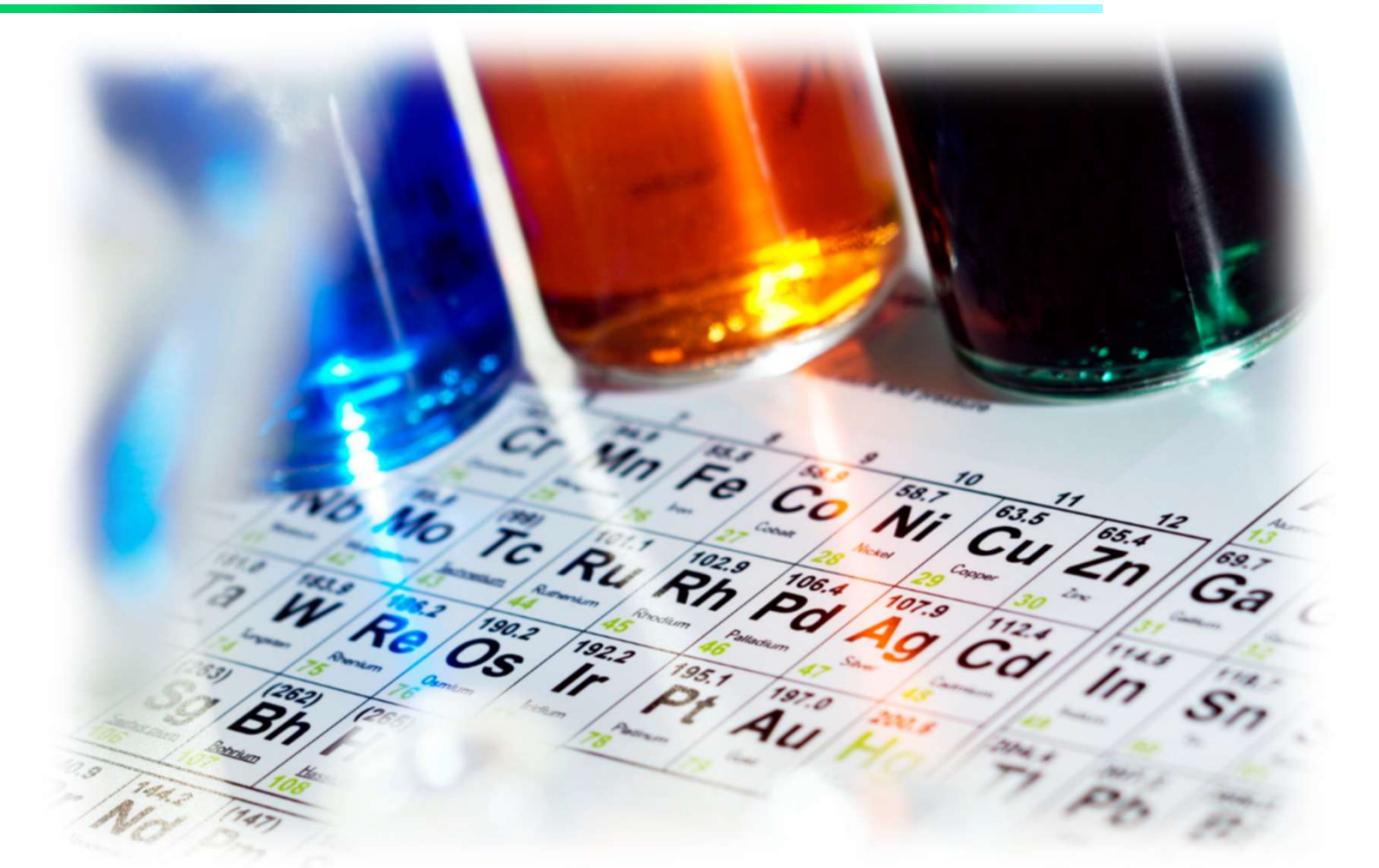


Elemental (Metal) Standard Solution

Ver.2024

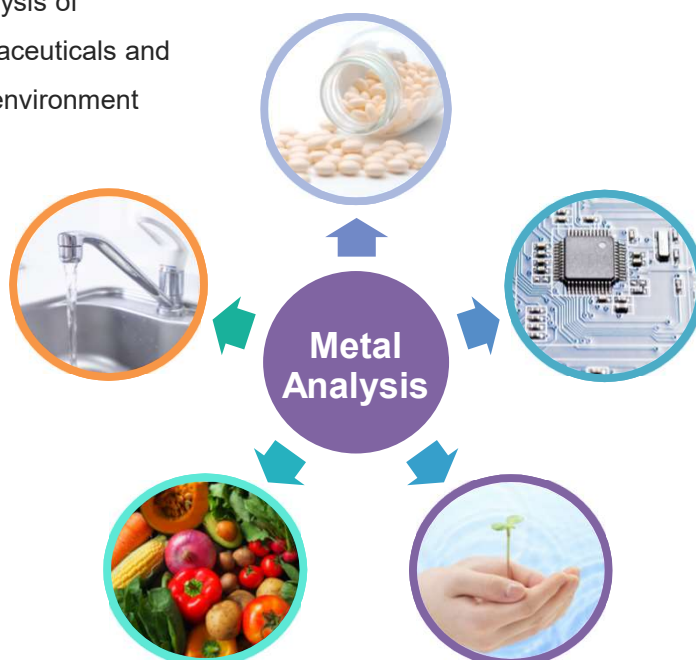
Single Elemental Standard Solutions
for Atomic Absorption Spectrometry (AAS), for ICP Analysis
Multi-elemental Mixture Standard Solutions
SPE Columns for Elemental Capture and Recovery
High Purity Acids



FUJIFILM Wako Pure Chemical Corporation

Introduction

Elemental (metal) analysis is performed in a wide range of fields, including the analysis of, ultra-trace elemental analysis of semiconductor materials, residual metals in pharmaceuticals and biological samples, and analysis of foods and the environment (water, waterways, soil, etc.).



Fujifilm Wako has a wide variety of elemental standard solutions used to create calibration curves for Atomic Absorption Spectrometry (AAS) and ICP analysis, which can be used for different purposes.

Flow of Metal Analysis

Step 1

Sample preparation

High purity acid

High purity acids with minimal particles and elemental impurities. Fujifilm Wako has a lineup of products by grade that are suited to different purposes.

Step 2

Trace analysis

Elemental standard solution

Fujifilm Wako supplies standard solutions used to create calibration curves for AAS, ICP luminescence, ICP-MS analysis, etc.

