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Chromium VI Analysis Revisited to Respond to Evolving Environmental Regulations

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Analytical & Measuring Instruments Division

Solutions COE

Today’s presentation

- **Background**
  - Introduction of chromium analysis and United States Environmental Protection Agency (EPA) methods
- **Experimental Conditions**
  - Instruments (Nexera™ lite inert) and analytical conditions
- **Results**
  - Quality control (QC) requirements in EPA method and experimental data

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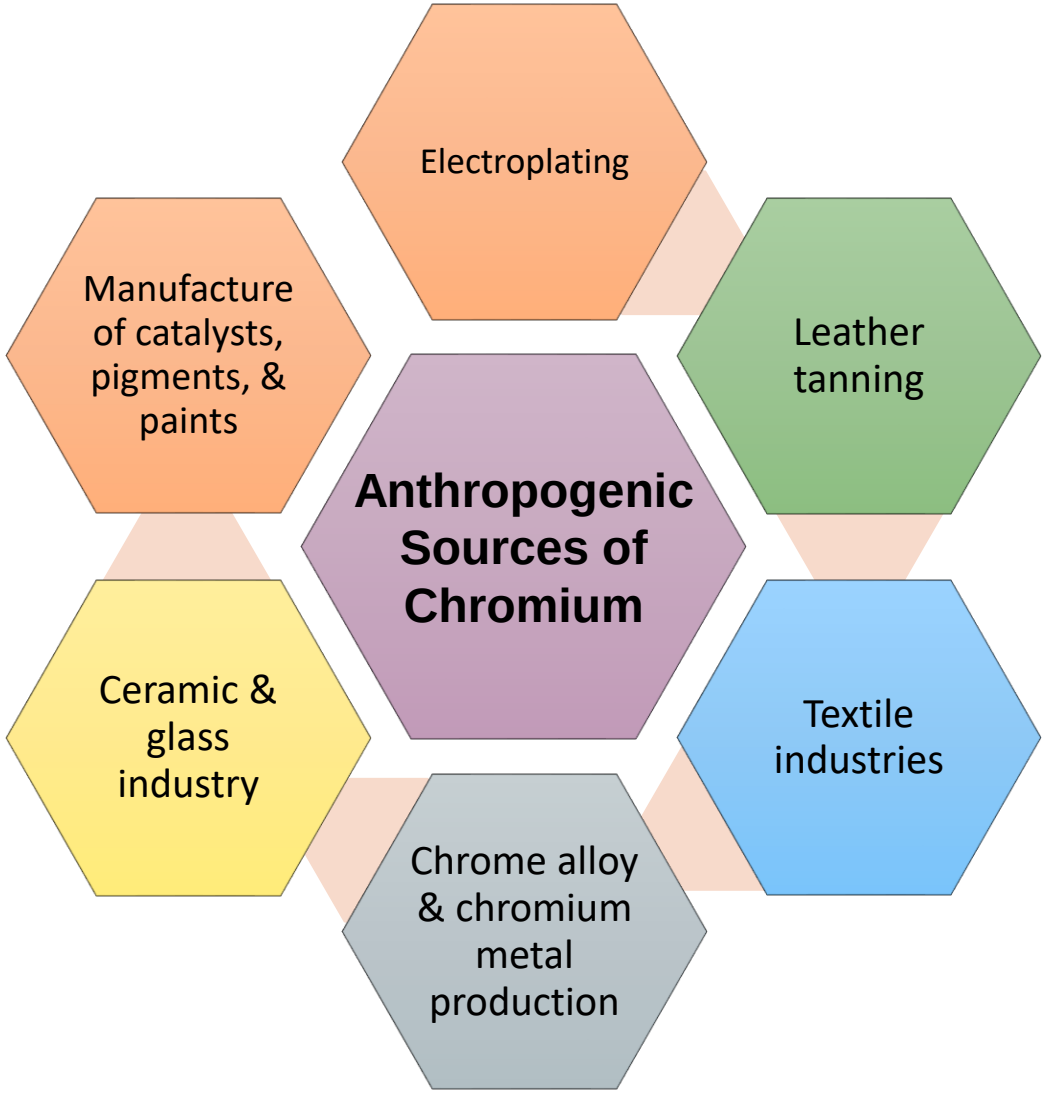
Why Chromium analysis is important?



- Cr is widely used in steelmaking, paints, etc.
- The most common forms of chromium: trivalent chromium (Cr Ⅲ), hexavalent chromium (Cr VI) and metallic chromium.
- The toxicity of Cr varies greatly depending on its valence.

  While Cr Ⅲ is non-toxic and essential for human health, Cr VI is highly toxic.
- Most of countries has established regulations and laws for public water.

Regulatory drivers for Cr VI analysis

- Total Cr is regulated in drinking water since 1942.
- In 1991, EPA set the maximum Contaminant Level (MCL) for total Cr at 100 µg/L.
- In July 2014, California adopted the first national standard for Cr VI in drinking water, setting MCL at 0.010 mg/L (invalidated in 2017).
- In April 2024, California added the MCL at 10 µg/L for Cr VI into the current regulation (MCL at 50 ug/L for Total Cr).

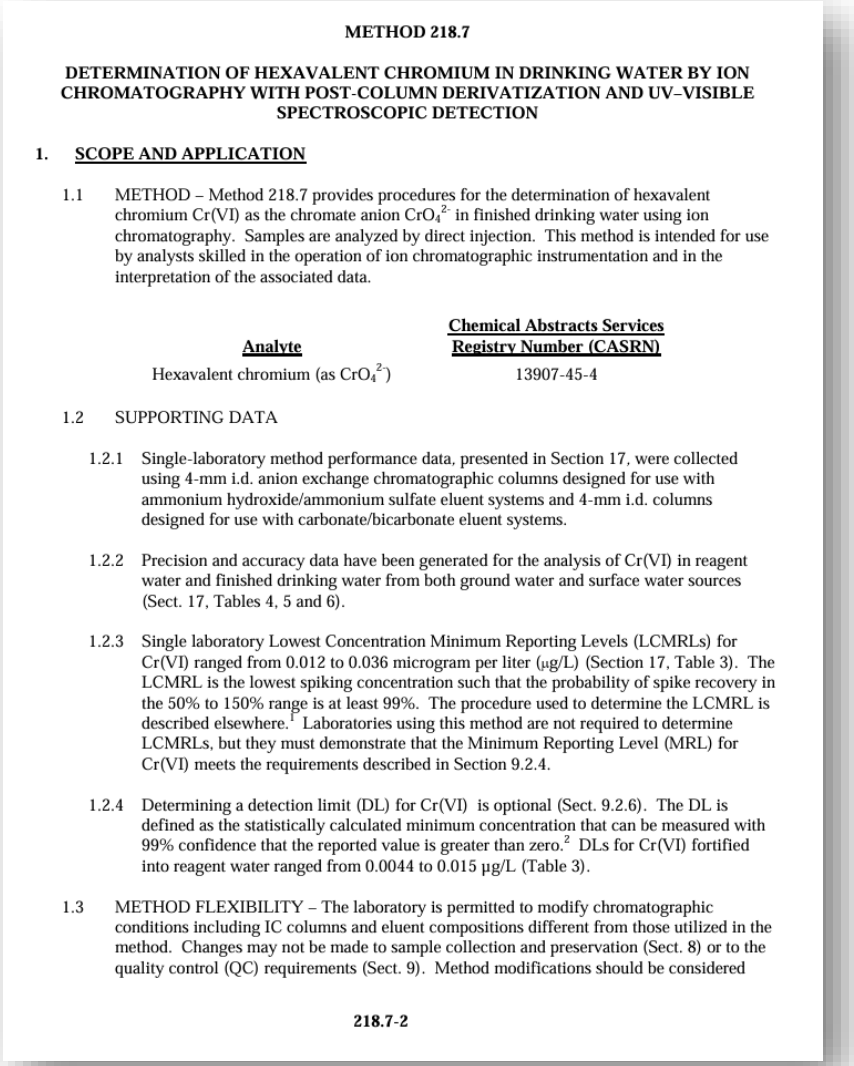
EPA method 218.7 outline

In EPA Method 218.7, Cr VI is separated by anion exchange column.

