FR 38

Evaluation of Inductively Coupled Plasma Optical Emission Spectrometers with Axially- and Radially-viewed Configurations

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Inductively coupled plasma optical emission spectrometry (ICP OES) is a well established technique for multi-element analysis. This technique had a rebirth in the last decade due to the development of equipments with axially-viewed configuration and solid state detectors. The idea of axially-viewed measurements was proposed in the seventies, however, in spite of the improvement of sensitivity, the system performance was degraded owing to interferences. After two decades, this proposal becomes viable due to the development of proper interfaces based on shear-gas or end-on-gas. However, the common sense in this area recommends ICP OES with axially-viewed configuration for applications where sensitivity is critical, but the sample matrix is not complex. In this sense, for samples with complex matrixes it seems that needs a more critical evaluation. In this work, the analytical performance of two ICP optical emission spectrometers with axially- and radially-viewed configurations and charge coupled device solid-state detectors were evaluated using Ar, Ba, Mg and Ni as test elements. The same operational conditions and sample introduction system were employed in both spectrometers in order to obtain results in similar experimental conditions. The axially-viewed configuration used an end-on-gas interface. The figures of merit evaluated were: warm-up time, repeatability, long-term stability, UV and VIS spectral resolutions and limit of detection (LOD) for Ni in 0.14 mol l^{-1} HNO_3 and in 1,000 mg l^{-1} Cr media. The robustness, repeatability, long-term stability and UV and VIS spectral resolutions were similar for both configurations. For radially-viewed equipment, the warm-up time was lower than that reached using the axially-viewed configuration. On the other hand, the sensitivity attained by the axially-viewed configuration was in general 15-fold better than that achieved by using the radially-viewed system. The axially-viewed configuration presented higher detection power than that achieved by radially-viewed equipment, even for complex samples. In spite of some particularities, such as the higher warm-up time observed for axially-viewed configuration, it could be supposed that the efficiency of the end-on-gas interface improved the performance of this arrangement and it seems that we could suppose that most applications could be perfectly performed at an ICP OES with this arrangement without any serious degradation of analytical performance.

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Map of the Island

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