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EZ1040 Zinc Analyser

Method and reagent sheets

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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.

Zinc - All specifications					
Analysis method		Colorimetric measurement at 630 nm using zincon			
Parameter		Zn (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		Aluminium (III) [(Al) ³⁺] > 5 mg/L, cadmium (II) [(Cd) ²⁺] > 1 mg/L, chromate (VI) [(CrO ₄) ²⁻] > 50 mg/L, chromium (III) [(Cr) ³⁺] > 10 mg/L, cobalt (II) [(Co) ²⁺] > 30 mg/L, copper (II) [(Cu) ²⁺] > 30 mg/L, iron (II) [(Fe) ²⁺] > 9 mg/l, iron (III) [(Fe) ³⁺] > 7 mg/L, manganese (II) [(Mn) ²⁺] > 5 mg/L, nickel (II) [(Ni) ²⁺] > 5 mg/L, organic matter and extreme sample pH fluctuation. Large amounts of colour 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	0.10
		B	25% of standard range	0.025	0.25
		C	50% of standard range	0.025	0.50
		0	standard range	0.05	1.0
		1	internal MP dilution (factor 4)	0.4	4.0
		2	internal MP dilution (factor 8)	0.8	8.0
		W	internal dispenser dilution (factor 10)	0.5	10
		X	internal dispenser dilution (factor 25)	1.25	25
		Y	internal dispenser dilution (factor 50)	2.5	50
		Z	internal dispenser dilution (factor 75)	3.75	75
		5	internal dispenser dilution (max factor 100)	5	100

3. Analysis method

Summary

The determination of the zinc concentration in water is based on the reaction of zincon with zinc in an alkaline solution (pH 9) to an intense coloured blue complex. The absorption is measured at 630 nm.

Zinc reacts zincon (2-carboxy-2'-hydroxy-5'-sulfoformazylbenzene) in a buffered medium (pH 9) to form a blue coloured complex. Other heavy metals likewise form colored complexes with zincon. Cyanide is added to complex zinc and heavy metals. Cyclohexanone is added to free zinc selectively from its cyanide complex so that it can be complexed with zincon to form a blue color.

Analysis steps

The analysis vessel is cleaned and filled with fresh sample. After sampling the buffer and colour solution are added and the initial absorbance value is measured at 630 nm. This measurement is performed to correct for any colour contribution of the sample itself. Next, the cyclohexanone solution is 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 zinc concentration can be calculated according to Beer's law.

Calibration

The calibration procedure measures a REF1 Zn solution (channel 9, REF1 valve) and a REF2 Zn 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
Buffer solution	~ 0.5 mL / analysis	~ 1.5 L	Plastic – 2.5 L
Colour solution	~ 0.5 mL / analysis	~ 1.5 L	Glass – 2.5 L
Cyclohexanone solution	~ 0.5 mL / analysis	~ 1.5 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 Buffer solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Sodium hydroxide	NaOH	40.00	1310-73-2	8.4 g
Boric acid	H ₃ BO ₃	61.83	10043-35-3	31.0 g
Potassium cyanide	KCN	65.12	151-50-8	1 g

Preparation

Dissolve 8.4 g sodium hydroxide (NaOH) in 500 mL de-ionized water. Next, add 31.0 g boric acid (H₃BO₃) and dissolve completely. Check the pH value of the solution, it should be 9. Add carefully 1 g potassium cyanide (KCN), dissolve completely and dilute to 1 litre with de-ionized water.

This solution is stable for 1 month.

4.5 Colour solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Zincon monosodium salt	C ₂₀ H ₁₅ N ₄ NaO ₆ S	462.41	62625-22-3	1 g
Methanol	CH ₃ OH	32.04	67-56-1	1 L

Preparation

Dissolve 1 g zincon monosodium salt (C₂₀H₁₅N₄NaO₆S) in 1 litre methanol (CH₃OH). Because Zincon dissolves slowly, stir and/or let stand overnight.

This solution is stable for 1 month.

4.6 Cyclohexanone solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Cyclohexanone	C ₆ H ₁₀ O	98.14	108-94-1	pure

This solution is stable for 1 month.

4.7 Calibration solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Zinc sulphate heptahydrate	$O_4SZn \cdot 7H_2O$	287.56	7446-20-0	4.424 g

Preparation

1000 mg/L Zn stock solution

Prepare a stock solution of 1000 mg/L Zn: Dissolve accurately 4.424 g zinc sulphate heptahydrate ($O_4SZn \cdot 7H_2O$) in 500 mL de-ionized water using a volumetric flask of 1000 mL. Fill up to 1 litre with de-ionized water.

Zn standard solution – REF2

Prepare a standard solution for calibration according to the following table: take accurately x mL of the 1000 mg/L Zn 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	0.10 mg/L Zn	0.10 mg/L Zn	0.10 mL
B	0.25 mg/L Zn	0.25 mg/L Zn	0.25 mL
C	0.50 mg/L Zn	0.50 mg/L Zn	0.50 mL
0	1.0 mg/L Zn	1.0 mg/L Zn	1.0 mL
1	4.0 mg/L Zn	4.0 mg/L Zn	4.0 mL
2	8.0 mg/L Zn	8.0 mg/L Zn	8.0 mL
W	10 mg/L Zn	10 mg/L Zn	10 mL
X	25 mg/L Zn	25 mg/L Zn	25 mL
Y	50 mg/L Zn	50 mg/L Zn	50 mL
Z	75 mg/L Zn	75 mg/L Zn	75 mL
5	100 mg/L Zn	100 mg/L Zn	100 mL

Zn standard solution – REF1

Prepare a standard solution of 0 mg/L Zn. 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.

4.9 Warning letter

RE: Hach EZ1040 Zinc analyzer

Dear Valued Customer,

Please forward this notice to your plant and laboratory operators who work with and near the above-referenced instrument and its chemical reagents.

WHAT

This notification is to make the customer aware on a possible health challenge with the EZ1040 (Zinc Analyzer) if not following the standard procedures for operation and maintenance.

WHY

The buffer reagent of the color measurement contains KCN which becomes a problem when pH-level drops to acid levels in the reaction vessel in the analyzer. The reason is that it forms HCN, which is a toxic gas harming human health.

HOW

For this reason, we want to avoid customers to apply any kind of acid (as a cleaning reagent) to the analyzer to prevent HCN-formation and thus ensuring safe operation.

Hach has experienced no reports of HCN formation in an EZ1040 analyzer yet, but we want to emphasize once more the possible risk for human health, if not following the standard procedure for operation and maintenance.

Best regards,

Hach

Change Information	
Date: 19/08/2021	Previous version: Edition 6 to Edition 1.01
Reason for Change	
- Compliance request - Addition of extra ranges to the portfolio of EZ1040 - Addition of water consumption - Addition of information reagents	
Description of Change	
- Addition of warning letter (chapter 4.9) - Addition of pH value for buffer solution (chapter 4.4) - Addition of extra ranges for internal dispenser dilution: 10x, 25x, 50x, 75x (chapter 4.7) - 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)	