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Research Article

Spectrophotometric Determination of Trace Copper in Dental –Unit Waste Water Using the Reagent (3, 5-Dibromo-2-Pyridylazo)-N-Ethyl-N-(3-Sulphopropyl) Aniline (3, 5-Di-Br-PAESA)

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Abstract: A simple and low cost method been utilized for the tenaciousness of trace copper ions in dental – unit wastewater samples. The method is predicated on the reaction of copper ions with the reagent 4-(3,5-dibromo-2-pyridylazo)-N-Ethyl-N-(3-sulphopropyl) aniline (3,5-di-Br-PAESA) in acidic medium .The composed intricate shows an absorption maximum at 580nm at max was obtained employing acidic buffer for intricate reaction to take place. Plots of the colored Cu –reagent intricate were obeyed in the concentration range 6.25-50ug/ml-1copper ions, respectively with a relative standard deviation in the range of 2±1 %. The inhibition of the detection (LOD) and quantitation (LOQ) of the procedure were 0.02 and 0.1ng/ml-1 Cu2+respectively. The proposed method was applied for the analysis of copper in dental-unit wastewater samples.
Keywords: Copper (II), waste water

INTRODUCTION

Nowadays, there is ever-incrementing concern about toxicity of trace metals, the concentration of many metals and other toxic chemicals species have been incrementing in the environment and expediting grievous pollution of the precious gifts of nature, namely air, water.

In dentistry, amalgam is an alloy of mercury with sundry metals utilized for dental fillings. It commonly consists of mercury (50%), silver (~22-32%), tin (~14%), copper (~8%), and other trace metals [1, 2], all these heftily ponderous metals will be dumped in the sink of the dental amalgamates. Dental amalgam remains an efficacious, vigorous, durable and frugal tooth filling material particularly resistant to secondary caries.

Dental amalgams were first documented in a Tang and appeared in Germany in the 1800s; amalgam became the dental restorative material of cull due to its low cost, ease of application, vigor, and durability[3].

Copper is one of these pollutants. The incrimination in copper concentration in the environment results from industrial and domestic waste discharge (dental clinics) Copper is essential for plant, animal and human health Copper is widely distributed in sundry organs of the body. The highest concentration is found in the liver followed by the brain and Kidney [4-5].

Some people who drink water-containing copper in excess of the action level may, with short-term exposure, experience gastrointestinal distress, and with long-term exposure may experience liver or kidney damage. The major sources of copper in imbibing water are corrosion of household plumbing systems; and erosion of natural deposits. Copper enters the water (“leaches”) through contact with the plumbing. Copper leaches into water through corrosion – a dissolving or wearing a way of metal caused by a chemical reaction between water and plumbing [6]. The amount of copper in water additionally depends on the types and amounts of minerals in the water, how long the water stays in the pipes, the amount of wear in the pipes, the water’s acidity and its temperature. The maximum contaminant level goals (MCLG), for copper is 1.3mg/ l or 1.3ppm EPA [3] regulation. Copper has a drastic effect on human health and is a potent environmental pollutant. It is there for consequential to develop a cost-efficacious, sensitive, selective and rapid analytical method for trace tenaciousness of copper.

I report the presence of copper from the analysis of samples taken from suction filters at the dental school at the Arab American University clinics and the concentration was tenacious utilizing colorimetric

method. Colorimetric method was a popular way for copper analysis until the exordium of atomic absorption spectroscopy.

The method is predicated on the utilization of spectrophotometer measurement of a colored involute in acid medium at a wavelength of 578 nm [4].

Copper +Di-Br- PAESA → Colored compound

MATERIALS AND METHODS

Principle

At pH 4.7 copper, it reacts with a specific color reagent, 3.5-Di-Br-PAESA 4-(3, 5-Dibromo-2-pyridylazo)-N-Ethyl-N-(3-sulphopropyl) aniline, to form a stable, colored chelate. The intensity of the color is directly proportional to the amount of copper in the sample [4].

Reagents 1

The stock solutions included Cu (II) 200 ng/dl from copper sulfate pent hydrate (labeled purity 99.5%).

Reagent 2

The acetate buffer solution, 0.2m/l pH 4.7 supplied, ready to use, stable up to expiry date when stored at 2-8^{o}C.

