

SUMMARY

The smelter in Mufulira is one of the several active copper smelters in Copperbelt area in Zambia. It had operated for almost 70 years and during that period all offgas and dust were released into the atmosphere. Six profiles, three of them beneath trees, were sampled in the distances of 3.6, 8 and 24 km from the smelter. Each profile consisted of 9-10 layers collected continuously from the topsoil till depth of 60-70 cm. Following parameters were measured for each layer: pH, TC, TS a CEC, then total concentration of Ag, As, Al, Fe, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Sn, V a Zn and extractability by EDTA. The total concentrations of metals/metalloids were measured by ICP-OES and quadrupole-based ICP-MS. TC and TS were determined by thermal analysis and mobility of metals was assessed according to their extractability by EDTA. The aim of this work was to compare vertical distribution and mobility especially of these metals Co, Cr, Cu, Pb, V and Zn among profiles. Finally a standardized toxicity test was performed with ten selected layers (include all top soils) from all profiles. This reproductive test with *Enchytraeus crypticus* reflected how tested soil samples were suitable for living and reproducing this specimen of invertebrates.

Generally the total concentrations of metals decreased in surface layers (0-1 cm) with distance from the smelter. About 3.6 km from the smelter the highest values reached: 42 mg Pb/kg, 46 mg Co/kg and 8980 mg Cu /kg and in the distance of 8 km: 58 mg V/kg, 69 mg Cr/kg and 83 mg Zn/kg. Similarly the highest concentrations of TC and TS were in the vicinity of smelter. Following metals and metalloids were under detection limit of used methods: Ag, As, Cd, Mo, Se a Sn.

Up to 55% of the total concentrations of metals were extractable in the surface layers by EDTA but in the most cases the total amounts of these metals were below 70 mg/kg. However in case of Cu it was possible to extract 38% (3494 mg/kg) and 55% (1568 mg/kg) of total copper by EDTA from the surface layers lying 3.6 km from the smelter. By comparing the sums of EDTA extractable metals (the sum of values of all layer in given profile for concrete metal) among profiles it was found that distance from the smelter did not have significant influence on extractability of Al, Cr, Fe, Ni and V. Nevertheless in case of Co, Mn and Pb their extractability by EDTA was increased in the vicinity of the smelter about 10-25% and around 10-40% for Cu in compare with reference profiles.

The toxicity test revealed that substances present in the soil layers had often significant influence on the reproduction of enchytraeids. In some cases they were even in lethal concentration. The total metals concentration and theirs correlations with number of reproduced enchytraeids indicated that the copper was probably the main reason of soil toxicity. The EC50 for Cu was 436 mg/kg.