EUROPEAN SYNCHROTRON RADIATION FACILITY
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	Experiment title: **Biotransformation of mercury and selenium in edible mushrooms *Boletus* sp. - indication for bioavailability and food safety**	**Experiment number**: Ev-210
Beamline: BM08	**Date of experiment**: from: 8.12.2016 to: 13.12.2016	**Date of report**: 1.9.2017
Shifts: 15	**Local contact(s)**: Francesco Dacapito	*Received at ESRF:*

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Report:

Background and aims

Wild growing edible mushrooms are regularly consumed in many European countries. The fruiting bodies of *Boletus edulis* are considered "the wild mushroom *par excellence*" in Italian, French and German cuisine for their aromatic taste and versatility. Yet *Boletus* species accumulate relatively large amounts Hg, but also contain relatively high amounts of Se [1]. By our preliminary results *B. edulis* in Slovenia accumulates up to 10 μg g^{-1} dry mass of Hg in neutral reference area, while in the vicinity of Idrija Hg mine, Hg conc. of up to 170 μg g^{-1} were detected [2]. For Se, conc. from 20-70 μg g^{-1} are reported [3].

Recently we showed that arbuscular mycorrhizal fungi are able to bind Hg to 4 S ligands while in plants Hg-2S complexes are mainly found [4]. The aims of this study were a) to determine speciation and ligand environment of Hg and Se by EXAFS and XANES in *Boletus* sp. fruiting bodies collected in natural environment, b) to follow the processes of biotransformation of Hg and Se in *in vitro* tissue culture of *B. edulis* including their uptake and accumulation, and c) to link the Hg and Se coordination to their bioavailability and toxicity by feeding the mushrooms to the slugs (*Arion* spp.), monitoring toxicity-sensitive biochemical parameters in snail hepatopancreas, namely the level of lipid peroxidation via MDA test.

XAS measurements and analysis

Hg concentrations in our mushrooms samples were too low to be able to record Hg-L3 spectra with satisfactory signal to noise ratio. Instead of Hg-L3 edge we therefore probed Zn-K, Pt-L3, Cu-K, Fe-K and Se-K edges.

XAS spectra were measured at BM08 beamline in fluorescence detection mode (using large area Ge detector) at room temperature. Spectra were analysed with IFEFFIT program package, exploiting LCA and PCA analysis for XANES spectra and multiedge parallel fitting of EXAFS spectra [4,5].

Results

Since we were not able to obtain Hg-L3 spectra of sufficient quality, we have used our beamtime (among others) also to measure Zn-K edge EXAFS spectra in *Canabis sativa* plants (Fig. 1 and Fig. 2) that grew in different combination of Zn/Si mixed in the growing substrate. Preliminary studies showed that addition of Si in the substrate alleviates Zn toxicity in hemp, therefore we wanted to learn whether addition of Si affect Zn coordination in plant tissues.

