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EZ7100 TOC Analyser

Method and reagent sheets

02/2022, Edition 1.01

Table of Contents

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.

TOC - All specifications				
Analysis method	Hot UV/persulphate method			
Parameter	Total Organic Carbon			
Cycle time	Standard measurement cycle time: 15 minutes			
Limit of detection (LOD)	≤ 0.20 mg/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	Chloride [$(Cl)^-$] > 1 g/L affects oxidation efficiency. Volatile organic compounds evaporate in the TOC configuration. Fats, oil, proteins, surfactants and tar.			
Measuring ranges	**% of range - Dilution**		**Low range (mg/L)**	**High range (mg/L)**
	B	25% of standard range	0.20	5
	C	50% of standard range	0.30	10
	0	**standard range**	**0.40**	**20**

3. Analysis method

Summary

The determination of the TOC concentration in water is based upon the UV heated persulfate oxidation method.

Analysis steps

First a flushing to remove any traces of previous measurements. Sample is dosed into the analysis vessel and acid solution is added to lower the pH to facilitate the removal of inorganic carbon sources such as bicarbonate and carbonate as CO_2 by stripping the gas. Persulfate solution is added in combination with UV-radiation (185 + 254 nm) whilst the analysis vessel is heated to 80°C. During this step, the organic carbon is converted to CO_2 gas which is transferred to the NDIR (Non-dispersive Infra-Red) detector by the controlled carrier gas. With the obtained signal from the detector during reaction time, the TOC value can be calculated.

The carbon dioxide and the carrier gas is first guided into a second vessel which separates the condensate from the gas before the gas flows through the membrane air dryer and reaches the detector.

Calibration

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

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 rate 1 analysis/15 min	Recommended containers
Acid solution	~ 1.5 mL / analysis	~ 4.0 L	Plastic – 5 L
Persulfate solution	~ 3 mL / analysis	~ 8.0 L	Plastic – 10 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 rate 1 analysis / 15min
A	N.A.	N.A.	N.A.	N.A.
B	N.A.	N.A.	N.A.	N.A.
0	N.A.	N.A.	N.A.	N.A.

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

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Phosphoric acid (85%)	H_3PO_4	98.00	7664-38-2	118 mL

Preparation

Dilute carefully 118 mL phosphoric acid (H_3PO_4, 85%) in 500 mL de-ionized water. Fill up to 1 litre with de-ionized water.

Remark

If the water or the wastewater contains high levels of calcium, it is preferable to replace the phosphoric acid solution by a nitric acid solution (see below) in order to prevent precipitation of calcium phosphate.

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Nitric acid (65%)	HNO_3	63.01	7697-37-2	77 mL

Preparation

Dilute 77 mL nitric acid (HNO_3, 65%) in 500 mL de-ionized water. Fill up to 1 litre with de-ionized water.

4.5 Persulfate solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Sodium persulfate	$Na_2S_2O_8$	238.10	7775-27-1	238 g

Preparation

Add 238 g of sodium persulfate ($Na_2S_2O_8$) to 500 mL de-ionized water. Fill up to 1 litre with de-ionized water.

4.6 Calibration solution

Products	Formula	MW (g/mol)	CAS No.	1 litre solution
Sucrose	$C_{12}H_{22}O_{11}$	342.2965	57-50-1	2.38 g

Preparation

1000 mg/L C stock solution

Prepare a stock solution of 1000 mg/L C: Dissolve accurately 2.38 g sucrose ($C_{12}H_{22}O_{11}$) in 500 mL de-ionized water using a volumetric flask of 1000 mL. Fill up to 1 litre with de-ionized water.

C standard solution – REF2

Prepare a standard solution for calibration according to the following table: take accurately x mL of the 1000 mg/L C stock solution and transfer into a plastic volumetric flask of 1 litre. Add de-ionized water up to the mark grade.

	Measuring range	Concentration REF2	Amount of stock solution to add to 1 litre
A	5 mg/L C	5 mg/L C	5 mL
B	10 mg/L C	10 mg/L C	10 mL
0	**20 mg/L C**	**20 mg/L C**	**20 mL**

C standard solution – REF1

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

4.7 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: 04/02/2022	Previous version: Edition 2 to Edition 1.01

Reason for Change

- Addition of water consumption
- Addition of reagents information

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)