

FT-IR spectroscopic study in plants from contaminated mining sites

NUNO DURÃES¹, IULIU BOBOS¹ AND
EDUARDO FERREIRA DA SILVA²

¹GIMEF – Center of Geology, University of Porto, Rua do Campo Alegre, 687 4169-007 Porto, Portugal
(nunoduraes@fc.up.pt)

²ELMAS – Department of Geosciences, University of Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal

The roots and above ground parts of three different plants species (*Cistus Ladanifer*, *Juncus efusus* and *Scirpus holoschoenus*) collected in contaminated mining sites of Iberian Pyrite Belt were chemical analysed. Concentrations of toxic metals (Cu, Pb, Zn) were found higher in both *Juncus efusus* and *Scirpus holoschoenus* species than *Cistus Ladanifer*. The concentration values of toxic metals determined in roots in the first plants species are: Cu 352 -519 mg.kg⁻¹, Pb 169 – 568 mg.kg⁻¹, Zn 212-563 mg.kg⁻¹. Both Fe and Mn concentrations increase, as toxic metals concentrations increase.

FT-IR technique was used for evaluation of the type of organic and inorganic complexes in plants. The analyses were carried out on drying and low ashing temperature material of different parts of each plant.

Slightly differences regarding to organic complexes were observed in FT-IR patterns. Strong stretching bands attributed to C–H (2923; 2850 cm⁻¹) and C=O (2360; 2340 cm⁻¹) were found for each part of studied plant. Salts and fatty acids are observed at 1620 cm⁻¹, 1536 cm⁻¹ and strong saturated fatty acids occur at 1700 cm⁻¹. A slight broadening band at 3400 cm⁻¹ is attributed to OH stretching band. Bands associated with H₂O (1630 cm⁻¹ bands) are more expressive in the roots and stems. No H₂O bands were identified in the upper part of plants.

However, strong differences in inorganic complexes were observed between the roots and above ground parts of plants species analysed. Molecular vibrations associated with inorganic complexes were related to the stretching modes of the S–O bonds show characteristic absorption bands at 1250 – 1000 cm⁻¹. Probably, these bands are characteristics for sulfate adsorption on Fe-oxyhydroxydes. The presence of S–O bonds suggests that some mechanisms of detoxification of metals in plants consist in the precipitation of metals as sulfates. A strong band at 669 cm⁻¹ attributed to anhydrite occur mainly in leaves and stems.

The organics acids and S–O complexes may act as chelating agents in the transporte of metals in plants allowing the accumulation of metals in plants.

Distribution and speciation of mercury in the Curuai floodplain lakes and role of the water exchanges with the Amazon River, Brazil

P. DUTRA MAIA¹, L. MAURICE BOURGOIN¹, E. TESSIER²,
D. COSSA³, D. AMOUROUX², M. PEREZ⁴
AND P. MOREIRA TURCQ⁴

¹LMTG, U. Toulouse, CNRS, IRD, OMP 14 Av. E. Belin F-31400 Toulouse, France (dutra@lmtg.obs-mip.fr, maurice@lmtg.obs-mip.fr)

²LCABIE, U. Pau et Pays de l'Adour, CNRS UMR 5034, Hélio parc 64053 Pau, France (emmanuel.tessier@univ-pau.fr, david.amouroux@univ-pau.fr)

³Ifremer, BP 21105 44311 Nantes, France
(Daniel.Cossa@ifremer.fr)

⁴UFF, Programa de Geoquímica, Outeiro São João Batista, 24020- 007 Nitéroí, Brazil (marcelaaperez@hotmail.com, pturcq@geoq.uff.br)

The role of the channel-floodplain interactions in the biogeochemical cycle of mercury in the Amazon basin is still poorly documented. It appears that floodplains can act as an important sink of sediments and Hg associated with fine particles. The main objective of this work is to study the distribution and the speciation of Hg in the Curuai floodplain lakes system (3800 km²) in the Middle Amazon.

The sediment inputs in these floodplain lakes occurs during the rising stage of the Amazon R., from January to May. In most of these lakes, the maximum Filtered-Hg and F-CH₃Hg concentrations are observed during the rising water stage, varying from 27.6 to 51.6 pM and 0.12 to 1.66 pM respectively, that coincides with the F-Hg input of the Amazon R. The dry season, when most of the lakes are isolated from the mainstream, is characterized by low F-Hg concentrations. This can be explained by the formation of Hg⁰ from Hg²⁺ reduction and its volatilisation induced by wind waves. On the contrary, the highest P-Hg concentrations are observed during the dry season (47 to 478 pM) due to the elevated TSS content associated to the re-suspension by the wind of the bottom sediments in shallow water lakes (~50cm) and by the fish and invertebrates bioturbation. The negative correlation between the partition coefficient of Hg (K_D) and the TSS content confirms the Hg complexation on OM-fine particles during its transfer in the floodplain system. The water and sediment storage in the floodplain lakes favors biogeochemical processes, like reduction, volatilization, adsorption and re-suspension of Hg in surface waters.

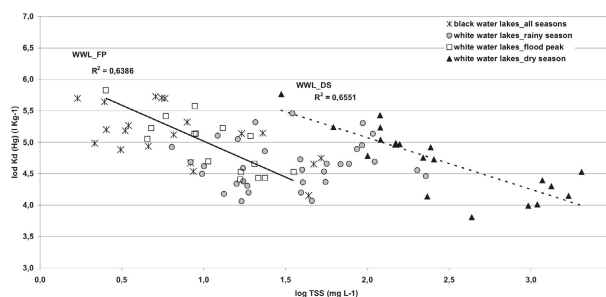


Figure 1. Relationship between log KD (Hg) and TSS concentration in the Curuai floodplain lakes