Use of modified nanocompostie for the extraction, separation, preconcentration and determination of trace amounts of copper ions in real sample

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ABSTRACT

In the present study, trace amount of copper (II) ions in real samples has been separated, preconcentrated and determined by a modified nanocomposite. The effective factors such as pH, nanocomposite amount, extraction time, eluent type, ionic strength and sample volume were optimized for quantitative determination of copper (II) ions. The linear range of the calibration graph was between 10 and 900 ng mL^{-1} with limit of detection (LOD) 3.62 ng mL^{-1}. Relative standard deviations (RSD) was 1.8%. Modified nanocomposite was used for measurement of the trace amounts of Cu (II) ions in the real samples such as sea water, tap water, river water and well water with suitable fallouts.

Keywords: Copper ions, Nanocomposites, Extraction.

1. INTRODUCTION

Copper is one of the basic elements in nature and has been used by human in a wide range of crafts. Today, there are many industries that use copper including plating, oil refinery and mining extraction. On the other hand, using this element in in- dustry causes the production of large amount of copper cations contains in form of wastewater and sludge and as this element is unsuitable to human life, which have negative impacts on the environment water [1]. The separation preconcentration techniques which has been employed to address the above mentioned barriers and problems consists of extracting the solvent, chelating sorbents, cloud point extraction, ion-exchange, using electro- analys is methods, solid phase extraction, etc. [2–4]. On the other hands, there are some other alternatives that have more benefits than the ordinarily used solid phase extraction (SPE). This research proposes an nanocellulose coat which is improved by using CBIMMT ligand, as an alternative sorbent which could be efficiently used as a new sorbent in both the preconcentration function and detecting the Cu ions via FAAS in widely used targets which are used in every day life.

2. Materials and methods

2.1. Reagents and apparatus

Ethanol, CBIMMT ligand, copper (II) nitrate, acetone and sodium hydroxide have been purchased from Merck Corporation and α-cellulose were purchased from sigma Aldrich. Analytical grade nitrate salts of elements (all from Merck) were of the highest purity available and used without any further purification. pH meter model Metrohm 744 from Switzerland was used to measuring pH. Kokusan model H-11n centrifuge was used to precipitating nanocomposite. Measuring Copper ions was done by a Thermo M series (Model: M5) FAAS with a Cu hollow cathode lamp. The following conditions were used: λ_{max}=249.0 nm; monochromator spectral bandpass=0.1 nm; lamp current=15 mA; burner head=50 mm; acetylene and air-flow rates were 0.8 and 10.0 L min^{-1} respectively.

2.2. General Procedure of Extraction

50 mL of Cu (II) ions solution (100 ng mL^{-1}) was prepared and pH value was adjusted to 9 using ammonium buffer solution, then 0.1 g of modified nanocomposite was added to 50 mL of solution. The mixture was stirred for 15 min at room tempretuer, after centrifugation of the mixture (at 4000 rpm for 5 min) Cu (II) ions retained on nanocomposite were eluted with 1.0 mL HNO$_3$ (0.5 mol L^{-1}). Finally, after stirring and centrifuge (at 5000 rpm for 5 min) the mixture acidic, Cu (II) ions determined by FAAS.

3. Result and discussion

3.1. Effect of pH on the extraction efficiency

To find the best pH for maximum extraction of Cu (II) ions , different values of pH (in the range of 2-11) were analyzed. As shown in Fig. 1, the maximum extraction can be found at pH=9. At low pH values, owing to the