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Novel ion imprinted polymer coated multiwalled carbon nanotubes as a high selective sorbent for determination of gold ions in environmental samples

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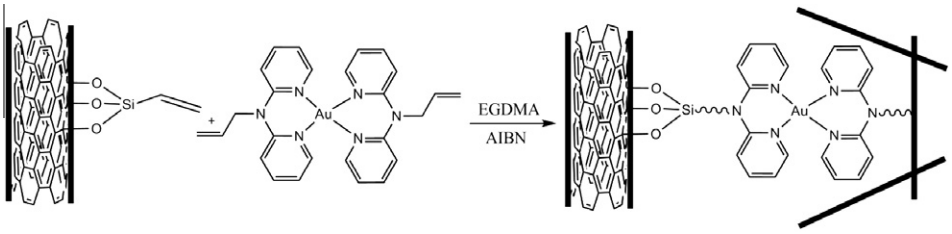
HIGHLIGHTS

- Synthesis of a novel ion imprinted polymer coated multiwalled carbon nanotube as a new sorbent.
- Preconcentration and determination of trace amounts of gold with high selectivity and accuracy.
- Synthesis of nanosize particles.

GRAPHICAL ABSTRACT



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ABSTRACT

In this work, for the first time an ion imprinted polymer (IIP) has been synthesized for gold ions preconcentration and determination. In order to increase extraction efficiency and improve the figures of merit, this polymer has been grafted on multiwalled carbon nanotube and was characterized by infrared (IR) spectroscopy, high resolution transmission electron microscopy (HRTEM), scanning electron microscopy (SEM), elemental analysis (CHN) and thermal analysis (TGA/DSC). The application of this sorbent has been investigated for rapid extraction, preconcentration and determination of trace amounts of gold ions in environmental samples. The optimum conditions, including pH of sample, eluent type and concentration, also eluent and sample flow rates and the least amounts of eluent for desorption of gold ions were obtained. The effects of various cationic interferences on the adsorption of gold ions, especially platinum and palladium ions, as the most important interferences, were evaluated. The analytical efficiency value of gold ions was 98.3% in the optimum condition. The limit of detection (LOD) was less than 0.041 ng mL^{-1} for gold extraction. The maximum capacity of this IIP modified nano-tubes were obtained more than 67 mg g^{-1}. The relative standard deviation for this method was determined to be 1.14. Furthermore, the accuracy of this method was confirmed using various standard reference materials. This method was successfully applied for determination of gold ions in natural samples.

1. Introduction

Gold is one of the most precious and important elements due to its usage in different areas such as jewelry, and industry. Gold possesses unique properties that promote its widespread industrial applications. So there have been so many techniques presented for its determination in environmental and mineral samples and waste waters [1–3]. Among them flame atomic absorption spectrometry (FAAS) is a good and common technique to determine low levels of gold ions due to its simplicity, easy operation and its fast response. But it has some difficulties such as lower levels of gold ions than the limit of detection of FAAS and effects of the matrix components of the working media [4–7]. To overcome these limitations on the determination of gold by FAAS, separation-enrichment techniques, including solid-phase extraction (SPE) [8–10], cloud point extraction [11,12], liquid–liquid extraction [13,14], coprecipitation [15], etc. have been used by the researchers around the world. Among these methods SPE has attracted more attention due to being inexpensive (does not need so much

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