DOC313.53.94182

EZ1025 Manganese Analyser

Method and reagent sheets

09/2023, Edition 2.01

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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.

Manganese - All specifications				
Analysis method	Colorimetric measurement using formaldoxime method at 450 nm			
Parameter	Mn (II)			
Cycle time	Standard measurement cycle time: 10 minutes Internal dilution: + 5 min. External dilution: + 10 min.			
Limit of detection (LOD)	≤ 2 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 ions commonly found in water and waste water do not interfere. Large amounts of colour and turbidity interferes. Fats, oil, proteins, surfactants and tar.			
Measuring ranges	**% of range - Dilution**		**Low range (mg/L)**	**High range (mg/L)**
	A	10% of standard range	0.002	0.1
	B	25% of standard range	0.005	0.25
	C	50% of standard range	0.005	0.5
	0	standard range	0.01	1 .0
	1*	internal MP dilution (factor 4)*	0.08	4.0
	2*	Internal MP dilution (factor 8)*	0.16	8.0
	W	internal dispenser dilution (factor 10)	0.10	10
	X	internal dispenser dilution (factor 25)	0.25	25
	Y	internal dispenser dilution (factor 50)	0.50	50
	Z	internal dispenser dilution (factor 75)	0.75	75
	5	internal dispenser dilution (factor 100)	1.0	100

**Not applicable for EZ1025.xxxxxxT (SC-version)*

3. Analysis method

Summary

The determination of the manganese concentration in water is based on the reaction of formaldoxime with ammonium hydroxide in an alkaline solution to an intense coloured orange-red complex. The absorption is measured at 450 nm.

EDTA and hydroxylamine hydrochloride (reducing reagent) are added to minimize the interference of iron (Fe^{2+} and Fe^{3+}).

Analysis steps

The analysis vessel is cleaned and filled with fresh sample. After sampling the initial absorbance value is measured at 450 nm. This measurement is performed to correct for any colour contribution of the sample itself. Next, the colour solution and buffer solution are added and after respecting a stirring period – performed to obtain complete colour development – the EDTA and reducing agent are added. The final absorbance value is determined. With the obtained absorbance values, the manganese concentration can be calculated according to Beer's law.

Calibration

The calibration procedure measures a REF1 Mn solution (channel 9, REF1 valve) and a REF2 Mn 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 litre of the reagents is given. Check the consumption of the reagents (28 days) to adapt the volumes needed.

Reagents

TAG	Code	Product	Consumption	Consumption/28 days A rata 1 analysis/10 min	Recommended containers
Reagent 1	**Red**	**Colour**	~ 0.5 mL / analysis	~ 2.02 L	Plastic – 2.5 L
Reagent 2	**Blue**	**Buffer**	~ 0.5 mL / analysis	~ 2.02 L	Plastic – 2.5 L
Reagent 2	**Green**	**EDTA**	~ 0.5 mL / analysis	~ 2.02 L	Plastic – 2.5 L
Reagent 3	**Yellow**	**Reducing agent**	~ 0.5 mL / analysis	~ 2.02 L	Plastic – 2.5 L

Calibration solutions

TAG	Product	Consumption	Recommended containers
REF1	**REF1 solution**	~ 0.5 L / calibration	Plastic – 1 L
REF2	**REF2 solution**	~ 0.5 L / calibration	Plastic – 1 L

4.2 DI-water overview and consumption

	TAG			
	Rinse (mL/analysis) Type I	**Dispenser Dilution (mL/analysis) Type I**	**Total (mL/analysis)**	**Consumption/28 days A rata 1 analysis / 10 min**
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 Reagent 1: Colour

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Hydroxylamine hydrochloride	H_3NO * HCl	69.49	5470-11-1	40 g
Formaldehyde (37%)	CH_2O	30.03	50-00-0	20 mL

Preparation

Dissolve 40 g hydroxylamine hydrochloride (H_3NO * HCl) in 500 mL de-ionized water. Next, add 20 mL of formaldehyde (CH_2O 37%) solution. Fill up to 1 litre with de-ionized water. This solution is stable for 2 weeks.

4.5 Reagent 2: Buffer

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Ammonium hydroxide solution (25%)*	NH_4OH	35.05	1336-21-6	100 mL

* Density: 0.91 g/ml (20°C)

Preparation

Take 100 mL concentrated ammonium hydroxide (NH_4OH 25%) and dilute to 1 litre with de-ionized water. This solution is stable for 1 month.

4.6 Reagent 3: EDTA (0.1M)

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
EDTA*	$C_{10}H_{14}N_2Na_2O_8$ * $2H_2O$	372.2	6381-92-6	37.22 g

*ethylenediaminetetraacetic acid disodium salt dihydrate

Preparation

Dissolve 37.22 g of ethylenediaminetetraacetic acid disodium salt in 500 mL de-ionized water and dissolve completely. Fill up to 1 litre with de-ionized water.

4.7 Reagent 4: Reducing agent (1%)

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Hydroxylamine hydrochloride	H_3NO * HCl	69.49	5470-11-1	10 g

Preparation

Dissolve 10 g of hydroxylamine hydrochloride (H_3NO * HCl) in 500 mL de-ionized water and dissolve completely. Fill up to 1 litre with de-ionized water.

4.8 Stock solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Manganese (II) nitrate tetrahydrate	MnN_2O6 * $4H_2O$	251.01	20694-39-7	4.5688 g
Nitric acid (65%)	HNO_3	63.01	7697-32-2	35 mL

Preparation

1000 mg/L Mn stock solution

Prepare a stock solution of 1000 mg/L Mn: Dissolve accurately 4.5688 g manganese (II)nitrate tetrahydrate (MnN_2O6 * $4H_2O$) in 300 mL de-ionized water using a volumetric flask of 1000 mL. Add 35 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.

4.9 REF2 Calibration solution

REF2 – Mn standard solution

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

4.10 REF1 Calibration solution

REF1 – Mn standard solution

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

4.11 Cleaning reagent (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: 13/09/2023	Previous version: Edition 1.01 to Edition 2.01

Reason for Change

- Addition of TAG's to reagents description
- Split between stock solution and calibration solutions

Description of Change

- Addition of 'Reagent x'-TAG to all reagent/water/reference solutions descriptions (Chapter 4.1, 4.2 and 4.3)
- Creation of chapter for stock solution preparation and calibration solution preparation (Chapter 4.8, 4.9 ad 4.10)