

the direct injection version of the Concentric Capillary Nebulizer. Results will be presented for several different matrices, including coal and clays. Improved techniques for dissolution of recalcitrant samples using the Anton Paar Multiwave 3000 microwave digestion system will be discussed, particularly for the preparation of coals, clays and ceramics. Most results presented are for ICP atomic emission spectrometry, using a PerkinElmer Optima 4300, which delivers detection limits and sensitivities than can, in some cases, compete effectively with ICP mass spectrometric techniques. Preliminary results for ICP-MS are presented for selected elements, where the MSIS delivers superior results as a consequence of the improvements in reducing polyatomic interferences for selected elements.

[1] Roger L. J. McLaughlin and Ian D. Brindle, A New Sample Introduction System for Atomic Spectrometry Combining Vapour Generation and Nebulization Capacities, *Journal of Analytical Atomic Spectrometry*, 17, 1540 (2002).

[2] Renjin Wang, Roger L. McLaughlin and Ian D. Brindle, A Concentric Capillary Nebulizer for Inductively-Coupled Plasma Atomic Emission Spectrometry, *Journal of Analytical Atomic Spectrometry*, 15, 1303 (2000).

TU-O-19 A CRITICAL EXAMINATION OF RELIABILITY OF INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY FOR COMPLIANT ANALYSIS OF ENVIRONMENTAL SAMPLES. I.B. Brenner, Environmental Analytical Services, 9 Dishon Street, Malkha, Jerusalem, Israel, Brenner@cc.huji.ac.il

Inductively coupled plasma mass spectrometry (ICP-MS) is now widely employed for determination of trace and minor element constituents in environmental samples from natural surface, drinking, and ground water to industrial effluents and toxic solid wastes. In this presentation we will evaluate the reliability of analytical data in terms of spectroscopic and nonspectroscopic interference effects. Emphasis will be placed on the long-term influence of the sample matrix (Na, Ca) on the sample introduction system, the plasma, and the plasma-MS interface. It will be shown that nonspectroscopic interferences can be compensated using internal standards and robust ICP operating conditions, while polyatomic ions can be compensated using reaction and collision cells. Data for spiked samples and CRMS will be used to quantify these effects.

TU-O-20 PASPALUM NOTATUM ROOTS AS BIOSORBENT FOR METALS PRECONCENTRATION. A.R.A. Nogueira, Grupo de Análise Instrumental Aplicada, Embrapa Pecúaria Sudeste, PO Box 339, 13560-970, São Carlos SP, Brazil; G.C.L. Araújo and J.A. Nóbrega, Grupo de Análise Instrumental Aplicada, Departamento de Química, Universidade Federal de São Carlos, PO Box 676, 13560-970; São Carlo SP, Brazil

Biological materials such as fungi, bacteria, algae and parts of plants have been successively employed to preconcentration, bioremediation and recover elements with commercial value due to their diversity and selectivity.

Among the procedures that comprise parts of plants, those that employ roots must be pointed out due to the great number of available organic functional groups carrying out as active sites for metal sorption. These functional groups adsorb metal ions effectively, and behave similarly to exchange ionic resins in response to changing solution pH. In this work, roots of *Paspalum notatum*, a native forage from Brazil, were evaluated as metal biosorbent. After cleaning with acid baths, the roots were lyophilised and metal binding experiments were performed using a multi-metal spiked containing the following 13 metals: Al³⁺, Cd²⁺, Co²⁺, Cr⁶⁺, Cu²⁺, Fe³⁺, Mn²⁺, Ni²⁺ and Zn²⁺ (5.0 mg L⁻¹), and Ca²⁺, K⁺, Mg²⁺ and Na⁺ (200 mg L⁻¹) in 0.5 mol L⁻¹ ammonium acetate buffer solutions, with pH varying from 3.5 to 7.5. The pH values were corrected with concentrate nitric acid or ammonium hydroxide. After exposure to the roots, the solutions were centrifuged and the metals present in supernatants determined by inductively coupled plasma optical emission spectrometry (ICP-OES) with radial view. Metal binding capacity of *Paspalum* roots showed the order Al > Fe > Cr > Zn > Cu, based on the sorption isotherms. At pH 7.5, it was possible adsorb 98% of Al, Fe, and Cr and around 40% of Cu, Mn, and Zn. The adsorption step was performed in lower than one minute. The evaluated biosorbent presented potentiality to efficiently be applied as bioremediator in polluted environments for Cr, Al and Fe. Although in the multi-elemental solution, it was used to preconcentrate Cu, Mn and Zn to increase ICP-OES detection limit.



Among the procedures that comprise parts of plants, those that employ roots must be pointed out due to the great number of available organic functional groups carrying out as active sites for metal sorption. These functional groups adsorb metal ions effectively, and behave similarly to exchange ionic resins in response to changing solution pH. In this work, roots of *Paspalum notatum*, a native forage from Brazil, were evaluated as metal biosorbent. After cleaning with acid baths, the roots were lyophilised and metal binding experiments were performed using a multi-metal spiked containing the following 13 metals: Al³⁺, Cd²⁺, Co²⁺, Cr⁶⁺, Cu²⁺, Fe³⁺, Mn²⁺, Ni²⁺ and Zn²⁺ (5.0 mg L⁻¹), and Ca²⁺, K⁺, Mg²⁺ and Na⁺ (200 mg L⁻¹) in 0.5 mol L⁻¹ ammonium acetate buffer solutions, with pH varying from 3.5 to 7.5. The pH values were corrected with concentrate nitric acid or ammonium hydroxide. After exposure to the roots, the solutions were centrifuged and the metals present in supernatants determined by inductively coupled plasma optical emission spectrometry (ICP-OES) with radial view. Metal binding capacity of *Paspalum* roots showed the order Al > Fe > Cr > Zn > Cu, based on the sorption isotherms. At pH 7.5, it was possible adsorb 98% of Al, Fe, and Cr and around 40% of Cu, Mn, and Zn. The adsorption step was performed in lower than one minute. The evaluated biosorbent presented potentiality to efficiently be applied as bioremediator in polluted environments for Cr, Al and Fe. Although in the multi-elemental solution, it was used to preconcentrate Cu, Mn and Zn to increase ICP-OES detection limit.

TU-O-21 SELENIUM SPECIATION BY SPME - MODERATE TEMPERATURE MULTICAPILLARY GC AND MIP-AES DETECTION. C. Dietz, J. Sanz, P. Ximenez, Y. Madrid, and C. Cámara, Universidad Complutense de Madrid, Faculty of Chemistry, Department of Analytical Chemistry, 28040 Madrid, Spain

Microwave induced plasma emission spectrometry (MIP-OES) in combination with multicapillary (MC) gas chromatography could be proven to be useful for element specific detection of volatile species. Solid phase microextraction (SPME) was used for preconcentration and sample-matrix separation. The advantages of this solvent-free technique are numerous: simplicity, low cost, and reduction of analyte loss during extraction. Desorption was carried out in an in-house developed unit, and home-made was as well the heating control for the MC column. The system is therefore independent from the use of a conventional gas chromatographic oven and can be used as a versatile alternative to highly cost intensive methods such as GC-ICP-MS. Multicapillary column was operated at moderate temperatures (aprox. 40 - 100°C). The method was optimized, using a chemometric approach, with respect to the detection of organoselenium species such as DMSe, DEtSe and DMDS. A comparative study of stationary phases for the SPME fiber as well as for the chromatographic column is given. Application was focussed on selenium speciation in plants such as Indian mustard, lupine, garlic and onion. These plants were grown in hydroponic solution containing inorganic selenium