The colored complex formed between Cr VI and 1,5-diphenylcarbazide in the post column derivation is detected at 530 nm.

EPA 218.7 requires

- Low detection limit (DL) of Cr VI
  → from 0.0044 to 0.015 µg/L
- Large injection volume
  → usually 1 mL



METHOD 218.7

DETERMINATION OF HEXAVALENT CHROMIUM IN DRINKING WATER BY ION CHROMATOGRAPHY WITH POST-COLUMN DERIVATIZATION AND UV–VISIBLE SPECTROSCOPIC DETECTION

1. SCOPE AND APPLICATION

1.1 METHOD – Method 218.7 provides procedures for the determination of hexavalent chromium Cr(VI) as the chromate anion CrO_4^{2-} in finished drinking water using ion chromatography. Samples are analyzed by direct injection. This method is intended for use by analysts skilled in the operation of ion chromatographic instrumentation and in the interpretation of the associated data.

Analyte	Chemical Abstracts Services Registry Number (CASRN)
Hexavalent chromium (as CrO_4^{2-})	13907-45-4

1.2 SUPPORTING DATA

1.2.1 Single-laboratory method performance data, presented in Section 17, were collected using 4-mm i.d. anion exchange chromatographic columns designed for use with ammonium hydroxide/ammonium sulfate eluent systems and 4-mm i.d. columns designed for use with carbonate/bicarbonate eluent systems.

1.2.2 Precision and accuracy data have been generated for the analysis of Cr(VI) in reagent water and finished drinking water from both ground water and surface water sources (Sect. 17, Tables 4, 5 and 6).

1.2.3 Single laboratory Lowest Concentration Minimum Reporting Levels (LCMRLs) for Cr(VI) ranged from 0.012 to 0.036 microgram per liter (µg/L) (Section 17, Table 3). The LCMRL is the lowest spiking concentration such that the probability of spike recovery in the 50% to 150% range is at least 99%. The procedure used to determine the LCMRL is described elsewhere.[1] Laboratories using this method are not required to determine LCMRLs, but they must demonstrate that the Minimum Reporting Level (MRL) for Cr(VI) meets the requirements described in Section 9.2.4.

1.2.4 Determining a detection limit (DL) for Cr(VI) is optional (Sect. 9.2.6). The DL is defined as the statistically calculated minimum concentration that can be measured with 99% confidence that the reported value is greater than zero.[2] DLs for Cr(VI) fortified into reagent water ranged from 0.0044 to 0.015 µg/L (Table 3).

1.3 METHOD FLEXIBILITY – The laboratory is permitted to modify chromatographic conditions including IC columns and eluent compositions different from those utilized in the method. Changes may not be made to sample collection and preservation (Sect. 8) or to the quality control (QC) requirements (Sect. 9). Method modifications should be considered

218.7-2

Today's presentation

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Instruments for Cr Analysis

PARAMETER	INSTRUMENT	PROS	CONS
Total Chromium	Atomic Absorption	Low price Short analysis time	Other components cannot be analyzed simultaneously
	ICP-OES	Simultaneous analysis	High price
	ICP-MS	Simultaneous analysis High sensitivity	High price
Cr VI	UV-vis	Short analysis time	Complicated pretreatment
	IC	Low price	Other components cannot be analyzed simultaneously

Atomic Absorption

ICP-OES

ICP-MS

UV-vis

Ion chromatography

Instrument configuration

Ion Chromatograph is same as an inert LC without a suppressor

Suppressor is not required in EPA 218.7

6.5 ION CHROMATOGRAPHY SYSTEM WITH POST-COLUMN REACTOR

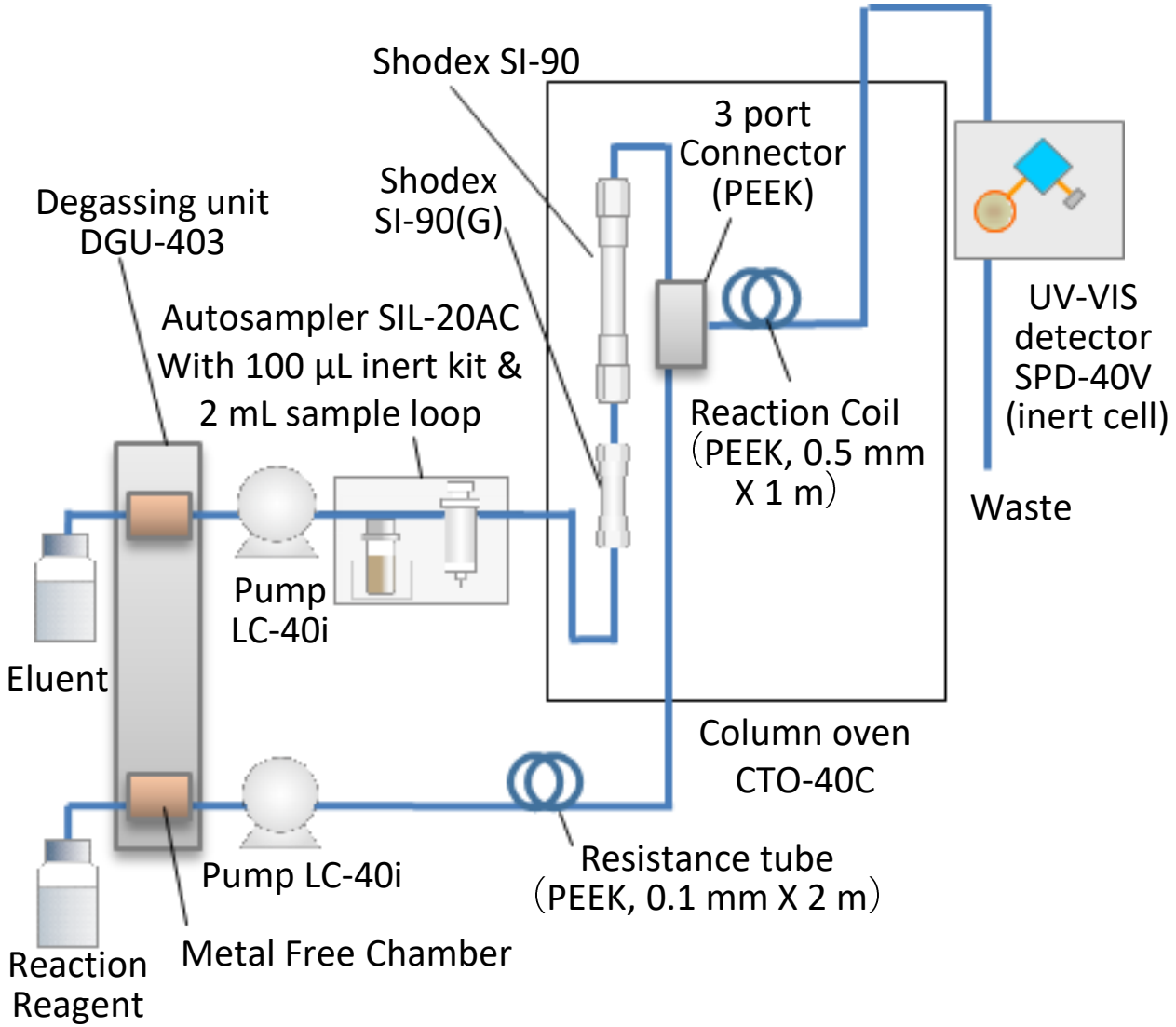
6.5.1 IC SYSTEM – An analytical system consisting of an autosampler, pump module with vacuum degassing option, sample loop, guard column, anion separator column, post-column reagent addition capability, post-column reaction coil, UV–Vis absorbance detector set to monitor a wavelength of 530 nm, and a data acquisition and management system. The system must not contain any metal parts in the sample, eluent and reagent flow paths.

