ReSoil

Remediation case #2

Remediation od Pb, Zn and Cd contaminated soil from Arnoldstein for production of safe vegetables

August 2018 – September 2020

Contaminated site

Lead mining and smelting for more than 300 years caused environmental accumulation of Pb, Zn and Cd. The extent of metal contamination in Arnoldstein, Austria is about 10 km², most of it in woody areas. Arable and grassland is affected in an area less than 1 km². The area used for housing and gardening in Arnoldstein and nearby Hohenturn is small (few ha) but highly contaminated.

Lead

TRADITIONAL LEAD SMELTER, ARNOLDSTEIN, AUSTRIA

A large lead smelter and a lead recycling plant that contributed to high lead exposure in the area - *Drasch, 2000*

For initial investigation the soil was collected from the upper 30 cm layer of active farmland.

Soil excavation, sieving & transportation


Photo: Cristoph Noller


Photo: Cristoph Noller


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Soil remediation, Prevalje, Slovenia

Soil washing

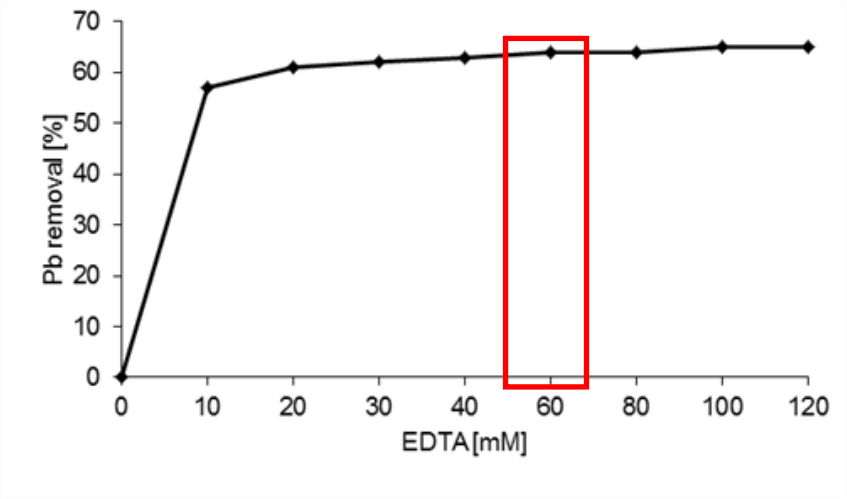
Soil rinsing, separation

EDTA, water recycle …alkaline phase

EDTA, water recycle …acidic phase

Remediation efficiency

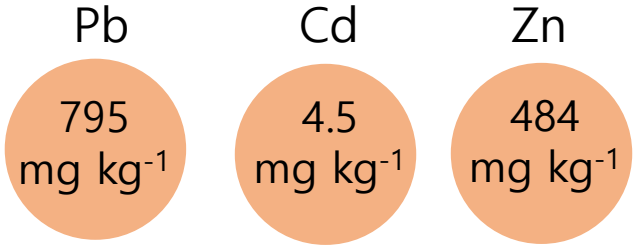
EDTA dose of 60 ± 10 mmol / ton of soil was used in remediation process.



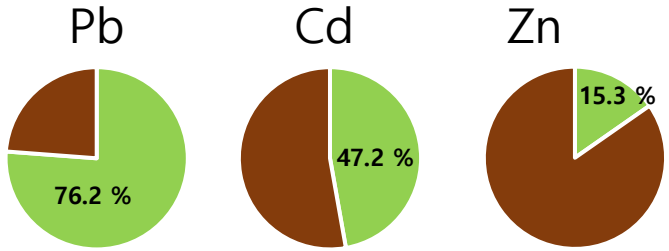
Effect of remediation on soil properties

	Original	Remediated
pH (water)	5.86	7.14
SOC (%)	2.86	2.93
C/N	9.5	10.1
P_2O_5 (mg kg^{-1})	116	63
K_2O (mg kg^{-1})	91	132
Sand (%)	38.2	32.8
Silt (%)	47.2	49.9
Clay (%)	14.6	17.3
CEC_{eff} ($cmol_c$ kg^{-1})	13.4	11.3

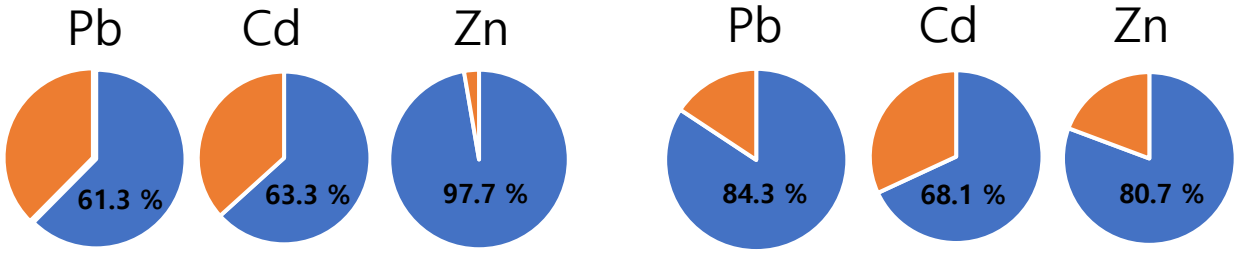
Initial metal concentration



Reduction in metal concentration



Hazard mitigation



(NH_4NO_3 extraction test) (Mehlich 3 extraction test)

Raised beds with remediated soil, BOKU, Tulin, Austria


Photo: Cristoph Noller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Remediated soil as a plant substrate

Remediation enables growth of healthy and safe vegetables on Arnoldstein soil. Toxic metal uptake in Spinach, Radish, Chinese Cabbage and Bush Beans was reduced by over 80%. Biomass production on the remediated soil was systematically increased for all vegetables.

Second crop rotation: Chinese cabbage and Cab beans (June 2020 – September 2020).

Remediated soil as an active ecosystem

Analyzing soil total soil C and N, DOC, NH_4, NO_3, microbial community (total microbial biomass, PLFA) and soil respiration indicated higher ecosystem activity and C/N turnover in remediated soil. Key soil micro- and mesofauna was preserved.

Stabile isotope experiment to investigate C and N cycle (October 2019 – Mach 2020).