Contents

1 Elemental (Metal) Analysis Overview

Elemental (Metal) Analysis Method Types	• • • • 2
Selection Guide for Elemental (Metal) Standard Solutions	• • • • 3
Precautions When Preparing Mixture Standard Solutions	• • • • 5

2 Standard Solution Product List

Single Elemental Standard Solutions

- for Atomic Absorption Spectrometry (AAS)	• • • • 6
- JCSS (Japan Calibration Service System)	• • • • 7
- for ICP Analysis	• • • • 9

Multi-elemental Mixture Standard Solutions

- Multi-element Standard Solutions for ICP Analysis	• • • • 1 2
- Multi-element Mixture Standard Solution for ICH Q3D	• • • • 1 3
- Search System for Multi-Element Standard Solutions	• • • • 1 3

3 Related Products

Presep® PolyChelate	• • • • 1 4
High Purity Acids	• • • • 1 6
Search System for Multi-Element (Metal) Standard Solutions	• • • • 1 8

Elemental (Metal) Analysis

Elemental (Metal) Analysis Method Types

Elemental (metal) analysis mainly uses instrumental analysis methods, but even within the category of instrumental analysis methods, there are various methods. The three main methods used for trace elemental (metal) analysis are as follows.

ICP-OES (Inductively coupled plasma optical emission spectroscopy)

When a sample solution in a mist form is introduced into argon plasma generated by high-frequency induction, the elements (atoms) in the sample are excited. When the excited elements return to their ground state, they emit a wavelength (light) peculiar to the element. This wavelength (light) and the intensity of the wavelength are used to qualify and quantify the elements.

ICP-MS (inductively coupled plasma mass spectrometry)

When a sample solution in a mist form is introduced into argon plasma generated by high-frequency induction, the elements in the sample are ionized. These ions are separated and detected using a mass spectrometer (MS).

AAS (Atomic Absorption Spectroscopy)

When a sample solution is heated at high temperature to atomize the element, and light of a wavelength peculiar to the element is passed through it, the atoms in the ground state absorb the light and become excited. Quantify is performed based on the absorption (absorbance) of light at this time.

Each analytical method has the following features.

	ICP-OES	ICP-MS	AAS
Sensitivity	ppb - %	ppt - ppm	ppb – ppm (Frame) ppt – ppb (Furnace)
Dynamic Range	5 digits	5 digits	2 digits
Multi-elemental Simultaneous Analysis	✓	✓	-
Rare Earth Analysis (Zr, Ta, P, B)	✓	✓	Some elements cannot be measured

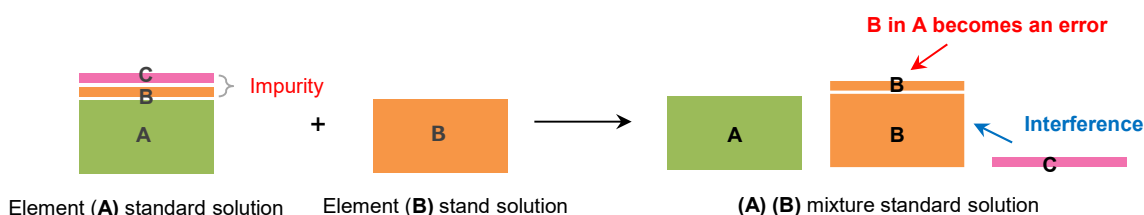
Selection Guide for Elemental (Metal) Standard Solutions

Standard solutions for metal analysis are sold according to the grade of each instrumental analysis method (ICP, AAS, etc.), and there are three points to consider when selecting a standard solution.

1. Check the guarantee of impurity elements

It is important to confirm that the elemental standard solution does not contain any impurity elements. This is an example of how to make a mixture standard solution by mixing element (A) standard solution and element (B) standard solution. Suppose that element A standard solution contains impurity elements (B) and (C) in addition to the element (A). When it becomes a (A) (B) mixture standard solution, the impurity element (B) in element (A) standard solution will appear as an “error” in the concentration of element (B). In addition, due to the influence of the impurity elements (B) and (C), there is a possibility that “interference” will occur, which did not occur when using element A standard solution alone.

Example 1: Effect of impurity elements



2. Check the raw materials

It is also important to confirm what kind of raw materials are used. In some cases, elements other than the element to be measured may be contained in the raw materials. As an example, when we compare our silicon standard solution for ICP analysis uses SiO_2 as a raw material, whereas the silicon standard solution for ASS analysis uses Na_2SiO_3 as a raw material, which contains sodium other than silicon.

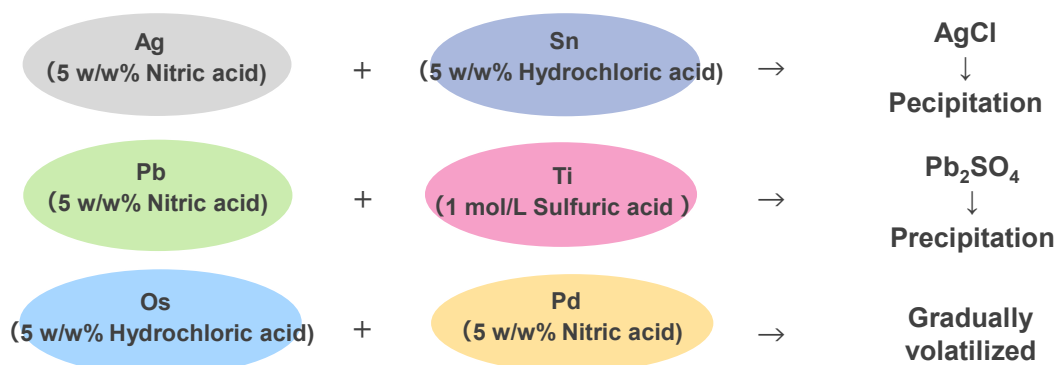
Example 2. Silicon standard solution (Si 1000)