1.3 METHOD FLEXIBILITY – The laboratory is permitted to modify chromatographic conditions including IC columns and eluent compositions different from those utilized in the method. Changes may not be made to sample collection and preservation (Sect. 8) or to the quality control (QC) requirements (Sect. 9). Method modifications should be considered

https://www.shimadzu.com/an/products/liquid-chromatography/hplc-system/nexera-lite-inert/index.html

Instrument configuration and flow path diagram

Shimadzu HPLC：	Nexera™ lite inert
System Controller：	CBM-40
Pump Unit：	LC-40i LC-40i
Degas Unit：	DGU-403
Autosampler：	SIL-20AC（inert）
Column Oven：	CTO-40C
Detector：	SPD-40V（inert cell）
Workstation：	LabSolutions LC/GC



Analytical conditions

Column	:	Shodex SI-90 (250 mm × 4.0 mm I.D., 9 µm)
Guard Column	:	Shodex SI-90(G) (10 mm × 4.6 mm I.D., 9 µm)
Eluent	:	50 mmol/L Ammonium sulfate 20 mmol/L Ammonium hydroxide
Eluent Flow Rate	:	0.8 mL/min
Post Column Reagents	:	2 mmol/L 1,5-diphenylcarbazide 10% Methanol 1 N Sulfuric acid
Post Column Reagents Flow rate	:	0.3 mL/min
Column temp.	:	45 °C
Injection volume	:	1000 µL
Vial	:	Shimadzu Vial, LC, 4 mL, Polypropylene
Detection	:	UV-VIS (530 nm, inert cell)
Reaction Coil	:	250 µL (1 m × 0.5 mm I.D.,(PEEK))

Analytical conditions

Column	:	Shodex SI-90 (250 mm × 4.0 mm I.D., 9 µm)
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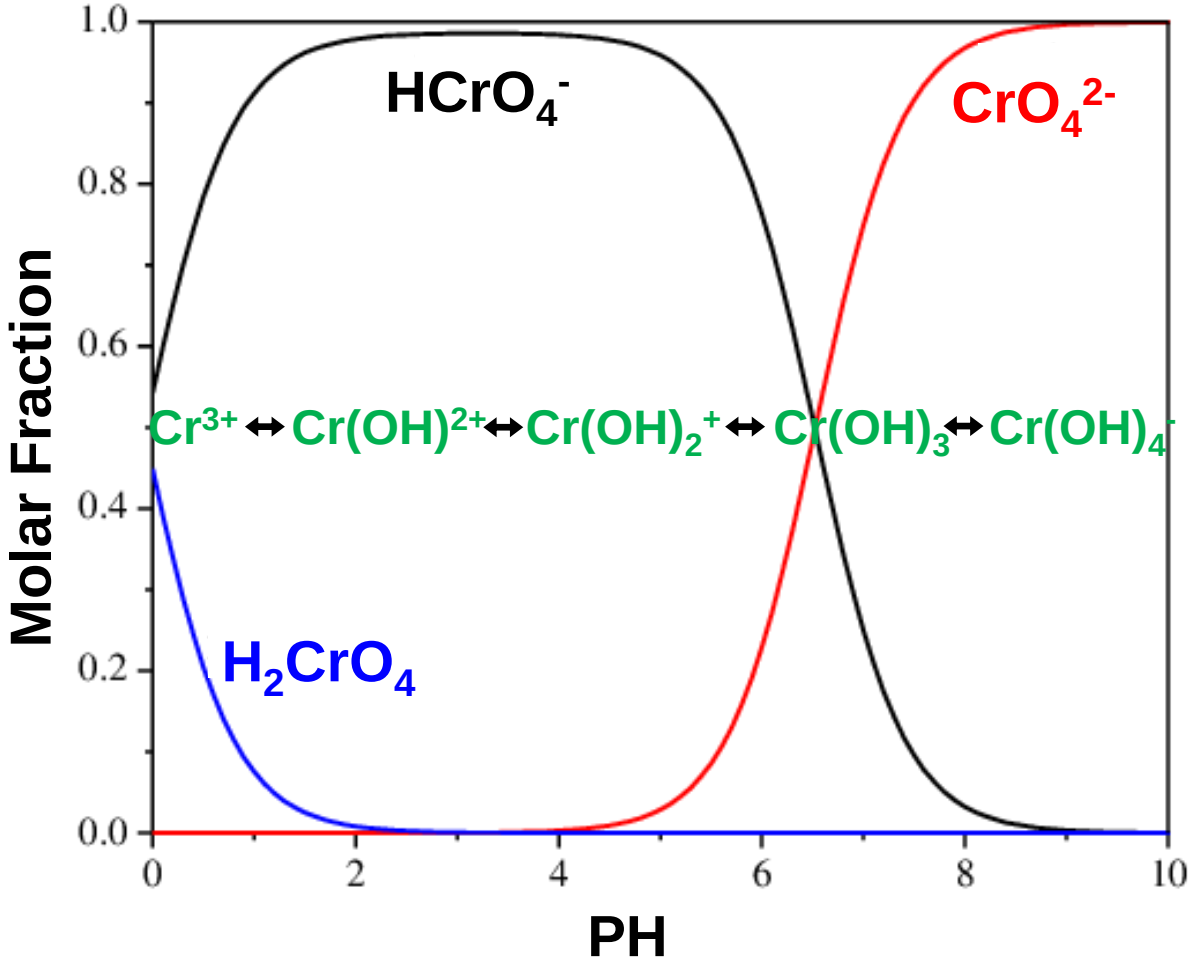
Chromium speciation as f(pH)



- Cr(III) typically exists as cationic aqua-hydroxo complexes
- Cr(VI) exists typically as an anionic chromate species
- Interconversion of Cr(III) & Cr(VI) depending on sample conditions (pH)

Today's presentation

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QC requirements of EPA method 218.7

TABLE 8. INITIAL DEMONSTRATION OF CAPABILITY (IDC) QUALITY CONTROL REQUIREMENTS

Method Reference	Requirement	Specification and Frequency	Acceptance Criteria
Section 9.2.1	Demonstration of low system background	Analyze an LRB after the high calibration standard during the IDC calibration.	Cr(VI) concentration is <1/3 of the MRL.
Section 9.2.2	Demonstration of precision	Analyze seven replicate Laboratory Fortified Blanks (LFBs) fortified near the midrange of the calibration curve.	Percent relative standard deviation must be ≤15%.
Section 9.2.3	Demonstration of accuracy	Calculate average recovery for replicates used in Section 9.2.2.	Mean recovery within ±15% of the true value.
Section 9.2.4	MRL confirmation	Fortify and analyze seven replicate LFBs at the chosen MRL concentration. Confirm that the Upper Prediction Interval of Results (PIR) and Lower PIR (Sect. 9.2.4.2) meet the recovery criteria.	Upper PIR ≤ 150% Lower PIR ≥ 50%
Section 9.2.5	Quality Control Sample (QCS)	Analyze mid-level QCS.	Cr(VI) must be within ±15% of the true value.

