

## 1.0 ACCREDITATION / REGISTRATION

**INORGANIC VENTURES** is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).



## 2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution  
Catalog Number: IV-STOCK-1643  
Lot Number: P2-MEB679507  
Matrix: 5% (v/v) HNO<sub>3</sub>

Value / Analyte(s):	32 000 µg/L ea:		
	Calcium,		
	21 000 µg/L ea:		
	Sodium,		
	8 000 µg/L ea:		
	Magnesium,		
	2 000 µg/L ea:		
	Potassium,		
	544 µg/L ea:		
	Barium,		
	323 µg/L ea:		
	Strontium,		
	158 µg/L ea:		
	Boron,		
	142 µg/L ea:		
	Aluminum,		
	121 µg/L ea:		
	Molybdenum,		
	113 µg/L ea:		
	Rhenium,		
	98 µg/L ea:		
	Iron,		
	79 µg/L ea:		
	Zinc,		
	62 µg/L ea:		
	Nickel,		
	60 µg/L ea:		
	Arsenic,		
	58 µg/L ea:		
	Antimony,		
	39 µg/L ea:		
	Manganese,		
	38 µg/L ea:		
	Vanadium,		
	27 µg/L ea:		
	Cobalt,		
	23 µg/L ea:		
	Copper,		
	20 µg/L ea:		
	Chromium,	Lead,	
	17 µg/L ea:		
	Lithium,		
	14 µg/L ea:		
	Beryllium,	Bismuth,	Rubidium,
	12 µg/L ea:		
	Selenium,		
	7 µg/L ea:		
	Thallium,	Cadmium,	
	1 µg/L ea:		
	Silver,	Tellurium	

**3.0 CERTIFIED VALUES AND UNCERTAINTIES**

<b>ANALYTE</b>	<b>CERTIFIED VALUE</b>	<b>ANALYTE</b>	<b>CERTIFIED VALUE</b>
Aluminum, Al	142.1 ± 0.7 µg/L	Antimony, Sb	58.03 ± 0.44 µg/L
Arsenic, As	60.03 ± 0.41 µg/L	Barium, Ba	544.2 ± 2.9 µg/L
Beryllium, Be	14.01 ± 0.10 µg/L	Bismuth, Bi	14.01 ± 0.08 µg/L
Boron, B	158.0 ± 1.2 µg/L	Cadmium, Cd	7.00 ± 0.06 µg/L
Calcium, Ca	32 010.0 ± 170.0 µg/L	Chromium, Cr	20.01 ± 0.17 µg/L
Cobalt, Co	27.01 ± 0.16 µg/L	Copper, Cu	23.01 ± 0.16 µg/L
Iron, Fe	98.0 ± 0.6 µg/L	Lead, Pb	20.01 ± 0.12 µg/L
Lithium, Li	17.00 ± 0.12 µg/L	Magnesium, Mg	8 000.0 ± 40.0 µg/L
Manganese, Mn	39.01 ± 0.24 µg/L	Molybdenum, Mo	121.0 ± 0.8 µg/L
Nickel, Ni	62.02 ± 0.42 µg/L	Potassium, K	2 001 ± 10 µg/L
Rhenium, Re	113.0 ± 0.7 µg/L	Rubidium, Rb	14.01 ± 0.08 µg/L
Selenium, Se	12.01 ± 0.12 µg/L	Silver, Ag	1.000 ± 0.009 µg/L
Sodium, Na	21 010.0 ± 100.0 µg/L	Strontium, Sr	323.1 ± 1.7 µg/L
Tellurium, Te	1.000 ± 0.008 µg/L	Thallium, Tl	7.00 ± 0.05 µg/L
Vanadium, V	38.02 ± 0.26 µg/L	Zinc, Zn	79.0 ± 0.5 µg/L

