

Simultaneous determination of trace elements in River Water using ICP-oTOF MS and USEPA 200.8 method



INTRODUCTION

The USEPA 200.8 method has been the standard method for ICP-MS for the determination of waters and waste waters for many years.

Traditionally, this method required 180 seconds acquisition time per sample for the 20 elements to be analysed.

This application note describes how the Optimass can accurately quantify all ICP-MS measurable elements in 25 seconds.

SAMPLE COLLECTION AND PREPARATION

A SLRS-4 River Water Reference Material for trace elements was analysed.

STANDARD PREPARATION

A series of four standards containing all the elements of interest were prepared. These were prepared in 1% HNO₃.

INSTRUMENTATION

The instrument used, the Optimass, allows simultaneous acquisition of the entire mass range. This was optimized for sensitivity and resolution.

The Smart Gate ion blanker was used to remove unwanted species, such as Ar.

RESULTS

Table 1 shows the results for the USEPA 200.8 elements. Table 2 shows the results for other elements certified but not required for the USEPA 200.8 method. As can be seen in both Table 1 and Table 2, the results obtained for the analysis show excellent correlation with the certified results. Also, excellent R² values were obtained, showing that the calibration graphs were linear.

Results were generated for all ICP-MS measurable elements and isotopes in the periodic table for this sample. With the Optimass, the same analysis time is used regardless of the number of elements required to be analyzed.



GBC

www.gbcsai.com

Elements	Certified Result (ppb)	Result (ppb)	Calibration R2
Al	54 ± 4	52.0	0.9918
Sb	0.23 ± 0.04	0.24	0.9949
As	0.68 ± 0.06	0.690	0.9959
Ba	12.2 ± 0.6	12.60	0.9988
Be	0.007 ± 0.002	0.006	0.9993
Cd	0.012 ± 0.002	0.012	0.9587
Cr	0.33 ± 0.02	0.343	0.9997
Co	0.033 ± 0.006	0.029	0.9999
Cu	1.81 ± 0.08	1.730	0.9992
Pb	0.086 ± 0.007	0.093	0.9971
Mn	3.37 ± 0.18	3.440	0.9985
Mo	0.21 ± 0.02	0.190	0.9988
Ni	0.67 ± 0.08	0.69	0.9144
Se	n/a	0.23	0.9995
Ag	n/a	0.13	1.0000
Tl	n/a	0.14	0.9996
Th	n/a	0.19	0.9999
U	0.05 ± 0.003	0.049	0.9983
V	0.32 ± 0.03	0.330	0.9991
Zn	0.93 ± 0.10	0.98	0.9997

Table 1: Results obtained for the USEPA required elements.

n/a – no certified values available

Elements	Certified Result (ppb)	Result (ppb)	Calibration R2
Ca	6.2 ± 0.2	6.13	0.9987
Mg	1.6 ± 0.1	1.57	0.9970
K	0.68 ± 0.02	0.67	0.9990
Na	2.4 ± 0.2	2.33	0.8998
Fe	103 ± 5	104.22	0.8904
Sr	26.3 ± 3.2	26.340	0.9989

Table 2: Results obtained for other non USEPA required elements.

DISCUSSION

The USEPA 200.8 method has been successfully used to analyze 26 elements in a certified river water sample. However, unlike quadrupole ICP-MS, which requires 180 seconds acquisition time for 20 elements per sample, the Optimass only requires 25 seconds per sample. In this acquisition time all ICP-MS measurable elements and isotopes can be analyzed and quantified because of the truly simultaneous nature of the data acquisition.

Also, as all masses can be displayed simultaneously, the user can view possible contaminants and elements previously not considered in real time. This can prompt a user to investigate what a particular peak is and then, if important, to quantify these.