QC requirements of EPA method 218.7

TABLE 9. ONGOING QUALITY CONTROL REQUIREMENTS

Method Reference	Requirement	Specification and Frequency	Acceptance Criteria
Section 10.2	Initial calibration	Use the external standard calibration technique to generate a linear or quadratic calibration curve. Use at least six standard concentrations. Validate the calibration curve as described in Section 10.2.3.	When each calibration standard is calculated as an unknown using the regression equations, the lowest level standard should be within ±50% of the true value. All other points should be within ±15% of the true value.
Section 9.3.1	Laboratory Reagent Blank (LRB)	Analyze one LRB with each Analysis Batch.	Demonstrate that Cr(VI) is below ⅓ the Minimum Reporting Level (MRL), and that other sources of interference do not prevent identification and quantitation.
Section 10.3	Continuing Calibration Check (CCC)	Verify initial calibration by analyzing a low-level CCC at the beginning of each Analysis Batch. Subsequent CCCs are required after every 10 field samples and after the last field sample in a batch.	The lowest level CCC must be within ±50% of the true value. All other points must be within ±15% of the true value. Results for field samples that are not bracketed by acceptable CCCs are invalid.
Section 9.3.4	Laboratory Fortified Sample Matrix (LFSM)	Analyze one LFSM per Analysis Batch. Fortify the LFSM with Cr(VI) at a concentration greater than the native concentrations. Calculate LFSM recovery.	For LFSMs fortified at concentrations ≤2 x MRL, the result must be within ±50% of the true value. At concentrations greater than the 2 x MRL, the result must be within ±15% of the true value.
Section 9.3.5	Laboratory Fortified Sample Matrix Duplicate (LFSMD) or Laboratory Duplicate (LD)	Analyze at least one LFSMD or LD with each Analysis Batch.	For LFSMDs or LDs, relative percent differences must be ≤15%. (≤50% if concentration ≤2 x MRL.)
Section 9.3.6	Quality Control Sample (QCS)	Analyze mid-level QCS with each new calibration curve.	Cr(VI) must be ±15% of the true value.

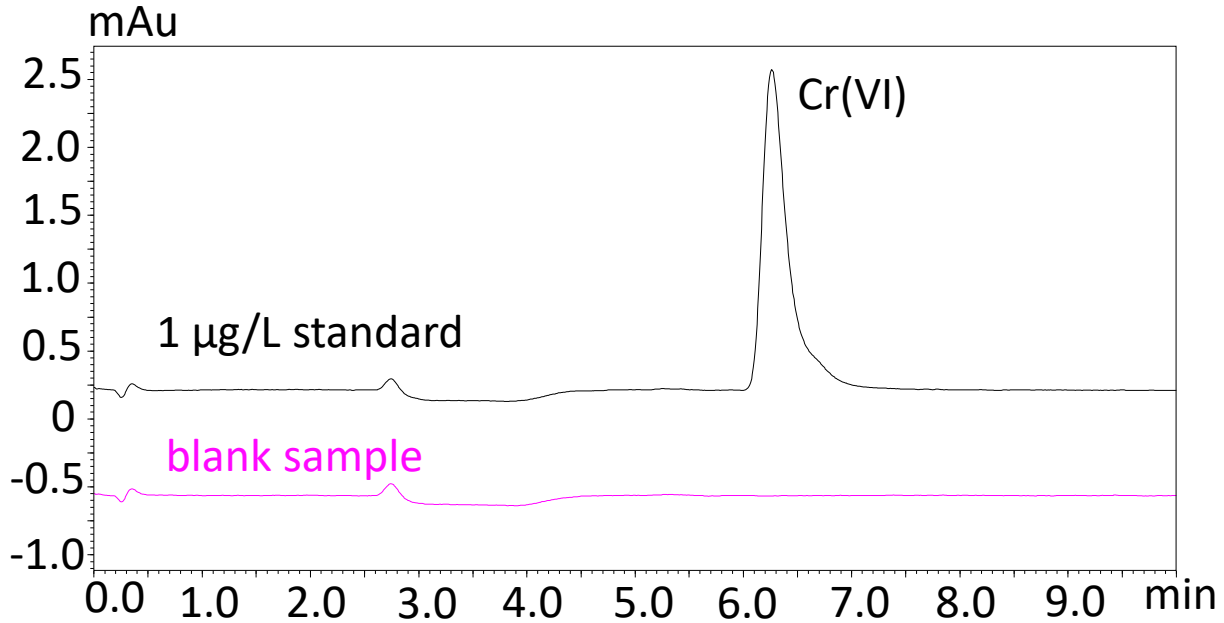
Sample preparation and elution time

Preparation of standard samples

- Diluting sodium chromate tetrahydrate with pure water (Analyte PDS).
- Prepare a series of calibration standards (6 levels) by diluting the Analyte PDS.
- To prevent reduction to Cr Ⅲ, pH control solution added to all samples, and pH was adjusted to greater than 8 with ammonium sulphate solution.

Elution time

- The elution time for Cr Ⅵ was about 6 min.



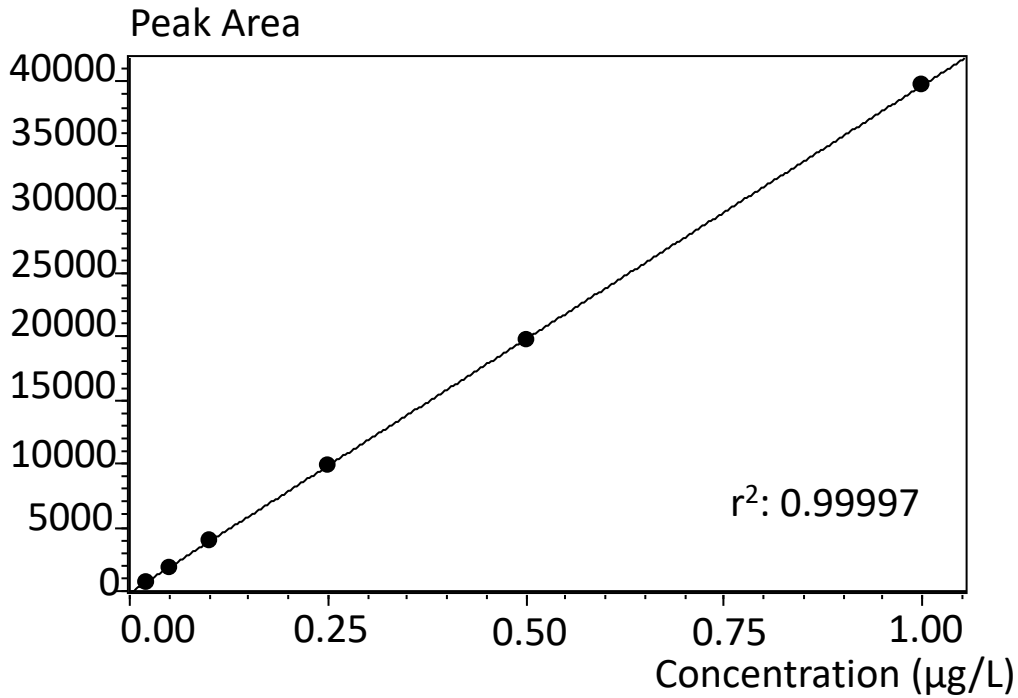
Chromatogram of 1 µg/L standard and blank sample

Initial calibration

- The calibration curve was created with 6 points between 0.02-1 µg/L.
- The coefficient of correlation (r^2) was 0.99997.

