

A REVIEW OF COMPARATIVE STUDY ON DETERMINATION OF COPPER BY ATOMIC ABSORPTION SPECTROSCOPY (AAS)

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Abstract:

Major environmental pollutants include heavy metals which are toxic and bio accumulative nature. The commonly found heavy metals in waste water include cadmium, chromium, copper, and zinc, all of which cause risks for human health and therefore the environment. It's essential to have a general understanding of the essential principles for various methods of elemental analysis. Atomic absorption spectroscopy (AAS) techniques were chosen to assess their suitability for the determination of several heavy elements in complex environmental and biological samples. Pre concentration of copper involving different techniques like solid-phase extraction, co-precipitation and liquid-liquid extraction (LLE), cloud-point extraction are used. This study is review of determination of copper by AAS .This article provides a summary of the foremost sensitive techniques of determination of copper by AAS.

Keywords: atomic absorption spectrometry, pre-concentration, copper.

INTRODUCTION:

Copper plays important role in carbohydrate and lipid metabolism for plants and is important for life in mammals. It has both the effects up to certain level it acts as useful for life but excess amount create toxic effects. Industrial and domestic waste discharge, refineries, disposal of mining, washing increases the amount of copper in waters and plants. The increased limits can cause serious problems .The utilization of copper-polluted water with amount of more than the permissible level causes hazardous problems like vomiting, nausea, blood cell damage, and kidney failure. Thus determination of trace amounts of copper is of great significance. For this determination of trace amount the sample must be processed for some initial treatment and this is termed as pre-concentration steps.

Several pre concentration procedures have been reported for copper determination involving different analytical techniques such as precipitation, liquid-liquid, solid-phase and cloud-point extraction. ¹

Atomic Absorption Spectroscopy (AAS)

In 1955 Walsh in Australia introduced the AAS technique (A. Walsh, Spectrochim. Acta, 1955, 7, 108) the technique AAS nearly half a century used for determination of single element in analytical samples. When an element is introduced into a flame most of the atoms remain in the ground state, these ground state atoms are capable of absorbing radiant energy of their own specific resonance wavelength. This radiation is the same as that emitted by the excited atoms of the element in flame photometry, if the characteristic resonance wavelength is passed on to a flame containing the atoms, then these atoms absorb light and the extent of absorption will be proportional to the number of ground state atoms (unexcited) present in the flame, hence independent of flame temperature.

AAS is very specific as particular element absorb own wavelength spectral interference is less.

Atomic Spectroscopic methods are used for qualitative as well as quantitative elemental analysis .Atoms will absorb light from an energy source known as hollow cathode lamp (HCL).

Serkan Sahan et .al. proposed a solid phase extraction method for separation and pre-concentration for the determination of copper in river water, sea water, dialysis solutions, and fertilizer samples. In this solid phase extraction copper (II) ions were collected on the column loaded with amberlite resin and Eriochrome blue black R, the eluent used was nitric acid .The various parameters were pH 3.0-10.0 ,flow rate of sample 4.0 ml /min. The detection limit was 1.3 mg/L .the pre-concentration factor was 60. This method is applied to sea and river water, fertilizer samples .The recovery rate was found to be 98%

The FAAS (Flame atomic absorption spectrometry) was used in this method ¹

Another simple, rapid and selective method was suggested by Ghadamali **Bagherian et.al** for determination of copper (II) ions based on complex formation between copper and salophen which then extracted by liquid- liquid micro extraction in the organic phase and later detected by FAAS. Various parameters like effect of pH, concentration of salophen, type and volume of extracting solvent, extraction time was reported. Under optimum conditions the detection limit was found to be 0.60ug/L for 10 ml of sample and calibration graph was linear up to 120ug/L. The method was successfully applied to food and water samples. ²

Valfredo Azevedo Lemos et. al ³ proposed the cloud point extraction with new reagent 6-[20-(60-methyl-benzothiazolylazo)]-1,2-dihydroxy-3,5-benzenedisulfonic acid as complexing agent and Triton X-114 as the surfactant method for determination of copper in tap water, bottled natural mineral water for drinking and river water. FAAS was used the detection limit was 1.5mg/L. Enrichment factor was 14.

Atamjyot, P.jain and Puri ⁴ used adsorption method in which copper forms sodium diethyl dithio carbamate complex and this is adsorbed on polymeric adsorbent in the pH range of 2.9-9.0. The copper complex is eluted with dimethyl formamide and copper is quantitatively determined by AAS. The linear range of concentration over which Beer's law obeyed was 0.15-2.0 ppm. The adsorbent was synthesized by using monomer methyl methacrylate and ethylene glycol dimethacrylate in 1:5 molar ratio. Toluene is used as solvent and azo bis iso butyronitrile as initiator. Polymerization is completed after 24 hrs in water bath with temperature 60-65 °C. After grinding the polymer sieved to size of 100 microns and then used. The method is applicable to determine copper content in alloy.

Conclusion: There are many methods with which determination of copper can be done, some of which we have addressed in this review paper. The selection of method depends on type of sample and concentration range. The merits of the method can be compared and accordingly method can be applied. The pre-concentration methods solid-phase extraction, co-precipitation, adsorption and cloud-point extraction the average recovery rate can be compared. In solid-phase extraction, the recoveries range of copper is 98%. Whereas in Liquid-Liquid extraction, the recovery range is about 96%, in cloud point extraction 95% is the recovery range.

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