Reagent 3

Color reagent 4-(3,5-dibromo-2-pyridylazo)-N-Ethyl-N-(3- sulphopropyl) aniline (3, 5-di-Br-PAESA) 0.2m/l, pH 4.7; supplied ready to use, stable up to expire date when stored at 2-8^{o}C.

Preparation

Dissolve the content of reagent 2 with reagent 3. Ensure that content been dissolved completely, stable for 2 week at 2- 8^{o}C.

Instrument

Human mini Photometer, Light source: Tungsten halogen Lamp a single beam, six filters in array wavelength (nm) 340, 405 505, 546, 578, and 630.

Method

	Reagent blank	Standards*	Sample
Working reagent	1 ml	1 ml	1ml
Distilled water	0.05 ml		
Copper standard(s)		0.05ml	
Sample (waste water)			0.05ml

Mix well and incubate at R.T (25^{O}C) for 10 minutes. Measure the absorbance of The standard (abs) and sample (wastewater) (abs) against the blank.

System parameters

Temperature	25^{o}C
Wavelength	578 nm
Path length	1 cm
Reaction	End point
Measurement	Against Reagent Blank

RESULTS AND DISCUSSION

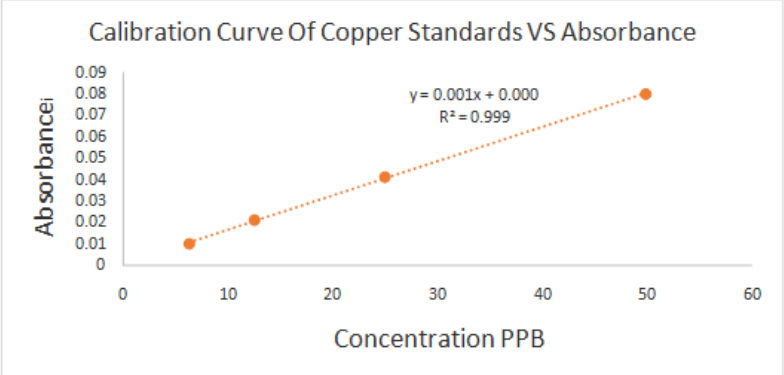

Fig. 1: Calibration curve, with different concentrations (PPB) been drawn to read unknown concentrations samples.

Table 1: Copper levels in PPB

Sample No.	Clinic C	Clinic D	Clinic E
	PPB	**PPB**	**PPB**
1.	2.6	negative	3.1
2.	negative	negative	9.61
3.	1.953	17.6	17.36
4.	1.64	21	9.232
5.	16.03	0.075	11.57
6.	0.2	1.95	6.0
7.	6.0	negative	3.0
8.	3	10	5
9.	14.2	negative	10.1
10.	1.25	3.68	negative
11.	0.388	15.68	2.75
12.	negative	21.75	1.4
13.	3.3	negative	0.8
14.	2.47	negative	0.3

Optimization studies

3, 5-di-Br-PAESA assay is quite sensitive in detecting copper as low as 6.25 ng in a 1 mL sample volume. The assay conducted at room temperature exhibits perfect linearity over 6.25 through 50ng copper while using 1ml of the mixture fig1.

The results reveal that the assay can be conveniently conducted at room temperature.

Since copper occurs naturally, leaching in to environment, from amalgam filling, paint, full consumption, ship peregrinating and others. All sources of copper must be monitored to mitigate the impact to the environment and to account for the relative impact of the sources. There for 3, 5-di-Br-PAESA is an ideal method for being selective, and sensitive respectively .Copper concentration in drinking water 1.3mg/l maximum contaminant level (EPA reference 5) .Some people who drink water containing copper in excess of the action level may, with short term exposure, experience gastrointestinal distress, and with long-term exposure may experience liver or kidney damage. People with Wilson's disease should consult their personal doctor if the amount of copper in their water exceeds the action level. Copper level should be monitored on agricultural soils to edible and non-edible structures of vegetables. Soils sample should be tested for copper level to eschew copper toxicity, especially if wastewater irrigation is common in arid areas with possible public health and environment side effects, as effluent may contain pathogen, salts and toxic metals including copper.

3, 5 –di-Br PAEAS assay for testing it on site would logistic, since being specific and sensitive.

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