Results of calibrations

STD	Setting conc. (µg/L)	Peak area	Conc. (µg/L)
STD-1	0.02	529	0.0197
STD-2	0.05	1615	0.0472
STD-3	0.10	3845	0.1035
STD-4	0.25	9606	0.2491
STD-5	0.50	19571	0.5010
STD-6	1.00	39296	0.9995



Calibration curve

Laboratory duplicate

- Calculate the relative percent difference (RPD) for duplicate measurements (LD1 and LD2) using the equation: $$\mathrm{RPD} = \frac{|\mathrm{LD}_1 - \mathrm{LD}_2|}{(\mathrm{LD}_1 + \mathrm{LD}_2)/2} \times 100$$

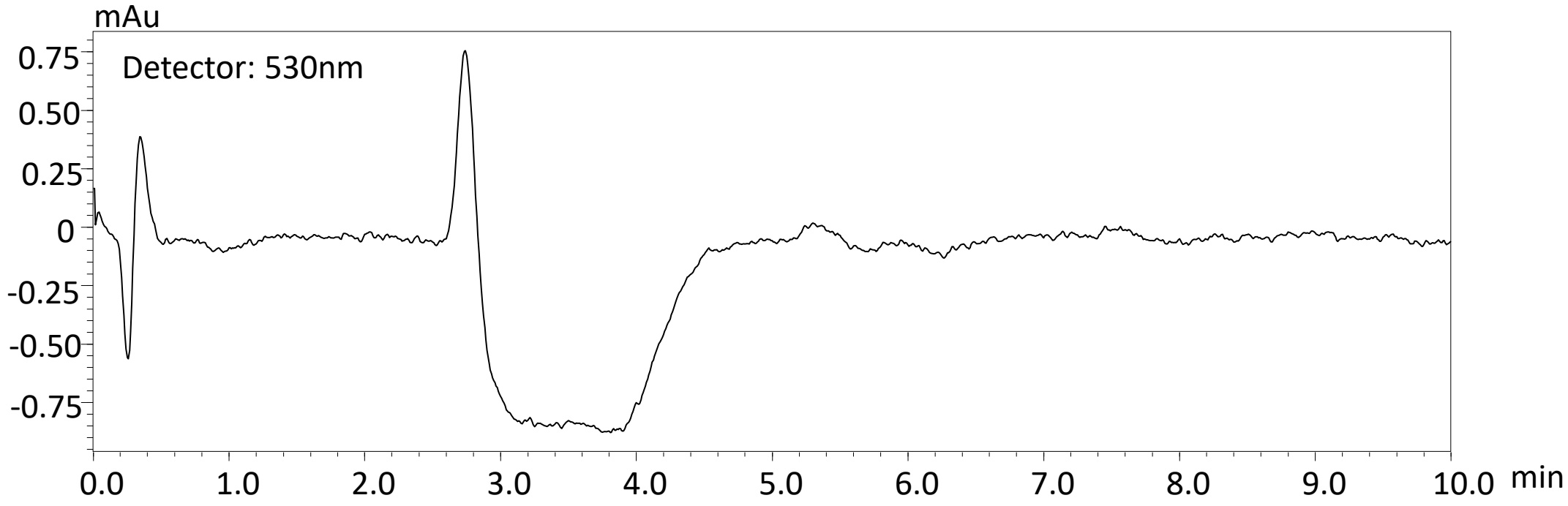
- EPA requirement: RPD must be ≤15%. (≤50% if concentration <2 x MRL.)

Laboratory duplicate measurements

STD	Setting conc. (µg/L)	Peak area 1	Peak area 2	Mean area	%RPD
STD-1	0.02	529	550	539.5	3.89
STD-2	0.05	1615	1565	1590	3.14
STD-3	0.1	3845	3718	3781.5	3.36
STD-4	0.25	9606	9821	9713.5	2.21
STD-5	0.5	19571	19380	19475.5	0.98
STD-6	1	39296	39738	39517	1.12

Demonstration of low system background

- A laboratory reagent blank (LRB) after the high calibration standard during the IDC calibration was analyzed
- Cr Ⅵ was N.D.



LRB result after calibration standards

Demonstration of precision and accuracy

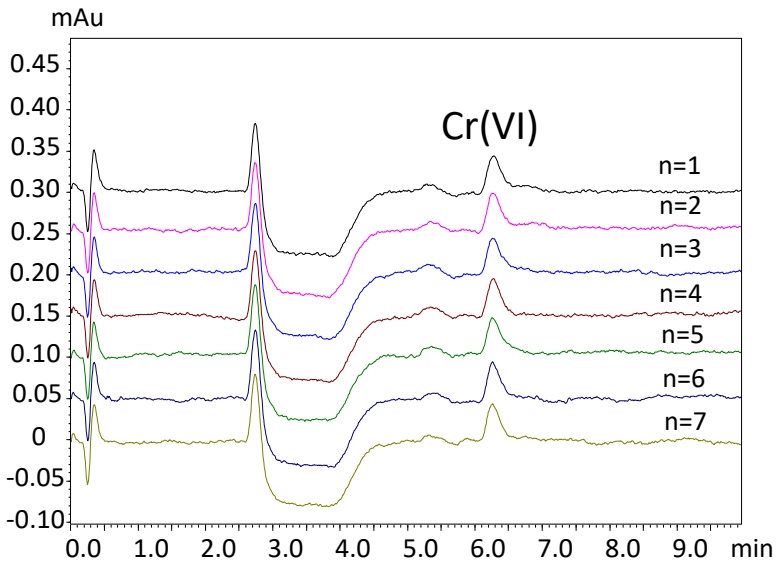
- Prepared 3 laboratory fortified blank (LFB) samples (0.02, 0.1, 1 µg/L) and analyzed 7 replicate LFBs
- EPA 218.7 requirements: Percent relative standard deviation (%RSD) must be ≦15%, mean recovery within ±15% of the true value

Recoveries and precision of area

Concentration of standards	0.02 µg/L	0.1 µg/L	1 µg/L
Mean measured value (µg/L)	0.0205	0.102	1.01
Mean recoveries of true value(%)	102.5	102.2	101.4
Area precision (%RSD)	4.93	2.66	0.51

Method detection limit (MDL) and quantitation limit

- MDL calculated as (t) x (S) after 7 replicated analyses of 0.02 µg/L Cr Ⅵ.
- MDL of 0.003 µg/L enables a LOQ of 0.009 µg/L for Cr Ⅵ, which is adequate for routine analysis at the California PHG of 0.02 µg/L.