	for ICP analysis	for AAS analysis
Raw materials	SiO_2	Na_2SiO_3

3. Check the compatibility and liquidity of the standard solution when mixing.

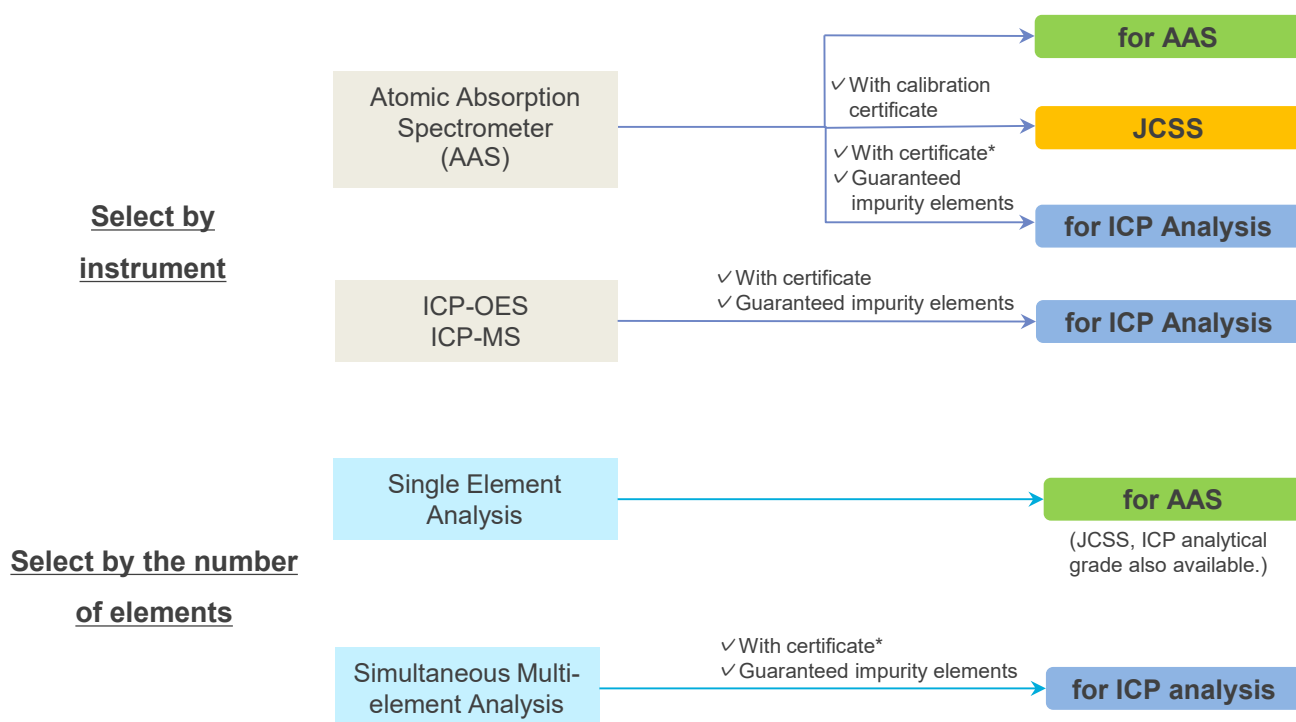
Depending on the type of elemental standard solution, there are combinations that may cause precipitation or volatilization when mixed. Check the type of acid used in the standard solutions to be mixed. Please prepare the elemental standard solutions that may cause precipitation or volatility separately. Also, there are differences in the liquid properties of the standard solutions depending on the element (metal). When using a mixture of standard solutions, it is necessary to check the liquid properties of the single-element standard solution and prepare the standard solutions separately with different liquid properties or prepare standard solutions with the same liquid properties.

Example 3. Combination of standard solutions that precipitate, volatilize, etc. when mixed



Selection Guide for Elemental (Metal) Standard Solutions

Fujifilm Wako's metal standard solutions are available in three series according to instrumental analysis methods. Select the one that suits your analytical instrument and the number of elements.



* Only some products

	for AAS	JCSS	for ICP analysis
Analysis method	- Titration - Gravimetric method	- Titration - Ion chromatography	- Titration - Ion chromatography - ICP-OES
Guarantee of impurity elements	-	-	- Guaranteed ppb order impurity elements using ICP-MS
Attachment	-	- Calibration certificate	- Certificate* - Wako product manual (with information of impurity elements)
Features	-	- Calibration by public institution (CERI) - Ensured SI traceability (CRM)	- Guarantee of impurity elements - Ensured SI traceability (CRM)*

* Only some products

Precautions When Preparing Mixture Standard Solutions

When preparing the single / multi element standard solution, the concentration may deviate from exact concentration due to various factors. Some of the factors are introduced below.

Item	Possible factors
Contamination from water and acids used for dilution	▶ Use of reagents without elemental impurity guarantee
Contamination from laboratory equipment	▶ Elution of contaminants from resin and glass contained in containers
Mistakes during experimental work	▶ Mistakes in dilution calculations, reagent mix-up, incorrect reagent injection volume
Contamination from the experimental environment	▶ Contamination in clean draft
Decreased concentration due to precipitation	▶ Precipitation due to acid and alkali liquid properties, elemental ions and certain acids
Interference ion	▶ Isobaric ions, adduct ions, polyatomic ion interference, etc.

Elemental concentration decreases due to precipitation are generally incompatible with the following elements and acids.

Precipitation in solution by combination of elements and acids

↓ : Precipitation

	NH ₄ ⁺	K ⁺	Ca ²⁺	Na ⁺	Mg ²⁺	Al ³⁺	Zn ²⁺	Fe ²⁺	Fe ³⁺	Ni ²⁺	Sn ²⁺	Pb ²⁺	Cu ²⁺	Hg ²⁺	Hg ₂ ²⁺	Ag ⁺
Cl ⁻	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	↓	✓	✓	↓	↓
CO ₃ ²⁻	✓	✓	↓	✓	↓		↓					↓	↓	↓		↓
NO ₃ ⁻	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OH ⁻	✓	✓	(✓)	✓	(↓)	↓	↓	↓	↓	↓	↓	↓	↓	↓		↓ (Ag ₂ O)
S ²⁻	Acidic	✓	✓	✓	✓	✓	✓	✓		✓	↓	↓	↓	↓		↓
	Neutral to basic	✓	✓	✓	✓	↓	↓	↓		↓	↓	↓	↓	↓		↓
SO ₄ ²⁻	✓	✓	↓	✓	✓	✓	✓	✓	✓	✓		↓	✓			(✓)

*Above list may not apply in all cases.

Main precipitation and color

Carbonate	CaCO ₃ (White), MgCO ₃ (White), BaCO ₃ (White)
Chromate	BaCrO ₄ (Yellow), PbCrO ₄ (Yellow), Ag ₂ CrO ₄ (Reddish brown)
Halide	CaF ₂ (White), AgCl (White), PbCl ₂ (White), AgBr (Light yellow), AgI (Yellow)
Hydroxide	Al(OH) ₃ (White), Fe(OH) ₂ (Light green), Fe(OH) ₃ (Reddish brown), Cu(OH) ₂ (Blue and white), Cr(OH) ₃ (Grayish green), Ni(OH) ₂ (Green)
Oxide	Al ₂ O ₃ (White), ZnO (White), MnO ₂ (Black), Ag ₂ O (Dark brown), FeO (Black), Fe ₂ O ₃ (Reddish brown), Fe ₃ O ₄ (Black), CuO (Black), Cu ₂ O (Reddish brown)
Sulfate	CaSO ₄ (White), SrSO ₄ (White), BaSO ₄ (White), PbSO ₄ (White)
Sulfide	CuS (Black), Ag ₂ S (Black), PbS (Black), ZnS (White), MnS (Light pink), SnS (Brown), CdS (Yellow)

Fujifilm Wako has a range of elemental (metal) standard solutions that can be used for atomic absorption analysis (AAS).

