Electronic Supplementary Material (ESI) for Journal of Analytical Atomic Spectrometry.


# Supplemental information

## ICP-OES

### Element wavelength table

| Element | wavelengths | Element | wavelengths | Element | wavelengths |
|---|---|---|---|---|---|
| Cu | 324.752 | Fe | 238.204 | Sr | 421.552 |
| Pb | 220.353 | Mn | 257.610 | Be | 313.107 |
| Zn | 213.857 | Al | 396.153 | Mg | 279.077 |
| Co | 228.616 | Ga | 294.364 | Rb | 780.023 |
| Cr | 205.560 | Ge | 209.426 | Ca | 317.933 |
| Cd | 214.440 | Sr | 460.733 | Ba | 233.527 |
| Ni | 232.003 | Sr | 407.771 | Nb | 309.418 |

## ICP-MS

### Smart tune solution criteria

| | |
|---|---|
| Mg 23.985 | >8000 |
| In 114.904 | >40000 |
| U 238.05 | >30000 |
| Bkgd 220 | ≤2 |
| Bkgd 8.5 | ≤3 |
| CeO 155.9/Ce 139.905 | ≤0.03 |
| Ba++ 68.9525/Ba 137.905 | ≤0.03 |

Smart tune solution from Perkin Elemer contained 10 ppb Ba and 1 ppb Be, Ce, Co, Fe, In, Mg, Pb, Th, U.

### ICP-MS Auto Lens settings

| Analyte | Mass | # Points | Dac Value | Max Intensity |
|---|---|---|---|---|
| Be | 9.0122 | 45 | 4.25 | 1500.16 |
| Co | 58.9332 | 45 | 5.25 | 33420 |
| In | 114.904 | 45 | 6.25 | 51244.2 |
| U | 238.05 | 45 | 7.5 | 40974.2 |

### ICP-MS Dual Detector calibration

| analyte | mass | # Points | Coefficient | Gain | N (max) | Conversion Factor |
|---|---|---|---|---|---|---|
| Be | 9.0122 | 17 | 0.99996 | 11715.8 | 1.07E+09 | 0.119782 |
| Na | 22.9898 | 8 | 0.999794 | 10518.5 | 1.19E+09 | 0.107541 |
| Mg | 23.985 | 18 | 0.999942 | 9745.94 | 1.28E+09 | 0.0996422 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Al | 26.9815 | 16 | 0.999933 | 9426.53 | 1.33E+09 | 0.0963765 |
| Ca | 43.9555 | 22 | 0.998705 | 12223.3 | 1.02E+09 | 0.124971 |
| Cr | 51.9405 | 14 | 0.999919 | 8871.48 | 1.41E+09 | 0.0907016 |
| Mn | 54.9381 | 12 | 0.99982 | 8569.42 | 1.46E+09 | 0.0876135 |
| Fe | 56.9354 | 13 | 0.999851 | 8740.44 | 1.43E+09 | 0.0893619 |
| Co | 58.9332 | 11 | 0.999747 | 8123.28 | 1.54E+09 | 0.0830521 |
| Ni | 59.9332 | 26 | 0.999947 | 8063.86 | 1.55E+09 | 0.0824446 |
| Cu-1 | 62.9298 | 21 | 0.999861 | 7751.99 | 1.62E+09 | 0.0792561 |
| Cu | 64.9278 | 27 | 0.999942 | 7795.78 | 1.61E+09 | 0.0797037 |
| Zn-1 | 65.926 | 26 | 0.999951 | 7967.14 | 1.57E+09 | 0.0814557 |
| Zn | 67.9249 | 20 | 0.999959 | 8012.08 | 1.56E+09 | 0.0819153 |
| Ga | 68.9257 | 16 | 0.99996 | 8031.53 | 1.56E+09 | 0.082114 |
| Ge | 73.9219 | 29 | 0.999951 | 7963.11 | 1.57E+09 | 0.0814145 |
| Rb | 84.9117 | 12 | 0.99982 | 7903.87 | 1.58E+09 | 0.0808089 |
| Sr | 87.9056 | 9 | 0.999827 | 7893.91 | 1.59E+09 | 0.0807071 |
| Nb | 92.906 | 10 | 0.999768 | 8172.64 | 1.53E+09 | 0.0835568 |
| Cd | 110.904 | 32 | 0.999961 | 7330.59 | 1.71E+09 | 0.0749476 |
| Ba | 137.905 | 15 | 0.999774 | 7112.79 | 1.76E+09 | 0.0727209 |
| Pb | 207.977 | 27 | 0.999865 | 6365.53 | 1.97E+09 | 0.065081 |

## ICP-MS Interference Correction equation

*analyte original = intensity original –abundance interference original/abundance interfereent correction *interferent correction*

*Mass, Corrections: Sr 83.9, -4.96 *Kr-83;*

*Sr-83.9 = intensity 83.9 – Kr-84 which is Sr-83.9 = intensity 83.9 – (57%/11.5%).96(Kr-83) intensity 83.9 – 4.96(Kr-83)*

*Mass, Corrections: Sr 85.9, -1.505*Kr-83;*

*Sr-85.9= intensity 85.9– Kr-86 which is Sr-85.9= intensity 85.9 – (17.3%/11.5%) Kr-83= intensity 85-1.505*Kr-83*

*Mass, Corrections: Sr 86.9, -0.385*Rb-85;*

*Sr-86.9= intensity 86.9– Rb-87 which is Sr-86.9= intensity 86.9-(27.8%/75.16%)*Rb-85= intensity 86.9-0.385*Rb-85*

*Mass, Corrections: In 114.9, -0.014*Sn118*

*In 114.9= intensity 114.9– Sn115 which is In 114.9= intensity 114.9-(0.34%/24.22%)*Sn118= intensity 114.9-0.014*Sn118*

**ICP-MS Analysis of Sr-84**

Analysis of Sr-84 in purified Sr-82, QC samples and the calibration curve (inset). Sample data was not on the calibration curve, so the data and calibration curve was validated using a 1, 10, 50, 1000, 5000, 10000 ppb strontium QC standards which were within 100+/-10% of the true value and %RSD were <5%.

## Gamma Spectroscopy

Energy and efficiency was calibrated multinuclide standard. Quality control checks of the detector were determined with Eu-152 standard. Both standards wereNIST traceable and purchase from Eckert & Ziegler Analytics Inc (GA, USA)

Eu-152 standard:

Detected energy of gamma 1408.05 keV (true value 1408.08 keV) acceptance range 1407.58-1408.58 keV

FWHM 1.79 % acceptance range =/- 5%

Detected energy of gamma 344.3 keV (true value 344.3 keV) acceptance range 343.5-344.8 keV

FWHM 1.16 % acceptance range =/- 5%