FUNDAMENTAL STUDIES ON THE IONS DISTRIBUTION IN ICP-MS FOR ETHANOL-WATER MATRICES AND ITS APPLICATION TO THE DETERMINATION OF METALS IN BIOETHANOL

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The development of new analysis methods to determine metals and metalloids in bioethanol and other ethanol-water matrices is being developed recently due to the expansion of the biofuels.

Several methodologies have been employed successfully to carry out the quantification of metals in bioethanol-gasoline mixtures, called ethanol fuel.[1] However, a limited number of works have been focused in the determination of metals in pure bioethanol. The most important difficulty encountered to carry out the determination of metals in bioethanol is the huge variety of matrices under the called commercially as bioethanol, which can contain up to 7% of water and 300 different organic compounds, that causes matrix effects, thus requiring standard addition calibration. Recently, it has been reported the use of the total sample consumption system called hTISIS as a possibility to remove the matrix effects induced by ethanol in ICP-OES.[2] In this case, a single pass spray chamber has been heated at 400ºC. Under these conditions the analyte transport efficiency was the same for all the matrices studied. Nevertheless, when this introduction system was tested in ICP-MS under optimal conditions in terms of analyte transport efficiency, it was necessary to move the torch-interface alignment to fully remove the matrix effects. These observations suggested that the ions distribution in the plasma was dependent on the matrix composition and chamber temperature.

In the present work, axial and radial plasma ionic profiles have been obtained for several analyte isotopes and additional diagnostic magnitudes such as CeO^+/Ce^+ and Ce^{++}/Ce^+ ratios and background ions. The hTISIS has been employed so as to remove interferences arising in the aerosol transport step. An ICP-MS Agilent 7700x equipped with a High Matrix Introduction device (HMI) and a He collision cell has been used. The signal profiles have been obtained for different injector inner diameters, hTISIS temperatures; 1st and 2nd extraction lens voltages and ethanol concentrations.

The data generated in the present work revealed the capital importance of the torch injector inner diameter and the spectrometer plasma sampling zone. These results allow to better understand the interferences caused by ethanol in ICP-MS and they have been applied to the determination of metals and metalloids in bioethanol samples by means of the external calibration under optimal conditions of matrix effects and sensitivity.

References.

[1] Metal and metalloid determination in biodiesel and bioethanol*, Raquel Sánchez, Carlos Sánchez, Charles-Philippe Lienemann, José-Luis Todolí, J. Anal. At. Spectrom., 30 (2015) 64-101.

[2] Metal and metalloid determination in bioethanol through inductively coupled plasma-optical emission spectroscopy, Carlos Sánchez, Charles Philippe-Lienemann, José-Luis Todolí, Spectrochimica Acta Part B 115 (2016) 16–22.