Li	Be	for AAS										B	C	N	O	F	Ne
Na	Mg	21 elements line up										Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra																
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
		Ac	Th	Pa	U												

-6-

Code No.	Element	Product Name	Composition	Concentration (mg/L)	Volume (mL)
191-18691	Ag	Silver Standard Solution	AgNO ₃ in 0.5w/w% HNO ₃	1,000	100
016-15471	Al	Aluminium Standard Solution	Al(NO ₃) ₃ in 0.5 mol/L HNO ₃	1,000	100
013-15501	As	Arsenic Standard Solution	As ₂ O ₃ and NaOH in water pH 5.0 with HCl	100	100
013-15481				1,000	100
025-16581	B	Boron Standard Solution	H ₃ BO ₃ in water	1,000	100
027-15321	Ba	Barium Standard Solution	BaCO ₃ in 0.1 mol/L HNO ₃	1,000	100
021-12661	Bi	Bismuth Standard Solution	Bi(NO ₃) ₃ in 0.5 mol/L HNO ₃	1,000	100
039-16161	Ca	Calcium Standard Solution	CaCO ₃ in 0.1 mol/L HNO ₃	1,000	100
030-16211	Cd	Cadmium Standard Solution	Cd(NO ₃) ₂ in 0.1 mol/L HNO ₃	100	100
036-16171				1,000	100
033-16181	Co	Cobalt Standard Solution	Co(NO ₃) ₂ in 0.1 mol/L HNO ₃	1,000	100
037-16221	Cr	Chromium Standard Solution	K ₂ Cr ₂ O ₇ in 0.1 mol/L HNO ₃	100	100
030-16191				1,000	100
030-21341	Cs	Cesium Standard Solution	CsCl in water	1,000	100
034-16231	Cu	Copper Standard Solution	Cu(NO ₃) ₂ in 0.1 mol/L HNO ₃	100	100
033-16201				1,000	100
091-03851	Fe	Iron Standard Solution	Fe(NO ₃) ₃ in 0.1 mol/L HNO ₃	100	100
094-03841				1,000	100
070-05781	Ga	Gallium Standard Solution	Ga in 0.5 mol/L HNO ₃	1,000	100
135-13671	Hg	Mercury Standard Solution	HgCl ₂ in 0.1 mol/L HNO ₃	100	100
138-13661				1,000	100
092-05841	In	Indium Standard Solution	In in 0.5 mol/L HNO ₃	1,000	100
165-17471	K	Potassium Standard Solution	KCl in water	1,000	100
129-05221	Li	Lithium Standard Solution	Li ₂ CO ₃ in 0.2 mol/L HNO ₃	1,000	100
136-12121	Mg	Magnesium Standard Solution	Mg(NO ₃) ₂ in 0.1 mol/L HNO ₃	1,000	100
139-12111	Mn	Manganese Standard Solution	Mn(NO ₃) ₂ in 0.1 mol/L HNO ₃	100	100
133-12131				1,000	100
130-14961	Mo	Molybdenum Standard Solution	Mo in 0.4mol/l HCl • 0.2 mol/L HNO ₃	1,000	100
199-10831	Na	Sodium Standard Solution	NaCl in water	1,000	100
147-06461	Ni	Nickel Standard Solution	Ni(NO ₃) ₂ in 0.1 mol/L HNO ₃	1,000	100
167-28921	P	Phosphorus Standard Solution	H ₃ PO ₄ in water	1,000	100
127-04301	Pb	Lead Standard Solution	Pb(NO ₃) ₂ in 0.1 mol/L HNO ₃	100	100
124-04291				1,000	100
188-01951	Rb	Rubidium Standard Solution	RbCl in water	1,000	100
191-19051	S	Sulfur Standard Solution	H ₂ SO ₄ in water	1,000	100
010-15491	Sb	Antimony Standard Solution	SbCl ₃ in 3 mol/L HCl	1,000	100
192-13861	Se	Selenium Standard Solution	Se in 0.1 mol/L HNO ₃	1,000	100
202-16311	Sn	Tin Standard Solution	Sn in 3 mol/L HCl	1,000	100
199-13871	Sr	Strontium Standard Solution	SrCO ₃ in 0.1 mol/L HNO ₃	1,000	100
209-17921	Te	Tellurium Standard Solution	Te in 1 mol/L HCl	1,000	100
205-16301	Tl	Thallium Standard Solution	TlNO ₃ in 1 mol/L HNO ₃	1,000	100
221-01851	V	Vanadium Standard Solution	V in 0.2 mol/L HCl • 0.5 mol/L HNO ₃	1,000	100
261-01431	Zn	Zinc Standard Solution	Zn(NO ₃) ₂ in 0.1 mol/L HNO ₃	100	100
264-01421				1,000	100

for ICP Analysis

Single Element Standard Solutions for ICP Analysis

Since simultaneous multi-element analysis using ICP-MS is the mainstream of trace element analysis, information on impurity elements in the standard solutions is important. Fujifilm Wako has a lineup of high purity elemental standard solutions for ICP analysis that contain few impurity elements. From March 2023, Fujifilm Wako has become the first company in Japan to obtain comprehensive accreditation (flexible scope of accreditation) as an elemental reference material (RM) manufacturer based on ASNITE accreditation, and Fujifilm Wako has been gradually upgrading grades for ICP analysis to SI-traceable certified reference material (CRM).

Features

- ✓ Guarantee impurity elements on the ppb order by using ICP-MS
 - ✓ Attach Wako product manual with information on impurity elements to the product
 - ✓ Use of raw materials that do not contain other elements in consideration of impurity elements
 - ✓ Certified reference material (CRM) whose concentration value is SI traceable*
- *Only for some products (to be renewed sequentially into CRM).



《Wako product manual》

FUJIFILM

Sample

Code No. 222-02501 100mL



Vanadium Standard Solution (V 1000)(CRM)

バナジウム標準溶液 (V 1000)(認定標準物質)

All elemental impurities were determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

全元素不純物は誘導結合プラズマ質量分析法 (ICP-MS) で測定されました。

Impurity element information

Trace impurities mg/L

Li	Be	B	C	N	O	F	Ne
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Na	Mg	Al	Si	P	S	Cl	Ar
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
K	Ca	Sc	Ti	V	Cr	Mn	Fe
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cs	Ba	Hf	Ta	W	Re	Os	Ir
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pt	Au	Hg	Tl	Pb	Bi	Po	At
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
La	Ce	Pr	Nd	Pm	Sm	Gd	Tb
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lu	Th	Pa	U				
<0.05	<0.05	<0.05	<0.05				

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 Telephone: 06-6222-2701
 Fax: 06-6222-2702
 E-mail: info@wfc.film
 Web: <http://www.wfc.film>

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 Telephone: 1-866-731-5727
 E-mail: info@wfcusa.film
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FUJIFILM Waste Chemicals Europe GmbH
 Europapark
 42699 Solingen, Germany
 Telephone: +49 212 31 01 02
 E-mail: info@wfc.eu
 Web: <http://www.wfc.eu>

- ✓ Wako product manual is attached with each product.
- ✓ Information of impurity elements is described.
- ✓ The source of traceability and concentration measurement method are described.