**Density:** 1.025 g/mL (measured at 20 ± 4 °C)

**Assay Information:**

<b>ANALYTE</b>	<b>METHOD</b>	<b>NIST SRM#</b>	<b>SRM LOT#</b>
Ag	ICP Assay	3151	992212
Ag	Volhard	999b	999b
Al	ICP Assay	3101a	140903
Al	EDTA	928	928
As	ICP Assay	3103a	100818
B	ICP Assay	3107	110830
B	Calculated		See Sec. 4.2
Ba	ICP Assay	3104a	140909
Ba	Gravimetric		See Sec. 4.2
Be	ICP Assay	3105a	090514
Bi	ICP Assay	3106	991212
Bi	Calculated		See Sec. 4.2
Ca	ICP Assay	3109a	130213
Ca	EDTA	928	928
Cd	ICP Assay	3108	060531
Cd	EDTA	928	928
Co	ICP Assay	3113	000630 Co
Co	EDTA	928	928
Cr	ICP Assay	3112a	030730Cr3
Cu	ICP Assay	3114	121207
Cu	EDTA	928	928
Fe	ICP Assay	3126a	140812
Fe	EDTA	928	928
K	ICP Assay	3141a	140813
Li	ICP Assay	3129a	000505
Li	Calculated		See Sec. 4.2
Mg	ICP Assay	3131a	050302
Mg	EDTA	928	928
Mn	ICP Assay	3132	050429
Mn	EDTA	928	928
Mo	ICP Assay	3134	130418
Mo	Calculated		See Sec. 4.2
Na	ICP Assay	3152a	120715
Na	Gravimetric		See Sec. 4.2
Ni	ICP Assay	3136	120619
Ni	EDTA	928	928
Pb	EDTA	928	928
Rb	IC Assay	3145a	150622
Rb	Gravimetric		See Sec. 4.2
Re	ICP Assay	3143	140825
Sb	ICP Assay	3102a	140911
Sb	Calculated		See Sec. 4.2
Se	ICP Assay	3149	100901
Se	Calculated		See Sec. 4.2
Sr	EDTA	928	928
Sr	ICP Assay	3153a	990906
Te	ICP Assay	3156	892901
Tl	ICP Assay	3158	993012
Tl	Calculated		See Sec. 4.2

V	EDTA	928	928
V	ICP Assay	3165	992706
Zn	ICP Assay	3168a	120629
Zn	EDTA	928	928

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

#### Characterization of CRM/RM by Two or More Methods

Certified Value,  $X_{\text{CRM/RM}}$ , where two or more methods of characterization are used is the weighted mean of the results:

$$X_{\text{CRM/RM}} = \sum(w_i)(X_i)$$

$X_i$  = mean of Assay Method  $i$  with standard uncertainty  $u_{\text{char } i}$

$w_i$  = the weighting factors for each method calculated using the inverse square of the variance:

$$w_i = (1/u_{\text{char } i})^2 / (\sum(1/u_{\text{char } j})^2)$$

$$\text{CRM/RM Expanded Uncertainty } (\pm) = U_{\text{CRM/RM}} = k (u_{\text{char}}^2 + u_{\text{bb}}^2 + u_{\text{Its}}^2 + u_{\text{ts}}^2)^{1/2}$$

$k$  = coverage factor = 2

$u_{\text{char}} = [\sum(w_i)^2 (u_{\text{char } i})^2]^{1/2}$  where  $u_{\text{char } i}$  are the errors from each characterization method

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{Its}}$  = long term stability standard uncertainty (storage)

$u_{\text{ts}}$  = transport stability standard uncertainty

#### Characterization of CRM/RM by One Method

Certified Value,  $X_{\text{CRM/RM}}$ , where one method of characterization is used is the mean of individual results:

$$X_{\text{CRM/RM}} = (X_a)(u_{\text{char } a})$$

$X_a$  = mean of Assay Method A with

$u_{\text{char } a}$  = the standard uncertainty of characterization Method A

$$\text{CRM/RM Expanded Uncertainty } (\pm) = U_{\text{CRM/RM}} = k (u_{\text{char } a}^2 + u_{\text{bb}}^2 + u_{\text{Its}}^2 + u_{\text{ts}}^2)^{1/2}$$

$k$  = coverage factor = 2

$u_{\text{char } a}$  = the errors from characterization

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{Its}}$  = long term stability standard uncertainty (storage)

$u_{\text{ts}}$  = transport stability standard uncertainty

## 4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

### 4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

### 4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

### 4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

## 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES ( $\mu\text{g/mL}$ )

N/A

## 6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

## 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

- Store between approximately  $4^\circ - 30^\circ \text{C}$  while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between  $4^\circ - 24^\circ \text{C}$  to minimize the effects of transpiration. Use at  $20^\circ \pm 4^\circ \text{C}$  to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit [www.inorganicventures.com/TCT](http://www.inorganicventures.com/TCT)

**Low Silver Note:** This solution contains "LOW" levels of Silver. Please store this entire bottle inside a sealed glass jar.

## 8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

## 9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

## 10.0 QUALITY STANDARD DOCUMENTATION

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

### 10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

### 10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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## 11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

### 11.1 Certification Issue Date

May 21, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

### 11.2 Lot Expiration Date

- **May 21, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

### 11.3 Period of Validity

- Sealed TCT Bag Open Date: \_\_\_\_\_

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

## 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

### Certificate Approved By:

Michael Booth  
Supervisor, Quality Control



### Certifying Officer:

Paul Gaines  
CEO, Senior Technical Director

