TP09b Intelligent Dilution Systems for ICP-OES and ICP-MS

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Abstract: Analytical laboratories confront a wide range of issues that can affect their data, such as resources, trained personnel, time constraints and traceability. New dilution and sample introduction accessory systems have been engineered to confront these issues. With these systems it is common to see calibration coefficients of > 0.999, serial dilutions with a precision of < 3% and an accuracy of ± 3%. The USGS reference material "Basalt - Columbia River, BCR-2" provides evidence of how an intelligent dilution can be utilized once less concentrated elements have been analyzed. Once trace elements are analyzed, higher concentrated elements above the highest calibration standard are diluted back into the range. Table 1 represents data derived by running the system without a dilution in order to capture the trace elements. Table 2 represents the majors that are reported before and after intelligent dilution. All of the majors displayed improvement after the intelligent dilution was enabled.

The advanced dilutor and autosampler resolve the issues of accuracy, traceability, resources and employee time. Intelligent dilution solves the problem of serial dilutions as they are needed, remedies the problem of needing to dilute samples at a later time and re-run the samples, and provides ancillary support to laboratory methodologies in terms of quality, turnaround time and traceability.

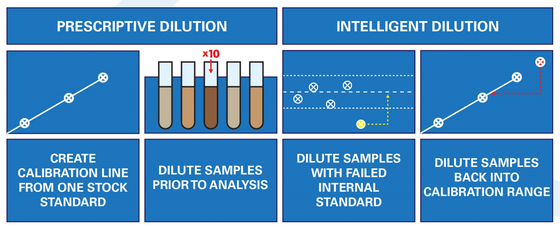
Instrumentation

ICP-OES

Sample introduction: ASX-500 autosampler

Sample dilutor: Teledyne CETAC SDX$_{HPLD}$ High Performance Liquid Dilution System

Teledyne CETAC Technologies SDX$_{HPLD}$ System



Sample

Columbia River Basalt

USGS reference material:
"Basalt - Columbia River, BCR-2"

Table 1: Trace elements without dilution.

Element	Cert. Value ug/g	SDX results	% Recovery
Mn	1520	1528	99.5
V	416	421	98.8
Zn	127	138	92
Ba	683	542	126
Cr	18	18.2	98.9
Sr	346	247.3	139.9
Li	9	7.3	123.3
Co	37	38.5	96.1

Table 2: Majors before and after dilution.

Element	Cert. Value wt%	Prior to dilution	% Recovery
Al	7.14	5.17	72.4
Ca	5.09	4.71	92.5
Fe	9.66	10.77	111.5
K	1.49	1.58	106.0
Mg	2.16	1.89	87.5
Na	2.34	2.62	112.0
Ti	1.35	1.22	90.2
Element	**Cert. Value wt%**	**SDX$_{HPLD}$ 49.38x dilution**	**% Recovery**
Al	7.14	7.16	100.3
Ca	5.09	4.89	96.1
Fe	9.66	9.95	103.0
K	1.49	1.52	102.0
Mg	2.16	2.19	101.4
Na	2.34	2.32	99.3
Ti	1.35	1.30	96.5

Summary and Notes

Table 2 displays the initial results of the elements that had concentration values that fell outside the calibrations range. The second part of Table 2 represents a 49.38 x intelligent dilution performed by the SDX to bring the elements concentrations back into the working calibration range. The intelligent dilution automatically recognizes samples that are in need of serial dilutions. This feature allows the end user to define the domain and range of where the serial dilution will fall on the calibration curve.

Conclusion

The intelligent dilution performs automatic serial dilutions as they are needed. It reduces or eliminates the cost in maintaining calibration standards, spent certified reference materials, traceability requirements, the cost in time for troubleshooting poor standardization curves and dilution results that are sometimes attributed to human error. Moreover, it solves the issue of running samples overnight, then having to do serial dilutions the next day on the samples that were over range, causing those samples to be re-run.