Methodological aspects of extracting heavy metals from soils and sediments

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PURPOSE

Soils and bottom sediments are a kind of depot for heavy metals, keeping the long-term anthropogenic impact on the ecosystem. Heavy metals are persistent pollutants, non-biodegradable, easily accumulated in living organisms even at low concentrations, and causing serious illnesses.

The main objective of this work was to study the influence of sample preparation on the extractability of heavy metals (HMs) from soil and bottom sediments in the model experiment.

MATERIALS AND METHODS

- the control (original **uncontaminated** Haplic Chernozem) and and sediments (aleuropelitic silt) (table 1)
- Polluted soil and sediments (treatments with the addition of of Cu, Ni, Zn, Cd and Pb at a rates of 2 (**low contaminated**), 10 (**contaminated**) and 20 (**high contaminated**) maximum permissible concentration)
- Different sample preparation techniques has been used: the air-dry sample was sieving through a **sieve with holes in 1 mm and** with holes in **0.25 mm**

Extraction methods included:

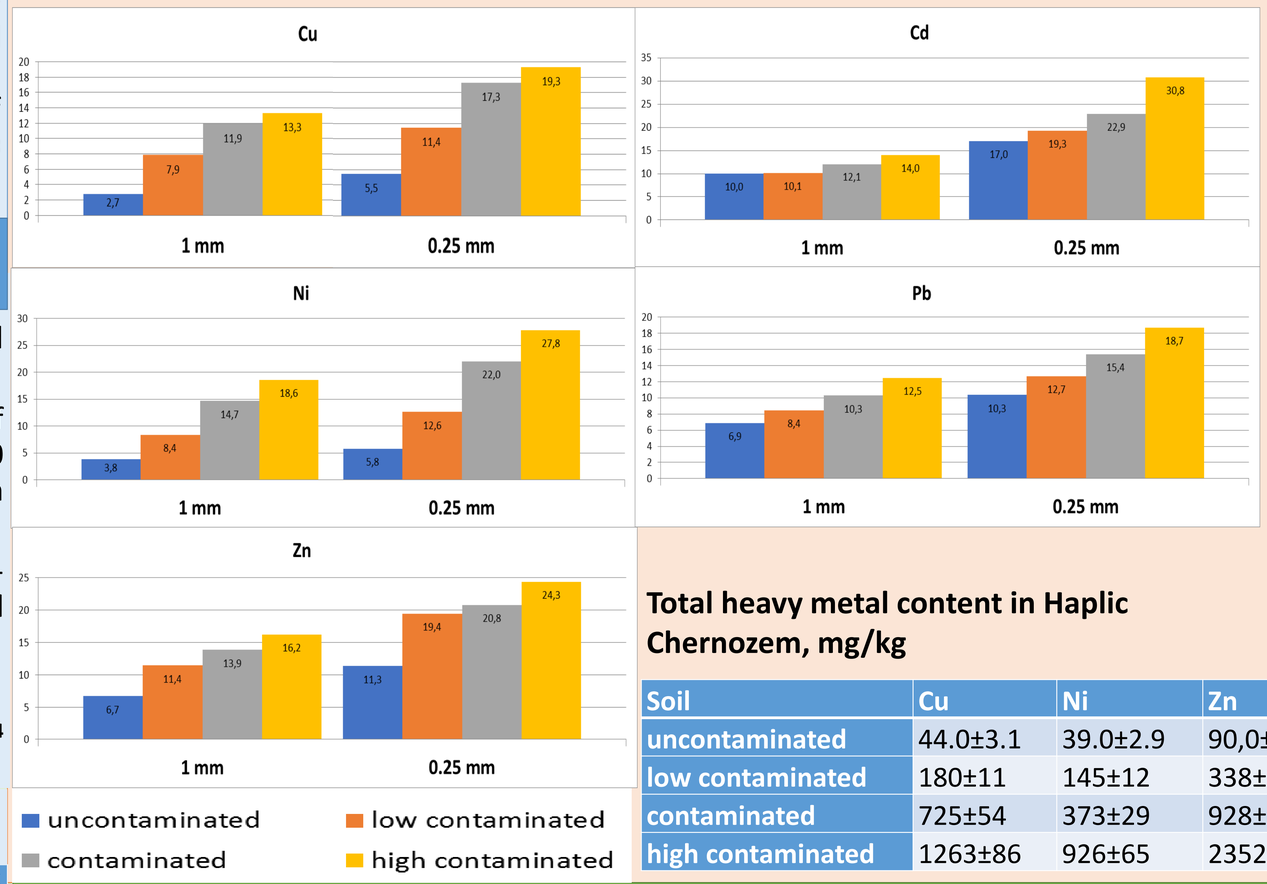
- The metal compounds extracted with the **1 M CH_3COONH_4 (pH4.8)** are classified as **exchangeable**

Table 1. Physical and chemical properties of soil and sediments

C_{org}, %	pH_{H2O}	Silt and clay (<0.01 mm), %	Silt (<0.001 mm), %	CEC, cmol/kg	$CaCO_3$, %	$MgCO_3$, %
Haplic Chernozem						
3.7	7.5 ±0.1	47.1	26.8	3.71±0.1	0.03	0.08
Sediments (aleuropelitic silt)						
4.1	8.3±0.1	69.6	17.6	2.13±0.2	0.18	0.09

RESULTS AND DISCUSSION

Exchangeable metal content in Haplic Chernozem under model conditions, % of the total content



Total heavy metal content in Haplic Chernozem, mg/kg

Soil	Cu	Ni	Zn	Cd	Pb
uncontaminated	44.0±3.1	39.0±2.9	90,0±8.5	0,1±0.1	29,0±2.2
low contaminated	180±11	145±12	338±27	3,8±0.3	58,0±4.2
contaminated	725±54	373±29	928±69	11,3±1.0	148±12
high contaminated	1263±86	926±65	2352±98	22,6±2.1	334±26

It was found that the extraction of HM during sample preparation through a sieve of 0.25 mm was higher than through a sieve of 1 mm (to 3-17%). This is due to the larger surface of soil particles. These differences were manifested both in unpolluted soil and sediments and at different levels of their pollution. With increasing contamination level there the differences were more noticeable.

CONCLUSIONS

Thus, the state of the analyzed sample has a significant influence of HMs extraction. To analyze and compare the results of fractionation of HM compounds from soils and sediments, it is necessary to take into account the sample preparation used and extraction time required in each method.

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