

**CERTIFICATE****Aqueous calibration solution****ASTASOL<sup>®</sup> AN9104MN**

This Certificate is designed in accordance with ISO Guide 31

**Category:** Certified reference material

**Analytes:** Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Rb, Se, Sr, Te, Tl, U, V, Zn

**Product code:** AN9104MN

**Starting primary compounds and their purities (%):**

Ag 99.9999; Al 99.999; As 99.9999; H<sub>3</sub>BO<sub>3</sub> 99.99; BaCO<sub>3</sub> 99.997; Be 99.5; Bi 99.999; CaCO<sub>3</sub> 99.999; Cd 99.999; Co 99.998; Cr(NO<sub>3</sub>)<sub>3</sub> · xH<sub>2</sub>O 99.995; Cu 99.999; Fe 99.998; Ga 99.9999; KNO<sub>3</sub> 99.995; Li<sub>2</sub>CO<sub>3</sub> 99.999; Mg 99.98; Mn 99.98; (NH<sub>4</sub>)<sub>6</sub>Mo<sub>7</sub>O<sub>24</sub> · xH<sub>2</sub>O 99.999; NaNO<sub>3</sub> 99.99; Ni 99.995; Pb 99.999; RbNO<sub>3</sub> 99.975; Se 99.995; SrCO<sub>3</sub> 99.994; Te 99.999; TiNO<sub>3</sub> 99.9995; UO<sub>2</sub>(NO<sub>3</sub>)<sub>2</sub> · 6H<sub>2</sub>O. 99.95; V<sub>2</sub>O<sub>5</sub> 99.99; Zn 99.99

**Matrix:**

5% HNO<sub>3</sub> (v/v), prepared from sub boil distilled HNO<sub>3</sub> (ANALPURE<sup>®</sup>) and ultrapure demineralized water (resistivity ≥ 18 MΩ.cm, 0.22μm filtered).

**Density and its expanded uncertainty (k = 2):** 1.0381 ± 0.0005 g/cm<sup>3</sup> (at 20 °C)

**Certified value of concentration and its expanded uncertainty (k = 2) at 20 °C**

Ca	1 000 ± 2 mg/l	963 ± 3 mg/kg*
As, B, Be, Fe, Se, Zn	100.0 ± 0.2 mg/l	96.3 ± 0.3 mg/kg*
Ag, Al, Ba, Bi, Cd, Co, Cr, Cu, Ga, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Rb, Sr, Te, Tl, U, V	10.00 ± 0.05 mg/l	9.63 ± 0.07 mg/kg*

\*Mass fraction in mg/kg is derived from density

**Intended use:**

For calibration and validation of analytical methods analysing aqueous solutions such as atomic spectrometry (AAS, AES, ICP-OES, ICP-MS), molecular absorption spectrometry and selected electroanalytical methods.

**Specification:**
**Batch No.:** 0010

**The date of production:** 27.06.2023

**Shelf life:** 1 year from the date of production

**The date of first opening of the aluminium bag:** .....

**Expiry date:**.....12 months from the first opening of the aluminium bag within shelf life period, which should be indicated on the label of the bottle as well.

**Certification and traceability:**

This CRM is certified on the basis of gravimetric preparation. This procedure also ensures a direct traceability to SI unit – kg. Certified values, uncertainties and traceability were further verified by primary analytical methods (gravimetric, titrimetric) as well as by instrumental methods (AAS, AES, ICP-OES) calibrated with independent reference solutions (e.g. SRM NIST, in-house solid and liquid CRMs). Analytical methods and references used are listed in the following table.