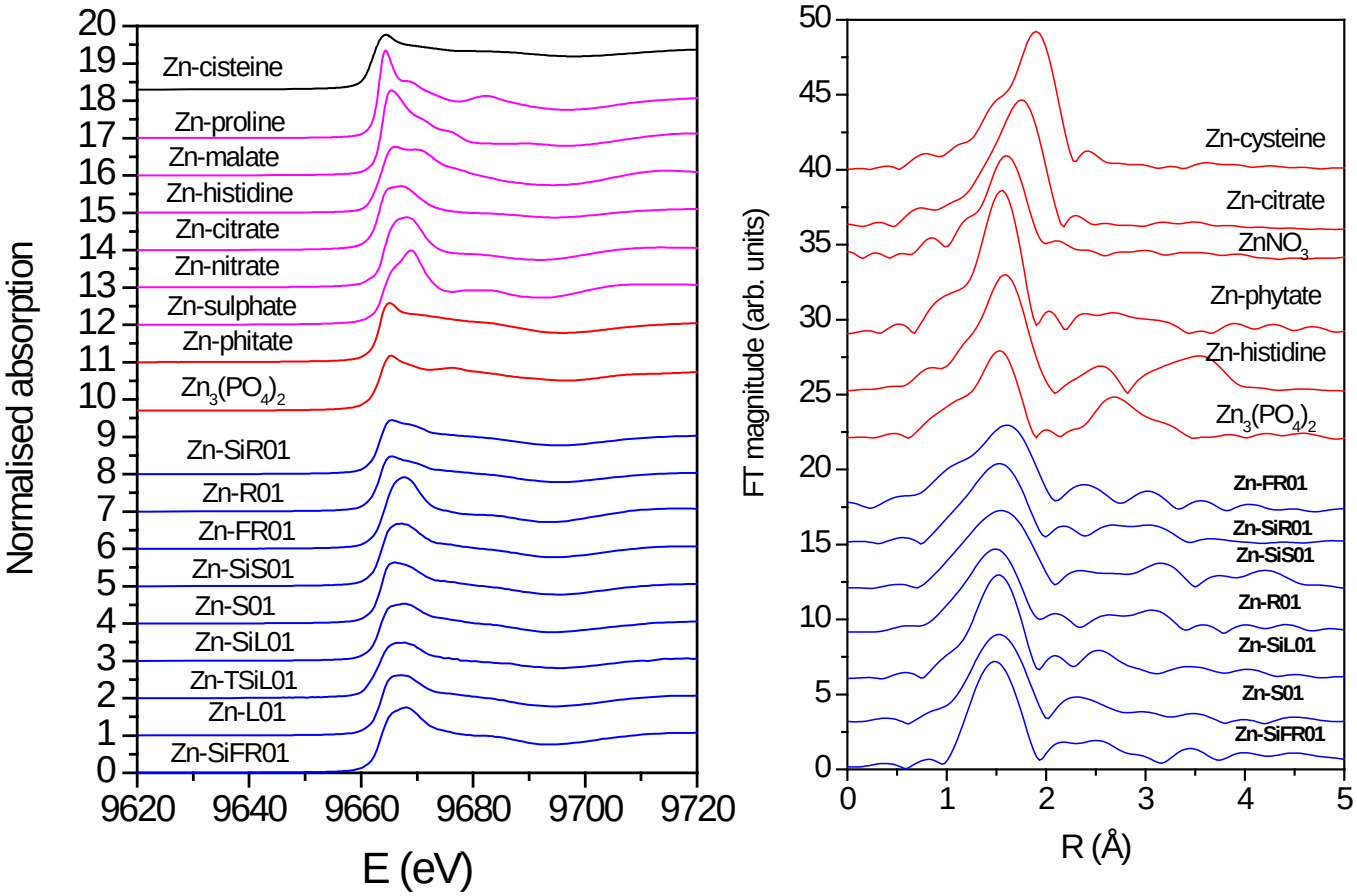

Figure 1. Zn K-edge XANES spectra (leftg) and FT EXAFS spectra (right) of *Canabis sativa* plants that grew in different combination of Zn/Si mixed in the growing substrate, and of reference Zn compounds. Spectra are shifted vertically for clarity.

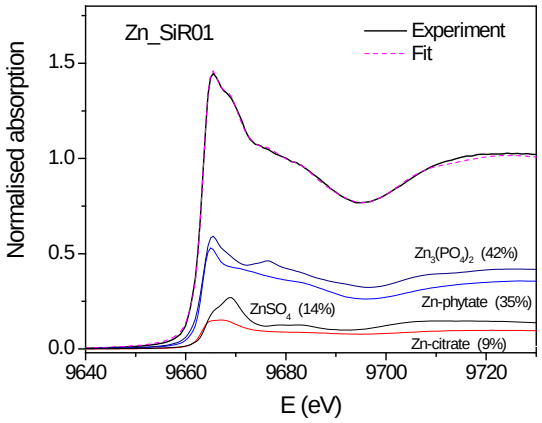

Figure 2: Zn K-edge XANES spectrum of Zn-SiR01 roots . Solid line - experiment; dashed line – best-fit linear combination of XANES profiles of Zn3(PO4)2 (42%), Zn-phytate (35%), $ZnSO_4$ (14%), and Zn-citrate (9%), all components shown below.

References

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