

The effect of plasma-preparation times on water analysis in ICP-AES

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New regulations on concentration limits, the constant request for lower limits of detection and the increasing demand for water analysis make the need for more accurate techniques and time-saving priority considerations.

That's why the ICP/AES (Inductively Coupled Plasma / Atomic Emission Spectroscopy) technology was developed. It allows a reliable sample analysis to be achieved in less than 2 minutes.

However, a fast relevant analysis requires some precautions. This study undertook to determine the appropriate analysis-outskirt times. As an illustration, a method for calibration was performed with an ICP/AES iCAP serie 6000 and iTeva software developed by Thermo. The sample introduction system is composed of a Mira Mist® nebulizer associated with a cyclonic spray chamber and a 1.5mm internal-diameter (id) injector. ICAP is equipped with a CCD detection system associated with an Echelle spectrometer, allowing for the simultaneous and sensitive detection of most water micro-polluting mineral and metal elements.

Experimental Conditions

Calibrations were performed with an internal standard (Yttrium, 30 mg/l) which was directly mixed with standards by means of a Y-tube system. Element concentrations are listed in Table 1. The natural matrix was simulated with the addition of metal elements in standards (e.g. Iron, Lead, Copper, etc.) as shown in Table 2. Standards were taken by a Cetac Auto-Sampler and driven to the Y-tube system by a 0.64mm i.-d. PVC tube. The internal standard was driven by a 0.25mm i.-d. PVC tube. The plasma RF power was 1150 W and the measurement height was adjusted on the radial view.

Table 1: standard preparations and concentrations in mg/l

Element	Ca	K	Mg	Na
Standard 1	40	2	5	5
Standard 2	100	5	10	10
Standard 3	200	10	25	25
Standard 4	300	15	40	40
Standard 5	400	20	50	50

Table 2: matrix micro-polluting element concentrations in µg/l

Elements	Fe	Mn Cu Zn B	Al Ni Co Ba	Cr Pb As Se Sb	Cd
Concentrations	52	20.8	10.4	5.2	1

Results and discussion

The example of Calcium is presented in Figure 1. Two parameters were tested: the so-called boosting time and the plasma-stabilization time. Reduction of these parameters led to a drastic signal intensity decrease. As seen in Figure 1, a 30-minute boost and 30-minute plasma stabilization halved the signal response obtained with a 1-hour boost and a 1-hour stabilization. The differences between each signal are shown by various slope angles.

Hence, the boost ability provided by the Thermo software is useful before switching on the plasma. It allowed the oxygen to be removed from the torch chamber thereby preventing the analysis of oxide formations, which provoke interference. The plasma needs to be stabilized for 1 hour in

Figure 1: Example on the Calcium wavelength 317.9 nm

