ICP-oTOFMS
APPLICATION NOTES

Analysis of soil and water samples using the OptiMass 9600

GBC

Introduction

With increased pressure by governments throughout the world to improve the environmental quality of this planet, there has been a tremendous increase in the requirement for environmental testing.

Many large international corporations now exist that specialise in environmental monitoring. These laboratories utilise a wide variety of techniques and apparatus. One such technique is ICP-MS for the analysis of toxic elements in environmental samples.

Fresh water is probably the most important requirement to maintain life. Government regulations have led to an increasing number of certified laboratories that are capable of analysing water sources to the required levels. The need for soils analysis has also grown due to the expanding construction industry.

GBC worked closely with a major environmental laboratory which is responsible for drinking water quality for over eight million people. The company turns over USD 45 million per year and employs over 700 people analysing more than two million samples per year.

Large commercial labs are always interested in improving efficiency. One of the major ways to achieve this is to increase sample throughput. Using conventional ICP-MS technology the laboratory can analyse 1 sample in 3 – 5 minutes. Using the truly simultaneous, multi-element capability of the time-of-flight (TOF) technology in the OptiMass 9600 ICP-TOFMS, GBC was able to analyse a sample in 25 seconds. This represents a significant increase in productivity.

The major samples being analysed are digested clay soils (1.6% Aqua Regia). This matrix often causes problems in ICP-MS analysis, so GBC set out to prove that the OptiMass 9600 was capable of routinely analysing these difficult matrices.

Sensitivity

The limits of detection (LOD) for elements selected by the laboratory were measured to ensure that the instrument could meet these criteria. Table 1 shows the required LODs and compares them to the OptiMass Detection Limits.

Element	LOD (ppb)	Equation	Instrument Detection Limit (ppb)
Cr	0.06439	M52	0.0091
Cu	0.00331	Cu63	0.0016
Ni	0.04450	M60	0.0061
Zn	0.04911	M66	0.0018
Pb	0.01314	M206 + M207 + M208	0.0002
As	0.57132	M75-3.132*M77+2.736*M82-2.760*M83	0.0025
Mo	0.00218	Mo100	0.00011
Hg	0.00078	Hg204	0.0009
Se	0.46328	Se78	0.033
Cd	0.00708	M114	0.00087
B	0.11462	M11	0.002
Be	0.01669	M9	0.002
Tl	0.00343	M205	0.00009
Te	0.04084	M130	0.005
Sc		M45	0.005
Rh		M103	0.0004
Bi		M209	0.00003
Ge		Ge72	0.013

Table 1: Required LODs versus OptiMass detection limits

It can be seen that the OptiMass 9600 easily meets the sample LOD requirements.

Maintenance

The OptiMass was proved to be both fast and sensitive, but was it reliable?

The next test was to analyse 400 samples every night for one week and to see what maintenance was required on a daily/weekly basis.

The result was that over the month, maintenance was less than 20 minutes per day.

Long term stability

To show whether the OptiMass 9600 drifted or whether it required periodic recalibration a long term stability test was performed. Recalibration is not desirable as it adds to the total analysis time. A stability run was performed over a 14 hour period. Figure 1 shows the raw counts normalised to the first sample without any recalibration. The variation found was acceptable to the laboratory and it was decided that periodic recalibration was not required.

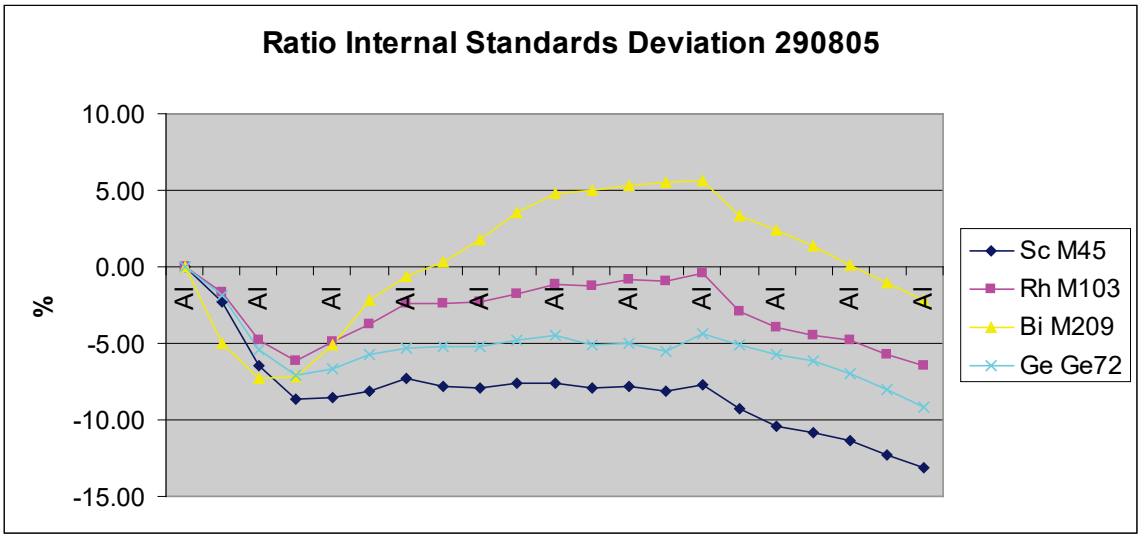

Figure 1: Long term stability

Conclusion

GBC works in close collaboration with its customers to ensure that analytical instruments and methods are tuned to the particular customer requirements. The OptiMass 9600 can easily analyse samples up to 10 times faster than a quadrupole ICP-MS with the sensitivity and long term stability required. The maintenance required for such dirty soil sample digests is also minimal.

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