Chromatograms of 7 replicated analyses of 0.02 µg/L

MDL calculation

MDL：0.003 µg/L

MDL=(t)×(s)
t=Student's t value for n-1 degrees of freedom at the 99% confidence level;
t = 3.143 for six degrees of freedom
s = standard deviation of the replicate analyses

7 replicated analyses of 0.02 µg/L standard

STD-1 (0.02 µg/L)	Conc. (µg/L)
n=1	0.0210
n=2	0.0213
n=3	0.0196
n=4	0.0221
n=5	0.0197
n=6	0.0204
n=7	0.0194
Ave	0.0205
SD	0.00094

Analysis examples of mineral water and tap water

- Following the procedure described in EPA method 218.7, 3 kinds of commercially available mineral water and tap water were analyzed.

Analytical results of samples

Sample	Mineral water A	Mineral water C	Mineral water S	Tap water
Mean measured value (µg/L)	<MDL	0.80	0.0095	0.021
Relative standard deviation (%RSD)		0.37	3.74	6.14

Fortified sample matrix test

- Low and high concentrations of Cr Ⅵ standard were added to samples, and 7 replicated analyses were measured.

- Mean recovery calculation followed by EPA Method 218.7.

$$\%R = \frac{(A - B)}{C} \times 100$$

where
A = measured concentration in the fortified sample,
B = measured concentration in the unfortified sample, and
C = fortification concentration.

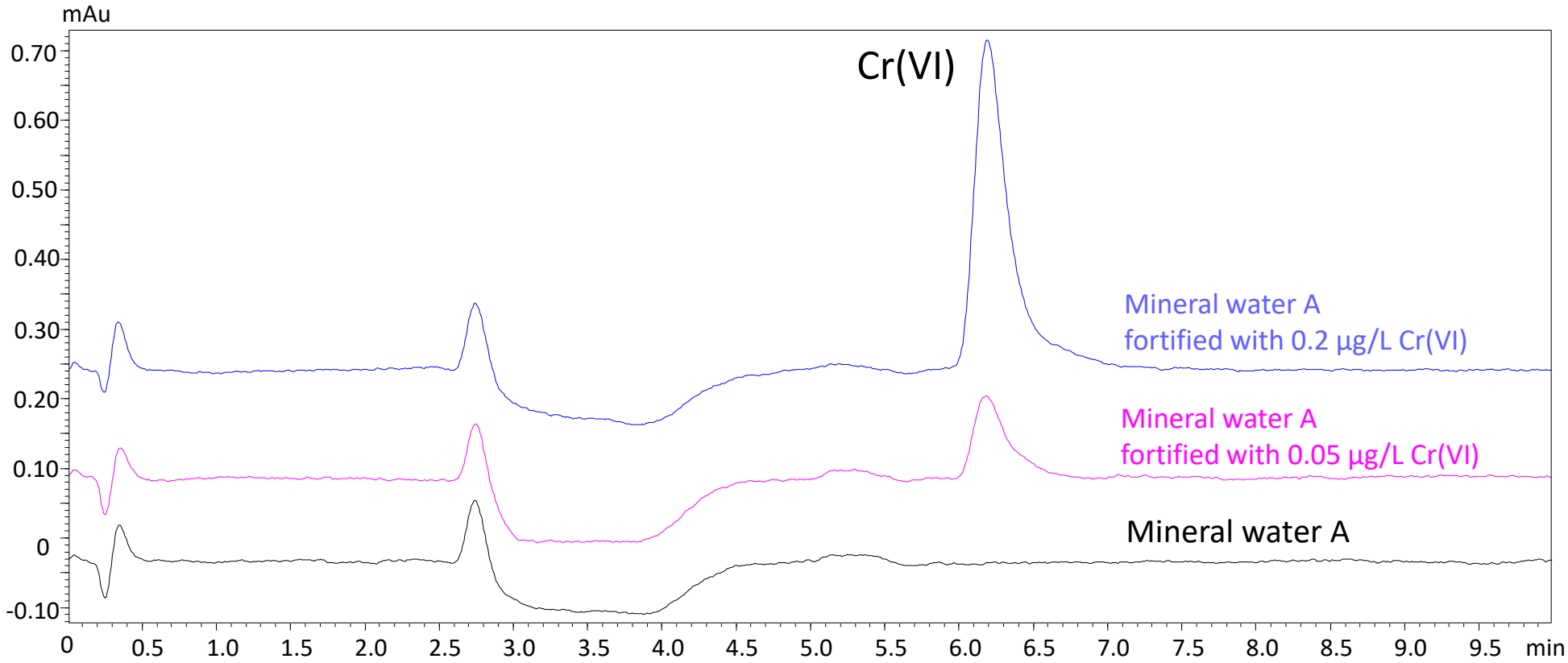
- EPA 218.7 requirement: %RSD must be ≦15%, mean recovery within ±15% of the true value)

Analytical results of fortified sample matrix test

Sample	Fortification (µg/L)	Concentration of unfortified sample (µg/L)	Mean measured value (µg/L)	Mean recovery (%)	%RSD
Mineral water A	0.05	<MDL	0.051	101.9	4.79
	0.2		0.20	101.5	0.95
Mineral water C	0.2	0.80	0.99	97.2	0.46
Mineral water S	0.05	0.0095	0.058	97.5	3.89
	0.2		0.21	97.9	4.68
Tap water	0.05	0.021	0.071	99.4	3.55
	0.2		0.22	101.7	0.85

Chromatograms of analysis and fortified sample

- Example chromatograms of the analysis results.

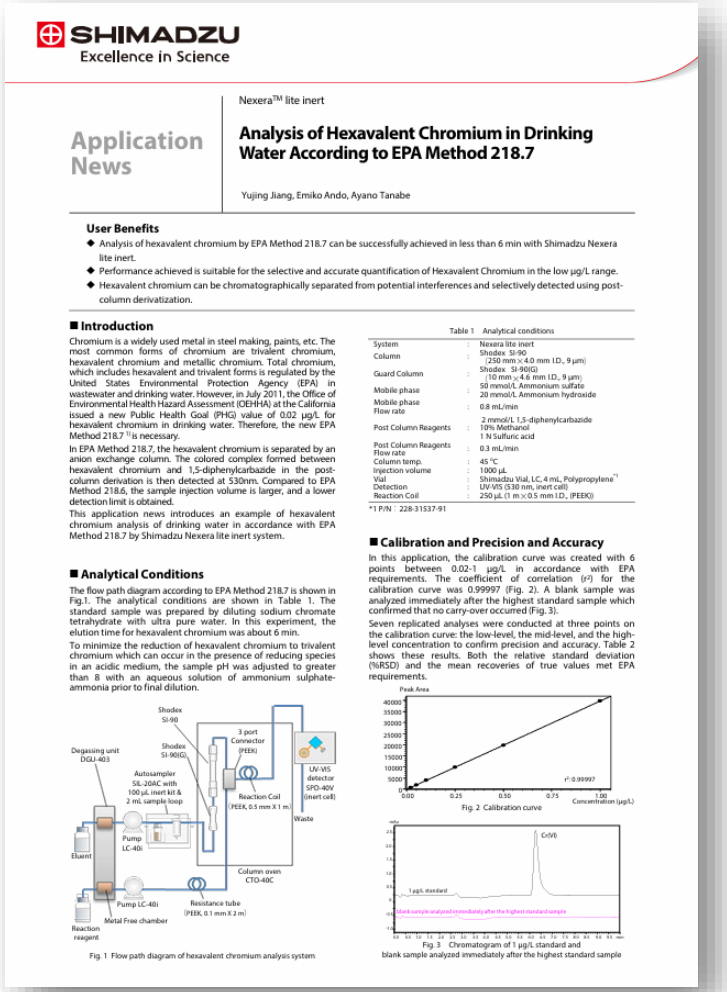


Chromatograms of mineral water A and
mineral water A fortified with 0.05 µg/L and 0.2 µg/L Cr Ⅵ standard

