH value and temperature on the formation rate of flocculates.

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