DOC313.53.94177

EZ1011 Copper Analyser

Method and reagent sheets

08/2021, Edition 1.01

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1. Legal information

Manufacturer: AppliTek NV/SA

Distributor: Hach Lange GmbH

The translation of the manual is approved by the manufacturer.

2. Analytical specifications

Please refer also to the respective technical datasheet at Hach Support Online.

Copper - All specifications				
Analysis method	Colorimetric measurement at 450 nm using bathocuproine method			
Parameter	Cu (II)			
Cycle time	Standard measurement cycle time: 10 minutes Internal dilution: + 5 min. External dilution: + 5 – 10 min.			
Limit of detection (LOD)	≤ 10 µg/L			
Precision/Repeatability	Better than 2% full scale range for standard test solutions			
Cleaning	Automatic; frequency freely programmable			
Calibration	Automatic, 2-point; frequency freely programmable			
Validation	Automatic; frequency freely programmable			
Interferences	The following substances can be tolerated with an error of less than ±2%. Cations: Al, Cd, Fe(II), Fe(III), Mg, Th(IV) < 100 mg/L; Be, Cr (III) < 10 mg/L; Ca, Na < 1000 mg/L; Co < 5 mg/L; Li, Mn(II), Ni(II) < 500 mg/L; Sr, Zn < 200 mg/l; Anions: Chlorate, chloride, sulfate orthophosphate, perchlorate < 1000 mg/L; fluoride < 500 mg/L; nitrate, nitrite < 200 mg/L. Cyanide, thiocyanate, persulfate and EDTA can also interfere. Large amounts of color and turbidity interfere. Fats, oil, proteins, surfactants and tar.			
Measuring ranges	**% of range - Dilution**		**Low range (mg/L)**	**High range (mg/L)**
	A	10% of standard range	0.01	0.50
	B	25% of standard range	0.02	1.25
	C	50% of standard range	0.02	2.50
	0	**standard range**	**0.05**	**5.00**
	1	internal MP dilution factor 4	0.40	20.0
	2	internal MP dilution factor 8	0.80	40.0
	W	internal dispenser dilution factor 10	0.50	50.0
	X	internal dispenser dilution factor 25	1.25	125
	Y	internal dispenser dilution factor 50	2.50	250
	Z	internal dispenser dilution factor 75	3.75	375
	5	internal dispenser dilution factor 100	5.00	500

3. Analysis method

Summary

The determination of the copper concentration in water is based on the reaction of copper ions with the disodium salt of bathocuproine disulphonate to form an intense coloured orange complex. The absorption is measured at 450 nm.

Analysis steps

The analysis vessel is cleaned and filled with fresh sample. After sampling, the initial absorbance value is measured at 450 nm. Next, acid solution, reductor solution, buffer solution and colour solution are added and after respecting a stirring period – performed to obtain complete colour development –the final absorbance value is determined. With the obtained absorbance values, the copper concentration can be calculated according to Beer's Law.

Calibration

The calibration procedure measures a REF1 Cu solution (channel 9, REF1 valve) and a REF2 Cu solution (channel 10, REF2 valve) to adapt the slope and offset factors by means of a two point calibration.

The calibration is performed in the MAIN method.

Remark

The methods cannot be started at the same time.

4. Reagents

⚠ CAUTION	
	Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Read the safety data sheet from the supplier before bottles are filled or reagents are prepared. For laboratory use only. Make the hazard information known in accordance with the local regulations of the user.

⚠ CAUTION	
	Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

4.1 Reagent overview and consumption

In the tables below, the products that are needed to prepare the reagents are listed. The product name, the formula, the molecular weight, the CAS No. and the amount needed to prepare 1 liter of the reagents is given. Check the consumption of the reagents (28 days) to adapt the volumes needed.

Product	Consumption	Consumption/28 days A rata 1 analysis/10 min	Recommended containers
Acid solution	~ 0.5 mL / analysis	~ 2.1 L	Plastic – 2.5 L
Reductor solution	~ 1.0 mL / analysis	~ 4.0 L	Plastic – 5 L
Buffer solution	~ 1.0 mL / analysis	~ 4.0 L	Plastic – 5 L
Colour solution	~ 1.0 mL / analysis	~ 4.0 L	Glass – 2.5 L
REF1 solution	~ 0.5 L / calibration	/	Plastic – 1 L
REF2 solution	~ 0.5 L / calibration	/	Plastic – 1 L

4.2 DI-water overview and consumption

	Rinse water (mL/analysis) Type I	Dilution water (mL/analysis) Type I	Total (mL/analysis)	Consumption/28 days A rata 1 analysis / 10 min
A	N.A.	N.A.	N.A.	N.A.
B	N.A.	N.A.	N.A.	N.A.
C	N.A.	N.A.	N.A.	N.A.
0	N.A.	N.A.	N.A.	N.A.
1	60 mL	15 mL	75 mL	302 L
2	60 mL	15 mL	75 mL	302 L
W	60 mL	15 mL	75 mL	302 L
X	60 mL	15 mL	75 mL	302 L
Y	60 mL	15 mL	75 mL	302 L
Z	60 mL	15 mL	75 mL	302 L
5	60 mL	15 mL	75 mL	302 L

Remark

The indicated volumes are an estimation of the consumption for rinse and dilution water, based on a standard operating procedure, as defined in the specifications of the EZ analyser. Please be aware that, depending on the sample matrix, the rinse water volumes might increase.

4.3 Storage and quality of chemicals

Quality of chemicals

All chemicals should be of Reagent grade, ACS grade or better (*). The use of pro analysis chemicals is recommended. Poor quality of the reagents can affect the analyser performance.