Summary

Requirement	Acceptance criteria	Results	
Demonstration of low system background	Cr Ⅵ concentration after high calibration standard <1/3 MRL	Cr Ⅵ was N.D..	**PASSED!**
Demonstration of precision	Percent relative standard deviation must be ≦15% (seven replicated)	3 LFB samples (0.02, 0.1, 1 µg/L) were analyzed. Percent relative standard deviation no more than 5%.	**PASSED!**
Demonstration of accuracy	Mean recovery within ±15% of the true value	3 LFB samples were analyzed. Recoveries were within 100~103%.	**PASSED!**
Quality Control Sample (QCS)	Concentration of mid-level QCS must be within ±15% of the true value	The recovery of mid-level QCS was 102.2%	**PASSED!**
Laboratory Fortified Sample Matrix (LFSM)	The recovery of LFSM must be within ±15% of the true value	All the recoveries of LFSM were within 97%~102%.	**PASSED!**
Laboratory Duplicate (LD)	For LDs, relative percent differences must be ≦15%	Each sample's relative percent differences no more than 4%.	**PASSED!**

Application news 01-00669



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Nexera™ lite inert

Application News

Analysis of Hexavalent Chromium in Drinking Water According to EPA Method 218.7

Yujing Jiang, Emiko Ando, Ayano Tanabe

User Benefits

- Analysis of hexavalent chromium by EPA Method 218.7 can be successfully achieved in less than 6 min with Shimadzu Nexera lite inert.
- Performance achieved is suitable for the selective and accurate quantification of Hexavalent Chromium in the low µg/L range.
- Hexavalent chromium can be chromatographically separated from potential interferences and selectively detected using post-column derivatization.

■ Introduction

Chromium is a widely used metal in steel making, paints, etc. The most common forms of chromium are trivalent chromium, hexavalent chromium and metallic chromium. Total chromium, which includes hexavalent and trivalent forms is regulated by the United States Environmental Protection Agency (EPA) in wastewater and drinking water. However, in July 2011, the Office of Environmental Health Hazard Assessment (OEHHA) at the California issued a new Public Health Goal (PHG) value of 0.02 µg/L for hexavalent chromium in drinking water. Therefore, the new EPA Method 218.7 [1] is necessary.

In EPA Method 218.7, the hexavalent chromium is separated by an anion exchange column. The colored complex formed between hexavalent chromium and 1,5-diphenylcarbazide in the post-column derivation is then detected at 530nm. Compared to EPA Method 218.6, the sample injection volume is larger, and a lower detection limit is obtained.

This application news introduces an example of hexavalent chromium analysis of drinking water in accordance with EPA Method 218.7 by Shimadzu Nexera lite inert system.

■ Analytical Conditions

The flow path diagram according to EPA Method 218.7 is shown in Fig.1. The analytical conditions are shown in Table 1. The standard sample was prepared by diluting sodium chromate tetrahydrate with ultra pure water. In this experiment, the elution time for hexavalent chromium was about 6 min.

To minimize the reduction of hexavalent chromium to trivalent chromium which can occur in the presence of reducing species in an acidic medium, the sample pH was adjusted to greater than 8 with an aqueous solution of ammonium sulphate-ammonia prior to final dilution.

Fig. 1 Flow path diagram of hexavalent chromium analysis system

Table 1 Analytical conditions

System	:	Nexera lite inert
Column	:	Shodex SI-90 (250 mm × 4.0 mm I.D., 9 µm)
Guard Column	:	Shodex SI-90(G) (10 mm × 4.6 mm I.D., 9 µm)
Mobile phase	:	50 mmol/L Ammonium sulfate
Mobile phase	:	20 mmol/L Ammonium hydroxide
Flow rate	:	0.8 mL/min
Post Column Reagents	:	2 mmol/L 1,5-diphenylcarbazide 10% Methanol 1 N Sulfuric acid
Post Column Reagents Flow rate	:	0.3 mL/min
Column temp.	:	45 °C
Injection volume	:	1000 µL
Vial	:	Shimadzu Vial, LC, 4 mL, Polypropylene *1
Detection	:	UV-VIS (530 nm, inert cell)
Reaction Coil	:	250 µL (1 m × 0.5 mm I.D., (PEEK))

*1 P/N : 228-31537-91

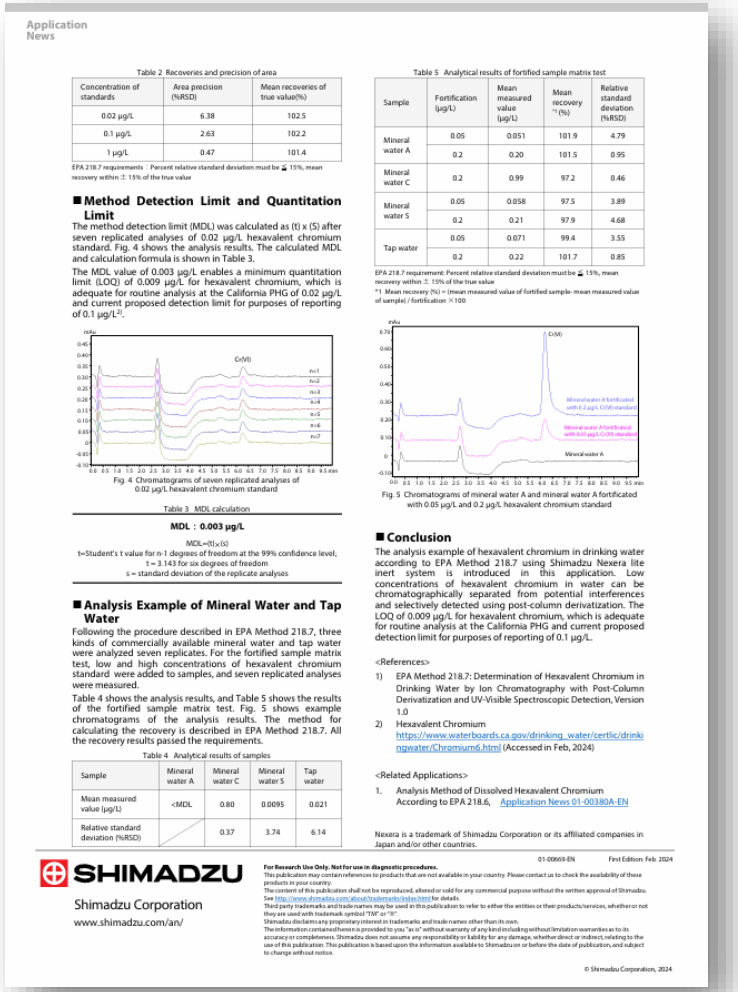
■ Calibration and Precision and Accuracy

In this application, the calibration curve was created with 6 points between 0.02-1 µg/L in accordance with EPA requirements. The coefficient of correlation (r^2) for the calibration curve was 0.99997 (Fig. 2). A blank sample was analyzed immediately after the highest standard sample which confirmed that no carry-over occurred (Fig. 3).