Analyt	Metoda	Reference
Ag	gravimetric determination	SRM NIST 3151
Al	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3101a
As	gravimetric determination	SRM NIST 3103a
B	alcalimetric titration	Internal standard
Ba	gravimetric determination	SRM NIST 3104a
Be	gravimetric determination	SRM NIST 3105a
Bi	complexometric titration with EDTA	SRM NIST 928, SRM NIST 3106
Ca	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3109a
Cd	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3108
Co	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3113
Cr	ICP-OES	SRM NIST 3112a
Cu	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3114
Fe	complexometric titration with EDTA	SRM NIST 928
Ga	complexometric titration with EDTA	SRM NIST 928, SRM NIST 3119a
K	ICP-OES	SRM NIST 3141a
Li	ICP-OES	SRM NIST 3129a
Mg	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3131a
Mn	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3132
Mo	gravimetric determination	SRM NIST 3134
Na	ICP-OES	SRM NIST 3152a
Ni	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3136
Pb	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3128
Rb	ICP-OES	SRM NIST 3145a
Se	iodometric titration	SRM NIST 3149
Sr	gravimetric determination	SRM NIST 3153a
Tl	complexometric titration with EDTA	SRM NIST 928, SRM NIST 3158
U	complexometric titration with EDTA	SRM NIST 928, SRM NIST 3164
V	complexometric titration with EDTA	SRM NIST 928, SRM NIST 3165
Zn	complexometric titration with EDTA	SRM NIST 928, NIST SRM 3168a

**Trace impurities in bottled solution (in mg/l):**

Determination of trace impurities was performed by AAS, ICP-OES and ICP-MS. Impurity levels are supplied only for information of the user and should not be used as calibration data.

Li	Be											B	C	N	O	F
A	A											A	N.A	M	M	N.A
Na	Mg											Al	Si	P	S	Cl
A	A											A	<0,1	<0,1	<0,5	N.A
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br
A	A	<0,05	A	A	A	A	A	A	A	A	A	A	<0,02	A	A	N.A
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I
A	A	<0,05	<0,01	<0,05	A	N.A	<0,05	<0,1	<0,02	A	A	<0,05	<0,01	<0,01	A	N.A
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi		
<0,05	A	<0,05	<0,1	<0,05	<0,05	<0,02	<0,1	<0,1	<0,02	<0,02	<0,001	A	A	A		

Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
<0,5	<0,1	<0,05	<0,02	<0,01	<0,1	<0,05	<0,05	<0,1	<0,05	<0,01	<0,01	<0,02
Th	U											
<0,1	<0,1											

M = matrix      N.A = not analysed      < x = below detection limit      A = analyte

**Homogeneity and stability:**

It has been demonstrated that this CRM is homogeneous and its stability is guaranteed during the whole shelf life provided the solution it kept under conditions presented below.

**Storing and instruction for use:**

This CRM must be stored in the original closed bottle between 5 – 30 °C. The producer guarantees a declared shelf life and expiration time provided the CRM is properly stored and professionally handled. The temperature of the solution must be 20 ± 0.5 °C before every use. It is necessary to indicate on this certificate and the label the expiration time, which depends on the date of the first time the aluminium bag was opened. After use, the bottle must be immediately tightly capped, and it is recommended to put it back into the reclosable aluminium bag. It is not recommended to use the standard solution when the bottle contains less than 10 % of the solution. Therefore, in case of non-transparent bottle, it is important to indicate the amount of the solution used, e.g. on the label. Do not pipette from the bottle. Do not return removed aliquots to bottle.

**Note:**

Detailed information about the production, homogeneity, stability, coding, characterization and storing of this CRM are described in the document “Detailed information about the production of aqueous calibration solutions ASTASOL®“ which is available for download on the website [www.analytika.net](http://www.analytika.net).

**Producer:**

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ANALYTIKA®, spol. s r.o.  
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**Quality management systems of company ANALYTIKA®, spol. s r.o.:**

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ČSN EN ISO 9001:2016  
ČSN EN ISO/IEC 17025:2018  
ČSN EN ISO 17034:2017

**Manager of Department of RM:**

Ing. Daniela Weissarová

**Head of production department:**

Mgr. Mirka Petránková

Date of the first issue of certificate: 27.06.2023

Revision of certificate:

Certificate revision date:

Version of certificate: 01