

Study of mobility of Zn, Co, Cu and Pb in the unsaturated zone in tropical climate

M. Szikszay
G.A.L. Alexandre
M.C.M. Toledo
R. Hypolito
D. Shimizu

Universidade de São Paulo, São Paulo, Brazil.
Universidade Federal de Corumbá, Mato Grosso do Sul, Brazil.
Universidade de São Paulo, São Paulo, Brazil.

Introduction

An Experimental Station was installed on the Campus of the University of São Paulo for the study of hydrogeochemical processes in the unsaturated zone. One of the aims of the research was to study the behavior of different pollutants in the unsaturated zone. Before using the pollutants at the site, the problem of pollution of the aquifer was considered. Therefore, it was decided that only after studying the behavior of certain metals in the laboratory, could the experiment be taken to the site under safe conditions. For this reason, column samples were collected at the site for preliminary study in the laboratory.

Methods

Sample selection and collection - Representative samples of the most differentiated lithological levels were selected. These were more or less at

clayey and more or less ferruginous levels (+ 2.0 m depth). Soil samples of 1.00 m length and 2" diameter were collected in PVC tubes.

Chemical analysis of the core material. The core material (2.0–3.0 m depth) was analysed by the Instrumental Neutron Activation Analysis method for: (in ppm) Cr 11.84–13.59; Zn 12.54–16.87; Co 1.2–1.33 and by Atomic Absorption method for: (in ppm) Pb 12–26 (Szikszay *et al.*, 1992a).

Solution preparation and application. Three types of solutions were prepared with concentrations of 100 ppm, 500 ppm and 1000 ppm of Zn, Co, Cu and Pb and applied on the columns.

Simulation of rain. During a period of one year 2 types of rains were applied on the columns: Type 1 - during 2 successive days 100 ml monthly; Type 2 - 100 ml for a week during 5 successive months and then during 7 months as Type 1. The percolating waters were collected for chemical analysis (Szikszay *et al.* 1992b).

TABLE 1. Concentrations of Zn, Co, Cu and Pb in the sediments and in the percolating and recuperated waters during a period of one year. (in ppm)

Elements in solid material	Column 1A blank Type 1	Column 1B blank Type 2	Column 2 solution 'B'T.1	Column 3 solution 'A'T.1.	Column 4 solution 'C'T.1.	Column 5 solution 'A'T.2.
Zn 11.54-16.87	1.85	2.4	29.3	76.6	347.2	28.12
Co 1.2-1.33	n.d.	n.d.	26.1	n.d.	431.1	2.2
Cu < 10	n.d.	n.d.	n.d.	n.d.	0.9	n.d.
Pb 12-26	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

Obs.: n.d. = not detected

Type 1 and 2 and T.1. and 1.2. = Rain Types 1 and 2

Solution 'A' 100 ppm of each element; Solution 'B' 500 ppm of each element and Solution 'C' 1000 ppm of each element.

Results

On Table 1 are shown the total results obtained during a year, for the chemical analyses of recuperated waters of each column, referring to concentrations of Zn, Co, Cu and Pb. On the same Table 1 are also shown the elements found in the sediments, before the application of pollutants and of rain.

As it can be seen on Table 1, not all applied elements were detected in the recuperated waters which indicates that there was retention on the solid material.

Conclusions

The results of this first part of the study furnish the following conclusions:

- The presence of Zn and Co was detected in all percolating waters in the case of both types of waters;
- The Cu was detected only when the applied

concentration was highest (1000 ppm) with insignificant values;

- The different rain types did not show significant changes in the mobility;
- The relative mobility of elements was: Zn > Co > Cu > Pb. The lead was not detected in any of the recuperated waters in spite of being found in the solid material (sediment) and in the applied solutions.

References

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