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Application of Secondary Ion Mass Spectrometry (SIMS)to Localize Chromium in Roots of Water Hyacinths *Eichhornia crassipes* (Mart.) Solms. in the Cachoeira Basin – Brazil.

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Abstract

In the last years metal pollution has become one of the most important environmental problems. Concerning the high toxicity of these elements, both sensitive analytical measurements and methods for the control of the ecosystem are required to reveal and localize metals on organism. Due to high transportations rates and exchange phenomena of sediment bound metals and changes of imission concentrations, the estimation of pollution in aquatic systems like the river Cachoeira is problematic. Water and sediments samples can only refect momentary concentrations. In this context the use of biomonitoring methods offers the possibility to assess the heavy metals pollution. Secondary Ion Mass Spectrometry (SIMS) and Inductively coupled plasma mass spectrometry (ICP-MS) were used to localize chromium in *Eichhornia crassipes*. The pollution in chromium is bound to the clandestin tan ery activity on the basin of the Cachoeira region south of Bahia (Brazil).
Keywords: SIMS, Chromium, ICP-MS.

Water and sediment samples were collected along the cachoeira basin – Bahia - Brazil, from the region close to the source up to a distance of 120 Km. In the Cachoeira basin. The ion microscope SMI 300 CAMECA was used to obtain direct analytical images.

The multi-elementary methods ICP-MS and SIMS investigations has permitted a precise investigation of the concentrations of Cr in *Eichhornia* tissue. The high sensitivity of SIMS permitted the Cr detection in a larger number of root cells, principally in cell walls. The SIMS images provide a map of the distribution of Na^+.Ca^+ and Cr^+ in roots tissues (figure 1). The results have evidenced the sites of Cr in root, the cell wall, nucleus, and xylem vessel are the site of Cr accumulation in roots. The presence of chromium in nucleus is due to the strong binding of Cr^{3+} to DNA contributes to the reduction of Cr^{3+} solubility, stabilization of the double-strand structure of DNA [5]. The ICP-MS data confirm *E. crassipes* like bioindicator plant. The references materials used were Riverine Water, SLRS-3 (National Research Council of Canadá) and soils-7 (International Atomic Energy, Vienna, Austria). The results obtained by ICP-MS shows anormal values of Cr concentrations in water samples (0,38 µg/l), in soil samples (63µg/g) and 70µg/g in plant. Cr was mainly accumulated in roots. *E. crassipes* seems to have the ability to accumulation high concentration of Cr in its roots. Although the high amount of Cr in the roots might be partly due to physical adsorption on the cell walls, it can be deduced that more than 25% of the total Cr concentration was associated with the protoplasmic fraction. Cross and

longitudinal sections of *E. crassipes* roots shows the existence of deposits in symplastic and apoplastic areas. Chemical analysis using ICP-MS, confirms SIMS analysis on the presence of Cr in roots cell walls. The use of ICP-MS, to investigate the same organs as the ones investigated by SIMS, provided complementary results on chromium study.

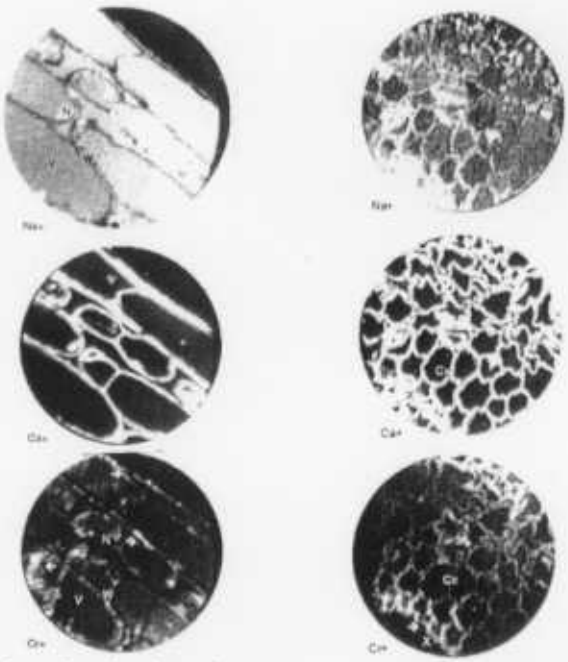

Fig 1. SIMS image of longitudinal and transverse section of *Eichhornia crassipes* roots, showing the cortex area (Cx), cell wall (w), nucleus (N), vacuole (V) and Xylem (X). The images shows abundance of chromium in root cell walls. Calcium image (ca), Sodium image (Na) and Chromium image (Cr).

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