Li		Be		B		C		N		O		F		Ne	
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Na	Mg	Al	Si	P	S	Cl	Ar								
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cs	Ba	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fr	Ra														
N/A	N/A														
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ac	Th	Pa	U												
<0.05	<0.05	<0.05	<0.05												

Product line up

Lineup of 68 elements for ICP analysis grade

Li	Be															
Na	Mg															
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	Xe
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	Rn
Fr	Ra															
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
Ac	Th	Pa	U													

■ : non-CRM

□ : CRM

	Code No.	Element	Product Name	Composition	Concentration (mg/L)	Volume (mL)
	195-18591	Ag	Silver Standard Solution	AgNO ₃ in 5 w/w% HNO ₃	1,000	100
CRM	011-28591	Al	Aluminium Standard Solution	Al(NO ₃) ₃ · 9H ₂ O in 5 w/w% HNO ₃	1,000	100
	013-27571	As	Arsenic Standard Solution	As ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
	074-06661	Au	Gold Standard Solution	HAuCl ₄ · 4H ₂ O in 5 w/w% HCl	1,000	100
	024-19231	B	Boron Standard Solution	H ₃ BO ₃ in water	1,000	100
	027-19221	Ba	Barium Standard Solution	BaCO ₃ in 5 w/w% HNO ₃	1,000	100
	028-19251	Bi	Bismuth Standard Solution	Bi(NO ₃) ₃ in 5 w/w% HNO ₃	1,000	100
CRM	034-26121	Ca	Calcium Standard Solution	CaCO ₃ in 5 w/w% HNO ₃	1,000	100
CRM	036-26201	Cd	Cadmium Standard Solution	Cd in 0.5 w/w% HNO ₃	1,000	100
CRM	030-25981	Ce	Cerium Standard Solution	CeO ₂ in 5 w/w% HNO ₃ (add. H ₂ O ₂)	1,000	100
CRM	035-26151	Co	Cobalt Standard Solution	Co in 5 w/w% HNO ₃	1,000	100
	039-25451	Cr	Chromium Standard Solution	CrO ₃ 5 w/w% HNO ₃	1,000	100
	035-25311	Cs	Cesium Standard Solution	CsNO ₃ in water	1,000	100
CRM	033-26191	Cu	Copper Standard Solution	Cu in 5 w/w% HNO ₃	1,000	100
	044-34591	Dy	Dysprosium Standard Solution	Dy ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
CRM	052-09541	Er	Erbium Standard Solution	Er ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
	056-09321	Eu	Europium Standard Solution	Eu ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
	092-07541	Fe	Iron Standard Solution	Fe in 5 w/w% HNO ₃	1,000	100
	071-06671	Ga	Gallium Standard Solution	Ga in 5 w/w% HNO ₃	1,000	100
	070-06761	Gd	Gadolinium Standard Solution	Gd ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
	078-06681	Ge	Germanium Standard Solution	GeO ₂ in 5 w/w% HNO ₃ (add. ammonia)	1,000	100
	083-10601	Hf	Hafnium Standard Solution	HfCl ₄ in 5 w/w% HCl	1,000	100
	139-18831	Hg	Mercury Standard Solution	Hg in 5 w/w% HNO ₃	1,000	100
	085-10541	Ho	Holmium Standard Solution	Ho ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
	099-07311	In	Indium Standard Solution	In in 5 w/w% HNO ₃	1,000	100
	093-07331	Ir	Iridium Standard Solution	H ₂ IrCl ₆ · nH ₂ O in 5% HCl	1,000	100
	162-28351	K	Potassium Standard Solution	KNO ₃ in H ₂ O	1,000	100
	123-06841	La	Lanthanum Standard Solution	La in 5 w/w% HNO ₃	1,000	100
	127-06741	Li	Lithium Standard Solution	LiNO ₃ in 5 w/w% HNO ₃	1,000	100
CRM	129-06941	Lu	Lutetium Standard Solution	Lu ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
CRM	134-19481	Mg	Magnesium Standard Solution	MgO in 5 w/w% HNO ₃	1,000	100
CRM	130-19461	Mn	Manganese Standard Solution	Mn in 5 w/w% HNO ₃	1,000	100
	135-18931	Mo	Molybdenum Standard Solution	(NH ₄) ₆ Mo ₇ O ₂₄ · 4H ₂ O in water	1,000	100

	Code No.	Element	Product Name	Composition	Concentration (mg/L)	Volume (mL)
	198-18581	Na	Sodium Standard Solution	NaNO ₃ in water	1,000	100
	147-09881	Nb	Niobium Standard Solution	Nb in 2 w/w% HNO ₃ and 0.5w/w% HF	1,000	100
CRM	143-10091	Nd	Neodymium Standard Solution	Nd ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
CRM	141-10151	Ni	Nickel Standard Solution	NiO in 5 w/w% HNO ₃	1,000	100
	157-03601	Os	Osmium Standard Solution	(NH ₄) ₂ OsCl ₆ in 7 w/w% HCl	1,000	100
	167-28921	P	Phosphorus Standard Solution [JCSS]*	H ₃ PO ₄ in water	1,000	100
CRM	127-06981	Pb	Lead Standard Solution	Pb(NO ₃) ₂ in 5 w/w% HNO ₃	1,000	100
	160-28411	Pd	Palladium Standard Solution	Pd in 5 w/w% HNO ₃ (add. HCl)	1,000	100
	167-28781	Pr	Praseodymium Standard Solution	Pr ₆ O ₁₁ in 5 w/w% HNO ₃	1,000	100
	165-28341	Pt	Platinum Standard Solution	H ₂ Cl ₆ Pt · 6H ₂ O in 5 w/w% HCl	1,000	100
	188-03391	Rb	Rubidium Standard Solution	RbNO ₃ in water	1,000	100
	189-03441	Re	Rhenium Standard Solution	Re in 5 w/w% HNO ₃	1,000	100
	180-03471	Rh	Rhodium Standard Solution	RhCl ₃ · 3H ₂ O in 5 w/w% HCl	1,000	100
	182-03431	Ru	Ruthenium Standard Solution	RuCl ₃ · xH ₂ O in 5 w/w% HNO ₃	1,000	100
	191-19051	S	Sulfur Standard Solution [JCSS]*	H ₂ SO ₄ in water	1,000	100
	010-27581	Sb	Antimony Standard Solution	Sb ₂ O ₃ in 5w/w% HNO ₃ (add. 0.5% L-tartaric acid)	1,000	100
	196-18901	Sc	Scandium Standard Solution	Sc ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
	196-18641	Se	Selenium Standard Solution	SeO ₂ in 5 w/w% HNO ₃	1,000	100
	197-18671	Si	Silicon Standard Solution	SiO ₂ in 0.2 w/w% HF	1,000	100
	197-18791	Sm	Samarium Standard Solution	Sm ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
CRM	206-21601	Sn	Tin Standard Solution	SnCl ₄ in 5 w/w% HCl	1,000	100
	199-18631	Sr	Strontium Standard Solution	SrCO ₃ in 5 w/w% HNO ₃	1,000	100
	201-21151	Ta	Tantalum Standard Solution	Ta in 2% HNO ₃ (add. HF)	1,000	100
CRM	202-21561	Tb	Terbium Standard Solution	Tb ₄ O ₇ in 5 w/w% HNO ₃	1,000	100
	207-20771	Te	Tellurium Standard Solution	H ₆ TeO ₆ in 5 w/w% HNO ₃	1,000	100
	200-21001	Ti	Titanium Standard Solution	Ti in 16 w/w% HCl	1,000	100
	206-20741	Tl	Thallium Standard Solution	TlNO ₃ in 5 w/w% HNO ₃	1,000	100
	203-21091	Tm	Thulium Standard Solution	Tm ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
CRM	222-02501	V	Vanadium Standard Solution	NH ₄ VO ₃ in 5 w/w HNO ₃ (add. oxalic acid dihydrate)	1,000	100
	207-21011	W	Tungsten Standard Solution	W in 5 w/w% HNO ₃ (add. HF)	1,000	100
CRM	259-00711	Y	Yttrium Standard Solution	Y ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
	252-00681	Yb	Ytterbium Standard Solution	Yb ₂ O ₃ in 5 w/w% HNO ₃	1,000	100
CRM	266-02341	Zn	Zinc Standard Solution	ZnO in 5 w/w% HNO ₃	1,000	100
	265-02291	Zr	Zirconium Standard Solution	ZrCl ₄ in 7 w/w% HCl	1,000	100