(*) Analytical Reagent (AR), Guaranteed Reagent (GR), UNIVAR, AnalaR, Premium Reagent (PR), ReagentCertified ACS reagent, ACS Plus reagent, puriss p.a. ACS reagent, ReagentPlus®, TraceCERT®, Suprapur®, Ultrapur®, or better are also possible.

Quality of DI-water

All EZ analysers are tested with standard solutions, reagents and dilution water prepared using type I water or better as defined by ASTM D1193-91.

To achieve the specifications as stated on the data sheet, method and reagents sheet and acceptance test reports, the same water quality (or better) must be used for the preparation of the standard solutions, reagents and dilution water.

Additionally the water used for the preparation of the standard solutions for an EZ analyser must be free of the parameter or any of the interferences for the method of that EZ analyser.

Storage of Reagents

While operating the instrument, keep in mind the reagent requirements as stated in the reagent overview, the chapters below and/or in the data sheet of the instrument.

⚠ CAUTION	
⚠	For longer-term storage: Store the reagents cold; Store the reagents in the dark; If applicable: Store the reagents in a fridge during operation

⚠ CAUTION	
⚠	Refresh the reagents after one month (unless stated differently in the chapters below). Do not mix old reagents with freshly prepared reagents. Remove old reagents from the container before adding freshly prepared reagents.

4.4 Acid solution (2.5M)

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Hydrochloric Acid (36%)	HCl	36.46	7647-01-0	207.5 mL

Preparation

Dilute 207.5 mL hydrochloric acid (HCl, 36%) in 500 mL de-ionized water. Mix and fill up to 1 litre with de-ionized water.

4.5 Reductor solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Hydroxylamine hydrochloride	H_3NO * HCl	69.49	5470-11-1	110 g

Preparation

Dissolve 110 g hydroxylamine hydrochloride (H_3NO * HCl) in 500 mL de-ionized water. Fill up to 1 litre with de-ionized water.

4.6 Buffer solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Sodium citrate tribasic dihydrate	$HOC(CO_2H)(CH_2CO_2NH_4)_2$	294.10	6132-04-3	300 g

Preparation

Dissolve 300 g sodium citrate tribasic dihydrate ($HOC(CO_2H)(CH_2CO_2NH_4)_2$) in 500 mL de-ionized water. Fill up to 1 litre with de-ionized water.

4.7 Colour solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Bathocuproinedisulfonic acid disodium salt dihydrate	$C_{26}H_{18}N_2Na_2O_6S_2 * 2H_2O$	582.55	1257642-74-2	1 g

Preparation

Dissolve completely 1 g of bathocuproinedisulfonic acid disodium salt dihydrate ($C_{26}H_{18}N_2Na_2O_6S_2 * 2H_2O$) in 500 mL de-ionized water. Mix and fill up to 1 litre with de-ionized water.

4.8 Calibration solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Copper (II) sulfate pentahydrate	$CuO_4S * 5H_2O$	249.69	7758-99-8	3.9293 g
Nitric acid (65%)	HNO_3	63.01	7697-32-2	1 mL

Preparation

1000 mg/L Cu stock solution

Prepare a stock solution of 1000 mg/L Cu: Dissolve accurately 3.9293 g copper(II)sulfate pentahydrate ($CuO_4S * 5H_2O$) in 500 mL de-ionized water using a volumetric flask of 1000 mL. Add 1 mL of concentrated nitric acid (HNO_3 65%). This addition is done to keep the solution stable. Fill up to 1 litre with de-ionized water.

Cu standard solution – REF2

Prepare a standard solution for calibration according to the following table: take accurately x ml of the 1000 mg/L Cu stock solution and transfer into a volumetric flask of 1000 ml. Add de-ionized water up to the mark grade.

	Measuring range	Concentration REF2	Amount of stock solution to add to 1 litre
A	0.50 mg/L Cu	0.50 mg/L Cu	0.50 mL
B	1.25 mg/L Cu	1.25 mg/L Cu	1.25 mL
C	2.50 mg/L Cu	2.50 mg/L Cu	2.50 mL
0	**5.00 mg/L Cu**	**5.00 mg/L Cu**	**5.0 mL**
1	20.0 mg/L Cu	20.0 mg/L Cu	20 mL
2	40.0 mg/L Cu	40.0 mg/L Cu	40 mL
W	50.0 mg/L Cu	50.0 mg/L Cu	50 mL
X	125 mg/L Cu	125 mg/L Cu	125 mL
Y	250 mg/L Cu	250 mg/L Cu	250 mL
Z	375 mg/L Cu	375 mg/L Cu	375 mL
5	500 mg/L Cu	500 mg/L Cu	500 mL

Cu standard solution – REF1

Prepare a standard solution of 0 mg/L Cu. Use de-ionized water.

4.8 Cleaning solution (facultative)

The cleaning procedure should prevent any build-up of chemicals in the analyser. To obtain an effective cleaning procedure one has to test the cleaning solution and the cleaning interval for each application. Perform the selected cleaning solution and interval for a trial period, check then the effectiveness of the procedure and change if necessary.

Change Information	
Date: 20/08/2021	Previous version: Edition 5 to Edition 1.01

Reason for Change

- Correction interferences
- Addition of water consumption
- Addition of information reagents

Description of Change

- Addition of estimated consumption of water for rinse and dilution (chapter 4.2)
- Addition of extra information regarding storage and quality of reagents (chapter 4.3)