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Nebulizers and Nozzles

Application Note

MultiNeb, the easiest way to eliminate carbon spectral interferences in ICP spectroscopy analysis

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1. Introduction

Spectral interference on an analyte peak can also result from the solvent itself, particularly non-aqueous solvents. Emissions from carbon when analyzing samples diluted in organic solvents are widely known to interfere with important elements. For example, in the analysis of wear metals in oils, complex background structures compromise detection limits for lithium and potassium. Traditionally, the carbon deposition can be avoided by adding a small amount of oxygen to the intermediate gas flow. However, the use of oxygen to support complete combustion of carbon further increases the complexity of the experimental setup and the cost per analysis. In previous studies, it was demonstrated that the spectral interferences caused by organic matrices can be eliminated by MultiNeb® nebulizer. This nebulizer allows the simultaneous introduction of organic and aqueous solutions into the plasma. Adding water in the aerosol, through MultiNeb's second channel, will help the complete combustion of carbon, avoiding its byproducts and the subsequent clogging of the torch's injector, and will, therefore prevent the spectral interference, providing a better sensitivity and precision.

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This implies an important advantage over conventional systems since it does not require the continuous cleaning of ICP components or the use of expensive additional components such as cooled spray chambers or an auxiliary oxygen supply.

2. Experimental

Solvents

The organic solvent used in this study was kerosene (QP, Panreac, Barcelona, Spain. Boiling range: 190–250 °C) and the aqueous solvent used was distilled deionized water (18 MΩ cm resistivity).

Instrumentation

All measurements are made using an axial view inductively coupled plasma optical emission spectrometer Agilent 720 ES (Agilent). The operating conditions are shown in Table 1.

Parameters	
Plasma power (kW)	1.2
Plasma gas flow rate (L min^{-1})	15
Auxiliary gas flow rate (L min^{-1})	1.5
Total nebulizer gas flow rate (L min^{-1})	0.75
Organic flow rate (µL min^{-1})	50
Aqueous flow rate (µL min^{-1})	100
Replicates	3
Read time (s)	1.0
Nebulizer	MultiNeb®
Spray chamber	Cyclonic

Table 1.

3. Results and discussion

Background Emission

Figure 1 shows the spectrum in the vicinity of the Li I emission line at 670.783 nm and the K I 766.491 nm when water was introduced through one of MultiNeb's channels. As it can be seen, no spectral interference is observed in both spectra.

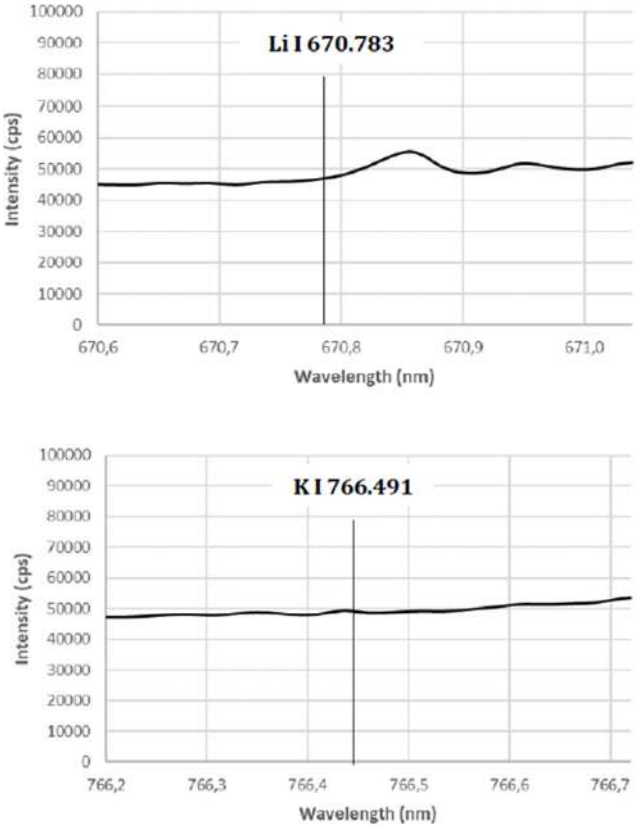

Figure 1. Spectra of lithium and potassium emission lines in water solution.

However, when the kerosene is introduced through MultiNeb's first channel instead of water, an intense peak at 670.783 nm can be observed, compromising the accuracy of Li determination in the analysis (Figure 2A, dot line). In case of potassium, several carbon emissions can be observed in the vicinity of the potassium emission line (Figure 2B, dot line).

In order to eliminate the spectral interferences, the simultaneous introduction of organic (kerosene) and aqueous solution (water) have been employed and the results are shown in Figure 2A (black line) for lithium and Figure 2B (black line) for potassium. As can be seen, the addition of water eliminates the carbon spectral interference from kerosene since the water contains enough oxygen to support complete combustion of carbon in the plasma.

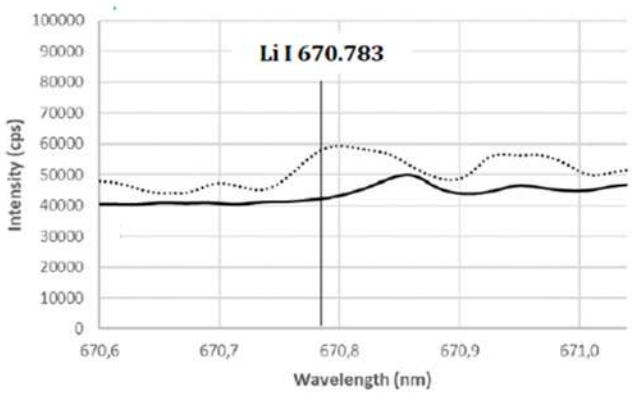

Figure 2A. Comparison between the lithium spectrum obtained introducing organic solution (dot line) and the spectrum obtained introducing simultaneously organic and aqueous solutions (black line).

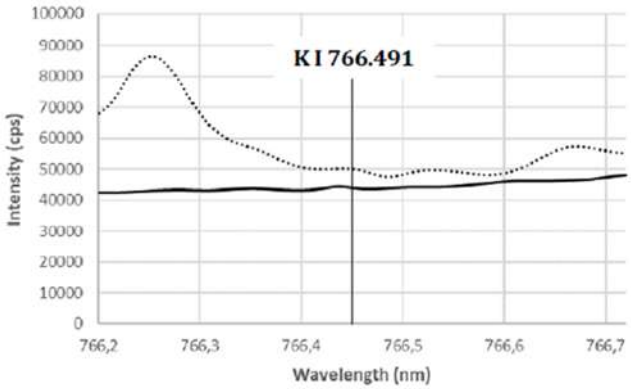

Figure 2B. Comparison between the potassium spectrum obtained introducing organic solution (dot line) and the spectrum obtaining introducing simultaneously organic and aqueous solutions (black line).

4. Conclusions

This work demonstrates that the use of the new MultiNeb® can eliminate the carbon spectral interference by the simultaneous introduction of organic and aqueous solutions. This simple and powerful alternative to remove spectral interference caused by organic matrix enables to analyze organic samples with confidence.

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