* Although it is a JCSS grade standard solution (non-ICP Analysis grade), containing impurity elements information are described in the Wako product manual as well as ICP Analysis grade.

for ICP Analysis

Multi-element Standard Solutions for ICP Analysis

Fujifilm Wako offers a variety of multi element mixture standard solutions for ICP analysis, which can be used for environmental analysis, etc.

Product line up

Use **W**: for water quality analysis, **R**: for rock and soil analysis, **L**: for rare earth analysis

Composition (mg/L)

Product Name	Multielement Standard Solution								
	W-I	W-II	W-III	W-IV	W-V	W-VI	W-X	L-I	R-III
Code No.	139-11491	132-11501	139-11511	139-11871	138-13781	139-14551	134-16201	138-11461	131-11451
Volume	50 mL	50 mL	50 mL	50 mL	50 mL	50 mL	50 mL	50 mL	50 mL
Al	-	-	-	-	100	100	100	1,000	-
As	-	-	-	-	-	-	100	-	-
B	-	-	-	-	100	100	-	-	-
Ba	-	-	-	-	-	-	-	100	-
Be	-	-	-	-	-	-	-	-	-
Ca	-	1,000	-	-	-	100	-	1,000	-
Cd	-	-	100	100	100	100	100	-	-
Co	-	100	-	-	-	-	-	-	-
Cr	-	-	100	100	100	100	100	100	-
Cu	-	-	1,000	100	100	100	100	-	-
Dy	-	-	-	-	-	-	-	-	100
Er	-	-	-	-	-	-	-	-	100
Fe	-	100	-	100	100	100	-	1,000	-
Ga	-	-	-	-	-	-	-	-	-
Ho	-	-	-	-	-	-	-	-	100
In	-	-	-	-	-	-	-	-	-
K	2,000	-	-	-	-	-	-	-	-
Lu	-	-	-	-	-	-	-	-	100
Mg	-	1,000	-	-	-	100	-	100	-
Mn	-	100	-	100	100	100	100	-	-
Mo	-	-	-	-	100	-	-	-	-
Na	2,000	-	-	100	100	100	-	-	-
Nd	-	-	-	-	-	-	-	-	-
Ni	-	100	-	-	100	-	-	-	-
P	1,000	-	-	-	-	-	-	-	-
Pb	-	-	100	100	100	100	100	100	-
Se	-	-	-	-	-	-	100	-	-
Sr	-	-	-	-	-	-	-	100	-
Tl	-	-	-	-	-	-	-	-	-
Tm	-	-	-	-	-	-	-	-	100
Y	-	-	-	-	-	-	-	-	-
Yb	-	-	-	-	-	-	-	-	100
Zn	-	-	1,000	100	100	100	100	-	-
Solvent	H ₂ O	1.0 mol/L HNO ₃	1.0 mol/L HNO ₃	0.1 mol/L HNO ₃	1.0 mol/L HNO ₃	0.1 mol/L HNO ₃	0.2 mol/L HNO ₃	1.0 mol/L HNO ₃	1.0 mol/L HNO ₃

Multi-element Mixture Standard Solution for ICH Q3D

Fujifilm Wako offers a variety of mixture standard solutions that can be used to evaluate oral and parenteral drugs for risk assessment in accordance with the [Guideline for Elemental Impurities \(ICH Q3D\)](#).

Features

- ✓ Guarantee elements other than mixed elements (impurity elements) using ICP-MS.
- ✓ Concentration is set with reference to the “Permitted Daily Exposure (PDE) for each element of toxicological concern”.
- ✓ Concentration confirmation is performed using JCSS standard solution or NIST SRM.
- ✓ Wako product manual with impurity element information is attached to the product.

Product line up

Composition (mg/L)

Product Name		Multielement Standard Solution for ICH Q3D			Oral	Parenteral	Inhalation	Cutaneous	
		Oral Preparation	Injection	Hg	PDE (µg/day)*				CTCL (µg/g)*
Code No.		138-18801	135-18811	133-18851					
Volume		100 mL	100 mL	100 mL					
Class 1	As	15	15	-	15	15	2	30	-
	Cd	5	2	-	5	2	2	20	-
	Hg	-	-	30	30	3	1	30	-
	Pb	5	5	-	5	5	5	50	-
Class 2A	Co	50	5	-	50	5	3	50	35
	Ni	200	20	-	200	20	6	200	35
	V	100	10	-	100	10	1	100	-
Class 2B	Ag	-	-	-	150	15	7	150	-
	Au	-	-	-	300	300	3	3,000	-
	Ir	-	-	-	100	10	1	100	-
	Os	-	-	-	100	10	1	100	-
	Pd	-	-	-	100	10	1	100	-
	Pt	-	-	-	100	10	1	100	-
	Rh	-	-	-	100	10	1	100	-
	Ru	-	-	-	100	10	1	100	-
	Se	-	-	-	150	80	130	800	-
Class 3	Tl	-	-	-	8	8	8	8	-
	Ba	-	-	-	1,400	700	300	7,000	-
	Cr	-	-	-	11,000	1,100	3	11,000	-
	Cu	-	300	-	3,000	300	30	3,000	-
	Li	-	250	-	550	250	25	2,500	-
	Mo	-	-	-	3,000	1,500	10	15,000	-
	Sb	-	90	-	1,200	90	20	900	-
	Sn	-	-	-	6,000	600	60	6,000	-
	-	-	-	-	-	-	-	-	-
-	Bi	-	-	-	-	-	-	-	-
	Ge	-	-	-	-	-	-	-	-
	In	-	-	-	-	-	-	-	-
	Lu	-	-	-	-	-	-	-	-
	Sc	-	-	-	-	-	-	-	-
	Te	-	-	-	-	-	-	-	-
Solvent		5 w/w% HNO ₃							

