

Sample Preparation Requirements for Trace Element Analysis at PCIGR

If you are interested in preparing your own samples for trace element analysis at PCIGR, please contact Vivian Lai (vlai@eoas.ubc.ca) for details, options and limitations.



Trace element analyses at PCIGR are performed on an Agilent 7700x quadrupole ICP-MS, and a Nu Instruments AttoM and Thermo Scientific Element 2 high-resolution ICP-MS.



Agilent 7700x



Nu AttoM



Thermo Scientific Element 2

Once you have received sufficient information about preparing your samples for analysis at PCIGR, follow these requirements below.

- 1. Samples to be introduced to the ICP-MS instruments must be free of particles.**
Particles will lodge within the sample path that precedes the mass spectrometer and can cause increased signal noise and memory effects. Therefore, samples must be either:
 - a) completely digested (no solid matter remaining)
 - b) centrifuged and an aliquot diluted, or
 - c) filtered through a 0.45-mm or finer filter. Filtration is the preferred method since it provides the best assurance that particles have been completely removed and only dissolved components remain.

2. **Dissolved organic matter in samples often causes changes in sensitivity due to differences in viscosity, plasma loading and polyatomic interferences.**

Organic components within the sample may also be deposited within the sample introduction lines, causing poor washout and nebulizer performance. Self-aspirating nebulizers will often stop aspirating if too much organic matter is present in a sample. Samples containing organic matter should be acid digested prior to analysis.

3. **The sample matrix for all samples prepared for the Agilent 7700x, Nu AttoM and Element 2 must be under 0.1% dissolved solids.**

If you are unsure of the dissolved solids content of your samples, weigh out 10 g of a typical sample, dry it down and weigh what is left; the residual mass should be below 0.01 g.

4. **The most favourable sample matrix is 2% concentrated HNO₃.** (e.g., Seastar Chemicals BASELINE grade nitric acid, Fisher Scientific Optima nitric acid, or equivalent).

The same sample matrix should be used for all standards and samples. This concentration can be critical when using self-aspirating nebulizers, so any deviations from 2% HNO₃ should be carefully considered and tested. Caveats:

- Using HCl causes spectral (polyatomic) interferences with ³⁵Cl and ³⁷Cl—please consult us if you prefer using HCl in your samples.
- Using H₃PO₄ causes rapid corrosion of the cones and is not permitted on PCIGR instruments.
- HF may be added to the matrix for some elements but at usually no more than 0.05% of concentrated HF.

5. **Internal standards must be used.**

6. **The concentration limit for standards and samples of most elements is 100 ppb for the Agilent 7700x, Nu AttoM and Element 2.**

The Element 2 and Nu AttoM are highly sensitive instruments that operate best in the ppb (parts per billion), ppt (parts per trillion) and sub-ppt concentration ranges (especially on Nu AttoM). For analyses at extremely low concentrations, please consult us on options for sample introduction systems or sample processing, and custom-made analytical methods.

If you need to measure elements in the ppm range or higher, please be aware that a large dilution of your samples is necessary to prevent contamination on the Element 2 and Nu AttoM. Otherwise, we recommend selecting a more appropriate instrument for these measurements (e.g., Agilent 7700x, ICP-OES).

7. **Users must prepare their own matrix-matched blank solutions with the same distilled deionized water and ultraclean acids used to dilute/prepare their samples.**

8. **Be prepared to learn that matrix matching is the shortest path to good analytical results.**

For more information about PCIGR and our services, visit us at <https://pcigr.ubc.ca/>.