TECHNOLOGY UPDATE

AGAT Laboratories leads in Metals Analysis

AGAT Laboratories uses new innovative technology for metals determination in difficult matrices.

Currently, there are several recognized analytical methods for the quantification of metals in environmental matrices. Acceptability of a method will vary somewhat across jurisdictions but in general, the following methods are recommended:

- ICPMS (Inductively Coupled Plasma - Mass Spectroscopy)
- DCP (Differential Coupled Plasma)
- ICP-OES or ICP-AES (Inductively Coupled Plasma – Optical Emission Spectroscopy)
- Flame AAS (Flame Atomic Absorption Spectroscopy)
- GF-AAS (Graphite Furnace Atomic Absorption Spectroscopy)
- Flame AAS - Hydride Generation

Each of these methodologies has positive and negative aspects. Across the analytical community, it is generally agreed that the best approach for an environmental production lab conducting metals analysis is to use ICPMS.

ICPMS - Limitations

The ICPMS technique relies on the determination of elements by atomic mass. For example, Lead's most abundant isotope has an atomic mass of 207.20 amu (atomic mass units). Therefore the instrumentation is able to distinguish Lead from other elements by registering a signal produced by the detection of that particular mass, and then quantifying the element based on the strength of that signal.

Situations exist however, where elements can combine in the *ICPMS System* to form compounds of similar molecular mass to a particular element's atomic mass. These situations can cause decreased sensitivity and elevated detection limits as they restrict the ability to use an element's most abundant isotope for evaluation.

Two of the most common mass interferences occur with Selenium and Arsenic. Selenium is an element with an atomic mass of 78 amu. Argon is used as a carrier gas in ICPMS and has an atomic mass of about half that of Selenium. As a result, the existence of Argon "dimers" (species of Ar-Ar) in the ICPMS process present themselves on the mass spectrometer as ^{78}Se, the most common isotope for Selenium. This means it is not possible to use the most abundant natural Selenium isotope for its quantification in a conventional ICPMS instrument. Instead, ^{77}Se is used most often because ^{77}Se is not as abundant as ^{78}Se and the sensitivity will decrease while the Metal Detection Limits (MDL) will increase.

Mass spectral interference also occurs in matrices that are high in a particular ion such as Chloride. This interference can be problematic when the Chloride is of sufficient concentration to combine with elements in the *ICPMS System*. These elements can then be disguised as other elements.

Chloride matrices

- ClO on Vanadium (36 + 15 = 51)
- ^{40}Ar^{35}Cl on Arsenic (40 + 35 = 75)
- ^{40}Ar^{37}Cl on Selenium (40 + 37 = 77)

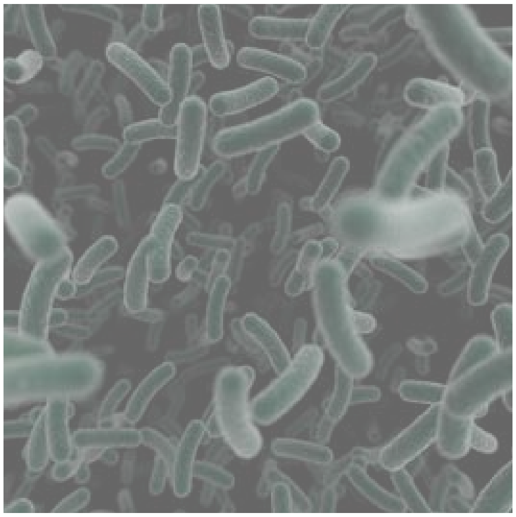
High Sulphate matrices

- SO on Titanium (32 + 16 + 48 = 96)
- Organic matrices (i.e. biological tissue)
- CO on Si (12 + 16 = 28)

Oxide forming matrices

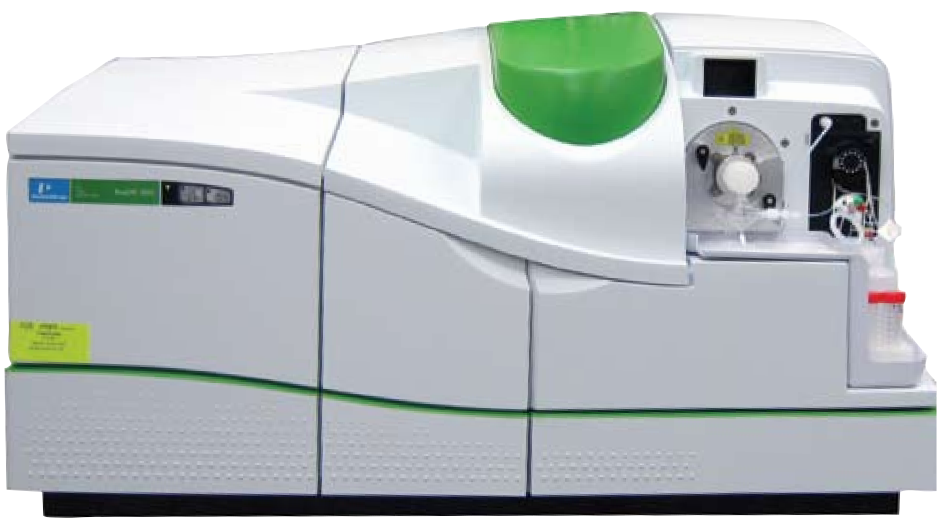
- CaO on Fe (40 + 16 = 56)
- MoO on Cd (98 + 16 114)

In cases where interference is suspected, it may be necessary to use an alternate isotope for quantification or to use a dilution to mitigate the interfering element. Both of these situations can cause elevated detection limits. Other techniques may also be used such as those listed previously, however these too may have inaccurate detection limits or other drawbacks.



The AGAT Solution

Alternatively, new technologies exist in the field of analytical chemistry that were developed to avoid polyatomic interferences as previously described with the ICPMS technology.



The NexION™ 300

AGAT Laboratories has acquired this state-of-the-art instrumentation which offers a collision cell (with kinetic energy discrimination) and a true reaction cell (with a scanning quadrupole). It brings together the two most powerful polyatomic interference removal techniques in the same instrument for the first time. Together with its standard setting, this universal cell technology allows the NexION™ 300 to be run in three different modes depending on the level of interference removal and detection limits required.

For more information on AGAT Laboratories' instrumentation, please contact your **AGAT Client Project Manager**.
To view more of our service capabilities, visit www.agatlabs.com.