* As of October 2024

SPE Columns for Elemental Capture and Recovery

Presep® PolyChelate

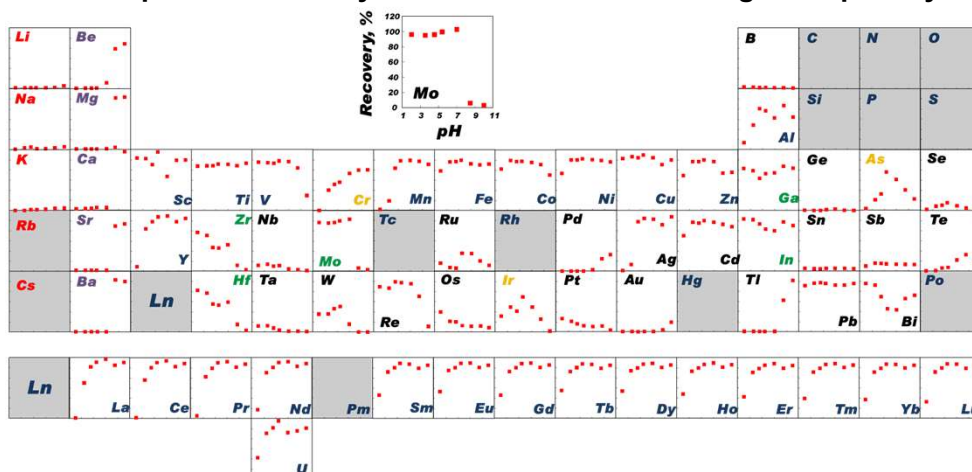
Presep® PolyChelates are syringe-type columns for metal (elemental) capture and recovery, filled with a packing agent with a long-chain aminocarboxylic acid group as the chelating functional group. Compared to general SPE column, filled IDA (iminodiacetic acid) chelating resins, Presep® PolyChelate can capture and recover many elements (metals) with higher efficiency over a wide pH range. It can also efficiently capture and recover metal oxoacids (Mo, V, W) under acidic to neutral conditions without recovering alkali metals or alkaline earth metals.

Features

- ✓ Capable of capturing and recovering many metals (elements) with high efficiency over a wide pH range!
- ✓ Efficient capture and recovery of metal oxoacids (Mo, V, W) under acidic to neutral conditions without recovery of alkali metals and alkaline earth metals!
- ✓ Can be used as a SPE column in the separation and concentration method by chelating resin in JIS K 0102 "testing methods for industrial wastewater!"

Data

Correlation Between pH and Recovery of 62 Elements When Using Presep® PolyChelate¹⁾



[Instrument]

PerkinElmer Optima 3000 DV ICP-AES, cross-flow nebulizer and a Scott-type spray chamber

1) Provided by Prof. Kagaya, Faculty of Engineering, University of Toyama

Example of Measurement of Elements in Treated Wastewater and Surface Seawater²⁾

■ Solid-phase extraction operation²⁾

On next page.

■ Recovery rate²⁾

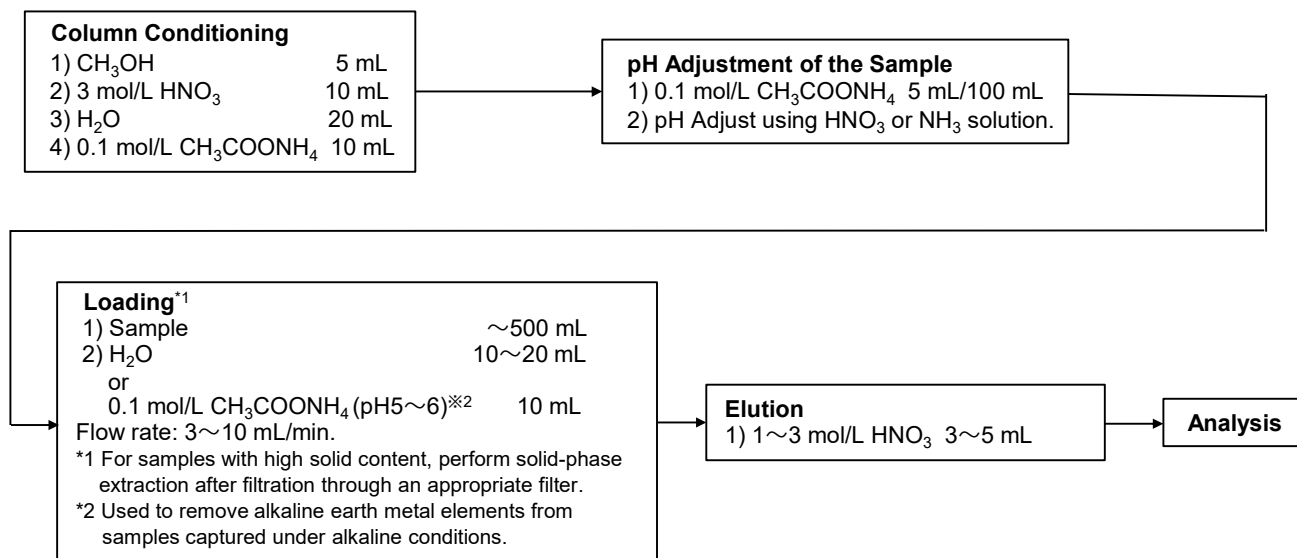
Elements	Treated wastewater* ¹ (n=3)		Surface seawater* ² (n=3)	
	Detection (μg/L)	Recovery rate* ³ (%)	Detection (μg/L)	Recovery rate* ³ (%)
Cd	0.2±0.02	93±2.9	(0.03±0.004)	96±1.7
Co	<0.033	92±3.7	(0.02±0.012)	96±1.5
Cu	1.1±0.13	104±3.5	0.77±0.017	112±3.2
Fe	33±3.3	114±13.8	1.3±0.05	94±3.2
Mn	871±75	64±9.0	Not measure	Not measure
Mo	458±9.3	98±1.7	7.4±0.07	100±4.5
Ni	11±0.2	101±4.9	0.46±0.017	100±1.8
Pb	<0.22	94±2.7	0.09±0.052	104±2.0
V	<0.22	92±3.1	1.3±0.05	96±2.5
Zn	11±3.1	83±2.1	2.5±0.24	102±2.2

- ✓ Trace metal oxoacids (Mo, V) in seawater containing a large amount of alkali metals can be captured and recovered efficiently!

*1 Sample volume: 200 mL (pH 5.5) *2 Sample volume: 300 mL (pH 4.0) *3 Internal standard solution (5 μg of each element) added to the solution

2) Kagaya, S., Maeba, E., Inoue, Y., Kamichatani, W., Kajiwara, T., Yanai, H., Saito, M. and Tohda, K.: *Talanta*, **79**, 146 (2009).

Solid-phase extraction operation



◆ These conditions are only example and may require further study depending on the sample.

Instruction for use and handling

1. Products must be conditioned prior to use. Drying the packing agent during conditioning may result in loss of reproducibility.
2. Add a buffer solution that does not interact with elements (metals) such as ammonium acetate before pH adjustment of the sample solution.
3. When passing the sample solution, reduce or increase the pressure to maintain a constant flow rate.
4. To avoid adsorption and elution of elements (metals), please refrain from using metal utensils. Use glass or plastic utensils that have been thoroughly rinsed with nitric acid.