Seven replicated analyses were conducted at three points on the calibration curve: the low-level, the mid-level, and the high-level concentration to confirm precision and accuracy. Table 2 shows these results. Both the relative standard deviation (%RSD) and the mean recoveries of true values met EPA requirements.

Fig. 2 Calibration curve

Fig. 3 Chromatogram of 1 µg/L standard and blank sample analyzed immediately after the highest standard sample



Application News

Table 2 Recoveries and precision of area

Concentration of standards	Area precision (%RSD)	Mean recoveries of true value(%)
0.02 µg/L	6.38	102.5
0.1 µg/L	2.63	102.2
1 µg/L	0.47	101.4

EPA 218.7 requirements : Percent relative standard deviation must be ≦ 15%, mean recovery within ± 15% of the true value

■ Method Detection Limit and Quantitation Limit

The method detection limit (MDL) was calculated as (t) x (S) after seven replicated analyses of 0.02 µg/L hexavalent chromium standard. Fig. 4 shows the analysis results. The calculated MDL and calculation formula is shown in Table 3.

The MDL value of 0.003 µg/L enables a minimum quantitation limit (LOQ) of 0.009 µg/L for hexavalent chromium, which is adequate for routine analysis at the California PHG of 0.02 µg/L and current proposed detection limit for purposes of reporting of 0.1 µg/L[2].

Fig. 4 Chromatograms of seven replicated analyses of 0.02 µg/L hexavalent chromium standard

Table 3 MDL calculation

MDL : 0.003 µg/L

MDL=(t)×(s)

t=Student's t value for n-1 degrees of freedom at the 99% confidence level; t = 3.143 for six degrees of freedom

s = standard deviation of the replicate analyses

■ Analysis Example of Mineral Water and Tap Water

Following the procedure described in EPA Method 218.7, three kinds of commercially available mineral water and tap water were analyzed seven replicates. For the fortified sample matrix test, low and high concentrations of hexavalent chromium standard were added to samples, and seven replicated analyses were measured.

Table 4 shows the analysis results, and Table 5 shows the results of the fortified sample matrix test. Fig. 5 shows example chromatograms of the analysis results. The method for calculating the recovery is described in EPA Method 218.7. All the recovery results passed the requirements.

Table 4 Analytical results of samples

Sample	Mineral water A	Mineral water C	Mineral water S	Tap water
Mean measured value (µg/L)	<MDL	0.80	0.0095	0.021
Relative standard deviation (%RSD)		0.37	3.74	6.14

Table 5 Analytical results of fortified sample matrix test

Sample	Fortification (µg/L)	Mean measured value (µg/L)	Mean recovery *1 (%)	Relative standard deviation (%RSD)
Mineral water A	0.05	0.051	101.9	4.79
	0.2	0.20	101.5	0.95
Mineral water C	0.2	0.99	97.2	0.46
Mineral water S	0.05	0.058	97.5	3.89
	0.2	0.21	97.9	4.68
Tap water	0.05	0.071	99.4	3.55
	0.2	0.22	101.7	0.85

EPA 218.7 requirement: Percent relative standard deviation must be ≦ 15%, mean recovery within ± 15% of the true value

*1 Mean recovery (%) = (mean measured value of fortified sample-mean measured value of sample) / fortification ×100

Fig. 5 Chromatograms of mineral water A and mineral water A fortificated with 0.05 µg/L and 0.2 µg/L hexavalent chromium standard

■ Conclusion

The analysis example of hexavalent chromium in drinking water according to EPA Method 218.7 using Shimadzu Nexera lite inert system is introduced in this application. Low concentrations of hexavalent chromium in water can be chromatographically separated from potential interferences and selectively detected using post-column derivatization. The LOQ of 0.009 µg/L for hexavalent chromium, which is adequate for routine analysis at the California PHG and current proposed detection limit for purposes of reporting of 0.1 µg/L.

<References>

1) EPA Method 218.7: Determination of Hexavalent Chromium in Drinking Water by Ion Chromatography with Post-Column Derivatization and UV-Visible Spectroscopic Detection, Version 1.0
2) Hexavalent Chromium https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.html (Accessed in Feb, 2024)

<Related Applications>

1. Analysis Method of Dissolved Hexavalent Chromium According to EPA 218.6, Application News 01-00380A-EN

01-00669-EN First Edition: Feb. 2024

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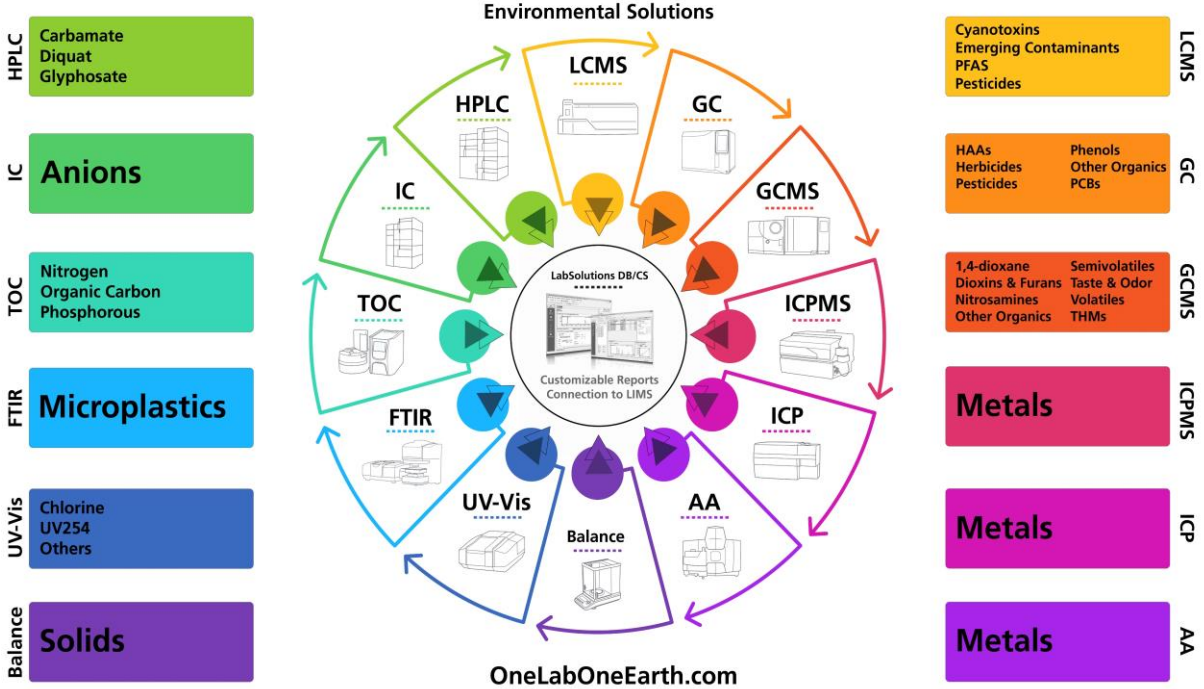

Thank you for your attention!

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