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**Testing methods for water quality by flow
analysis—Part 7: Chromium (VI)**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Japan Environmental Measurement and Chemical Analysis (JEMCA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

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JIS K 0170 series consists of the following 9 parts under the general title

“Testing methods for water quality by flow analysis”:

Part 1: Ammonium nitrogen

Part 2: Nitrite nitrogen and nitrate nitrogen

Part 3: Total nitrogen

Part 4: Orthophosphate and total phosphorus

Part 5: Phenol index

Part 6: Fluoride

Part 7: Chromium (VI)

Part 8: Anionic surfactants

Part 9: Cyanide compounds

Testing methods for water quality by flow analysis— Part 7: Chromium(VI)

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of ISO 23913 published in 2006, with some of the technical contents modified so as to make them applicable to apparatuses, etc. used in Japan.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with explanations is given in Annex JC.

1 Scope

This Standard specifies the method for determination of chromium(VI) contained in industrial water, industrial wastewater, etc. by using the flow analysis by the di-phenylcarbazide absorption spectrophotometry. The method is also applicable to surface water, ground water, seepage water, etc.

It does not apply to samples with much suspended matter.

NOTE: The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 23913:2006 *Water quality – Determination of chromium (VI) – Method using flow analysis (FLA and CFA) and spectrometric detection (MOD)*

The symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21-1.

WARNING The reagents shall be handled with utmost attention, ensuring compliance with the relevant laws, ordinances, regulations and the like.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS K 0050 *General rules for chemical analysis*

JIS K 0094 *Sampling methods for industrial water and industrial wastewater*

JIS K 0101 *Testing methods for industrial water*

JIS K 0102 *Testing methods for industrial wastewater*

JIS K 0115	<i>General rules for molecular absorptiometric analysis</i>
JIS K 0126	<i>General rules for flow analysis</i>
JIS K 0211	<i>Technical terms for analytical chemistry (General part)</i>
JIS K 0215	<i>Technical terms for analytical chemistry (Analytical instrument part)</i>
JIS K 0557	<i>Water used for industrial water and wastewater analysis</i>
JIS K 8005	<i>Reference materials for volumetric analysis</i>
JIS K 8034	<i>Acetone (Reagent)</i>
JIS K 8102	<i>Ethanol (95) (Reagent)</i>
JIS K 8488	<i>1,5-Diphenylcarbonohydrazide (Reagent)</i>
JIS K 8838	<i>1-Propanol (Reagent)</i>
JIS K 8951	<i>Sulfuric acid (Reagent)</i>
JIS K 9005	<i>Phosphoric acid (Reagent)</i>
JIS R 3503	<i>Glass apparatus for chemical analysis</i>
JIS R 3505	<i>Volumetric glassware</i>

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS K 0101, JIS K 0102, JIS K 0115, JIS K 0126, JIS K 0211 and JIS K 0215 apply.

4 Common matters

4.1 General

The general matters common to the chemical analyses shall be in accordance with JIS K 0050. The general requirements relating to the flow analysis shall be in accordance with JIS K 0126.

4.2 Water

The water used in this Standard shall be the water of A3 or A4 specified in JIS K 0557.

4.3 Reagents

The reagents to be used shall be those specified in Japanese Industrial Standards and shall not be such that they impair the measurement. In the case of using reagents not specified in Japanese Industrial Standards, those reagents shall not be such that they impair the measurement. The reagent blank shall be periodically checked.

NOTE: The concentration indicated in parentheses at the rear of the designation of a reagent solution, except when it is a reference solution, is an approximate concentration.

4.4 Glassware

The glassware to be used, unless otherwise specified, shall be in accordance with JIS R 3503 and JIS R 3505.

5 Sample

5.1 Sampling

The sampling, sample container, water sampler and sampling operation shall be in accordance with JIS K 0094. For the sample container, a glass bottle with ground-in stopper shall be used.

5.2 Handling of sample

The test shall be carried out immediately after sampling. When this is not practicable, the sample shall be preserved in a cool and dark place.

6 Measurement

6.1 Principle

In the flow injection analysis (hereafter referred to as the "FIA"), the sample is injected in the carrier solution flowing continuously a capillary, mixed with the continuous flow of 1,5-diphenylcarbazide solution and made to react. In the continuous flow analysis (hereafter referred to as the "CFA"), the sample and 1,5-diphenylcarbazide solution are mixed in a capillary and made to react. The absorbance of the resultant reddish purple complex is measured at a wavelength in the vicinity of 540 nm to determine chromium(VI).

Range of determination Cr (VI) : 5 µg/L to 5 mg /L

NOTE: Though it differs depending on the apparatus and measuring conditions, repeatability of this method, expressed by relative standard deviation (%), is not more than 10 %.

6.2 Interferences

Substances which reduce or oxidize chromium (VI) will influence the test results. Molybdenum, mercury, vanadium and the like will also influence the test.

6.3 Classification of measuring methods and reagents and apparatus

6.3.1 Classification of measuring methods

Classification of measuring methods shall be in accordance with table 1.

Table 1 Classification of measuring methods

Classification of measuring method	Clause					
	Reagent and preparation of reagent solution	Apparatus	Measuring operation	Calculation of concentration	Expression of results	Test report
FIA method of di-phenylcarbazide colouring (3 flow channels)	6.3.2.1	6.3.2.2	6.4	7	8	9
FIA method of di-phenylcarbazide colouring (2 flow channels)	6.3.3.1	6.3.3.2				
CFA method of di-phenylcarbazide colouring	6.3.4.1	6.3.4.2				
NOTE: In Annex JA, as a reference example of FIA method of diphenylcarbazide colouring (2 flow channels), the FIA method by parallel measurement with the sample blank is described. In Annex JB, as a reference example of CFA method of diphenylcarbazide colouring, the CFA method by alcohol reduction-blank correction which incorporates the method of reduction of chromium(VI) to chromium (III) is described.						

6.3.2 FIA method of diphenylcarbazide colouring (3 flow channels)

6.3.2.1 Preparation of reagents and reagent solutions

6.3.2.1.1 Reagents

The reagents shall be as follows.

- 1,5- Diphenylcarbonohydrazide**, specified in **JIS K 8488**.
- Acetone**, specified in **JIS K 8034**.
- 1-Propanol**, specified in **JIS K 8838**.
- Sulfuric acid**, specified in **JIS K 8951**.
- Phosphoric acid**, specified in **JIS K 9005**.
- Potassium dichromate**, specified in **JIS K 8005**.

6.3.2.1.2 Preparation of reagent solutions

The reagent solutions shall be prepared as follows. The prepared solution shall be degassed as necessary.

- Carrier solution** Water is used.
- Diphenylcarbazide solution (1.72 g/L)** Dissolve 0.43 g of 1,5-diphenylcarbonohydrazide in 9 ml of acetone and 9 ml of 1-propanol. Add 125 ml of 1-propanol and add water to make the total volume 250 ml. When precipitation is produced, remove the precipitation by filtering the solution.

Preserve this solution in a brown bottle and in a cool and dark place.