Code No.	Product Name	Grade	Volume
296-36931	Presep® PolyChelate (250 mg/15 mL)	for Sample Pretreatment	20 EA

Solvent / buffer

Code No.	Product Name	Grade	Volume
010-09685	Ammonium Acetate	for Iron Analysis	500 g
133-18731	Methanol	for Electronics Industry	1 L
143-09741	Nitric Acid	for Electronics Industry	1 kg
217-01651	Ultrapure Water	for ICP Analysis	1 L

High Purity Acids

Since simultaneous multi-elemental analysis is the mainstream of trace elemental analysis, information on impurity elements in the standard solutions used is important. In addition to elemental standard solutions used to create calibration curves, Fujifilm wako also offers **"high purity acids and ultrapure water"** with minimal elemental impurities to provide total support for elemental analysis.

Product line up

for ICP Analysis

This series is recommended for ICP analysis that guarantees a large number of impurity elements.

Guarantee level: sub-ppb to ppb

for Electronics Industry

High purity products with minimal particles and elemental impurities. This series is ideal for testing and research in the electronics industry.

Guarantee level: ppb

Super Special Grade

This series guarantees a very high level of quality with specification value and requirement items more stringent than specification value and requirement items of JIS special grade.

Guarantee level: ppb

for Analysis of Poisonous Metals

This series is a high purity product designed to measure toxic elements in water. Hg, Cd, As, Cr, etc., are suppressed to extremely low levels.

Guarantee level: ppb

Grade	Nitric acid			Hydrochloric acid			Sulfuric acid			Ultrapure water
	for Electronic Industry (1.42)	Super Special Grade (1.38)	for Analysis of Poisonous Metals (1.38)	for Electronic Industry	Super Special Grade	for Analysis of Poisonous Metals	for Electronic Industry	Super Special Grade	for Analysis of Poisonous Metals	for ICP Analysis
Code No.	143-09741	149-02886	140-04016	087-10361	083-03435	081-03475	194-18321	190-04675	199-07325	217-01651
Volume	1 kg	500 mL	500 mL	1 kg	500 mL	500 mL	1 kg	500 g	500 g	1 L
Ag	0.001 ppm	-	-	1 ppb	-	-	5 ppb	-	-	100 ppt
Al	0.1 ppm	-	-	200 ppb	-	-	200 ppb	-	-	100 ppt
As	0.002 ppm	0.001 ppm	1 ppb	5 ppb	0.005 ppm	2 ppb	5 ppb	0.01 ppm	5 ppb	100 ppt
Ba	0.1 ppm	-	-	100 ppb	-	-	50 ppb	-	-	100 ppt
Ca	0.05 ppm	0.01 ppm	-	300 ppb	-	-	50 ppb	-	-	100 ppt
Cd	0.001 ppm	0.1 ppb	0.1 ppb	1 ppb	0.002 ppm	0.5 ppb	5 ppb	0.005 ppm	1 ppb	100 ppt
Co	0.001 ppm	0.003 ppm	-	1 ppb	0.002 ppm	-	5 ppb	-	-	100 ppt
Cr	0.002 ppm	0.001 ppm	1 ppb	2 ppb	0.01 ppm	0.5 ppb	20 ppb	0.003 ppm	10 ppb	100 ppt
Cu	0.005 ppm	0.003 ppm	-	10 ppb	0.003 ppm	-	5 ppb	0.003 ppm	-	100 ppt
Fe	0.05 ppm	0.01 ppm	-	100 ppb	0.05 ppm	-	50 ppb	0.04 ppm	-	100 ppt
Ga	-	-	-	-	-	-	-	-	-	100 ppt
Ge	-	-	-	-	-	-	-	-	-	100 ppt
Hg	-	0.05 ppb	0.05 ppb	5 ppb	0.001 ppm	0.1 ppb	5 ppb	0.0002 ppm	0.1 ppb	-
K	0.05 ppm	0.1 ppm	-	50 ppb	-	-	50 ppb	-	-	100 ppt
Li	0.005 ppm	-	-	5 ppb	-	-	5 ppb	-	-	100 ppt
Mg	0.05 ppm	-	-	200 ppb	-	-	20 ppb	-	-	100 ppt
Mn	0.005 ppm	0.001 ppm	1 ppb	5 ppb	0.002 ppm	2 ppb	3 ppb	-	10 ppb	100 ppt
Mo	-	-	-	-	-	-	-	-	-	100 ppt
Na	0.2 ppm	0.1 ppm	-	500 ppb	-	-	300 ppb	-	-	100 ppt
Ni	0.005 ppm	0.001 ppm	-	10 ppb	0.002 ppm	-	10 ppb	0.01 ppm	-	100 ppt
Pb	0.01 ppm	0.5 ppb	0.5 ppb	20 ppb	0.0003 ppm	0.5 ppb	5 ppb	0.003 ppm	2 ppb	100 ppt
Sb	-	-	10 ppb	-	-	1 ppb	-	-	10 ppb	100 ppt
Se	-	-	10 ppb	-	-	2 ppb	5 ppb	0.1 ppm	50 ppb	-
Sn	-	-	10 ppb	-	-	2 ppb	-	-	10 ppb	100 ppt
Sr	0.005 ppm	-	-	20 ppb	-	-	10 ppb	-	-	100 ppt
V	-	-	10 ppb	-	-	10 ppb	-	-	10 ppb	100 ppt
W	-	-	-	-	-	-	-	-	-	100 ppt
Zn	0.02 ppm	0.005 ppm	5 ppb	50 ppb	0.002 ppm	2 ppb	10 ppb	0.01 ppm	5 ppb	100 ppt
Zr	-	-	-	-	-	-	-	-	-	100 ppt

Search System for Multi-Element (Metal) Standard Solutions

Introducing the “Search System for Multi-Element (Metal) Standard Solutions,” which allows you to easily search for multi-element (metal) standard solutions on the web. By selecting the element (metal) to be measured from the periodic table, you can instantly find our mixture standard solutions.

Search method

Step 1 Select elements (e.g., Li, Cd, Pb).

Search System for Multi-Element (Metal) Standard Solutions

FUJIFILM Wako provides various multi-element (metal) standard solutions.
You can search for the products by specifying elemental component.
The custom solutions are also available if there is no applicable product or it is different from your desired concentration.

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
Lanthanoid			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Actinoid			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Release all

Step2 Mixture standard solutions containing the selected elements (e.g., Li, Cd, Pb) are displayed.

Open All ▼ Close All ▲

Element : **Al, Cd, Pb, As, Co, V, Ni, U, Sb, Cu**

> **Multielement Standard Solution for ICH Q3D Injection** ▼

for ICP Analysis

Manufacturer : FUJIFILM Wako Pure Chemical Corporation

Easily find and compare products containing the selected elements