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Mercury uptake of Olea europaea from contaminated soils of Almadén mining district (Spain).

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Mercury uptake by plants is the main transfer pathway from mining-related mercury contaminated soils to human trophic chain. On this work we present the first data for mercury contents in Olea europaea, a cultivated plant commonly used for olive oil production in Mediterranean countries. The survey was carried out on the vicinity of Almadén (Spain), the largest mercury-mining district worldwide. Nowadays, mercury production on this mining district has ceased, but two millennia of mining and metallurgic activities have produced a wide dispersion of this heavy metal on its environment.

Samples of soils and plants were collected in a transect from the main hotspot of the district to Picón, a small village located 70 km away. Plants sampling were focused on leaves from the last three years of olive life and olives skins. Analysis of samples has been carried out using an atomic absorption spectrometer AMA254.

Mercury contents in soils shows a wide range (0.20 – 105.34 μg•g-1), with a minimum up to background levels for soils (0.01 – 0.03 μg•g-1) (Senesi et al., 1999), but consistent with mercury levels on Almadén district soils (0.13 – 2695 μg•g-1) (Molina et al., 2006) or other Spanish mercury mining districts like Asturias (1.7 – 29304 μg•g-1) (Loredo et al., 1999) and Azogue valley (6 – 1400 μg•g-1) (Viladeval et al., 1999). However, mercury contents in plants considered in this study (0.026 – 6.68 μg•g-1) show similar range than those found by Molina et al. (2006) and a similar uptake pattern than their type 2, with an initial linear relationship between Hgsoil-Hgplant, after which no increments on mercury in plants tissues can be observed. Bioconcentration factor on leaves varies from (0.003 – 0.30 μg•g-1) on young leaves to (0.019 – 0.80 μg•g-1) on three years leaves.

A remarkable fact is that samples from Almadenejos show differences with the other anomalous samples on uptake behaviour, with high mercury contents on soils but lower than expected on plants tissues. This is probably due to the presence of mercury in the soil as less mobile compounds, mainly cinnabar and metacinnabar as by-product of metallurgic activities (Esbri et al., 2010), as well as to lower levels of atmospheric mercury than in the mining areas. On this samples from Almadén, mercury can be introduced on plants via root uptake, but also via foliar uptake (Patra et al., 2000).

On fruits, the edible part of Olea europaea, mercury appears on lowers levels than in leaves (≈20%), which means a lower risk for human consumption.

References

Esbri JM, Bernaus A, Ávila M, Kocman D, García-Noguero EM, Guerrero B, Gaona X, Álvarez R, Pérez-González G, Valiente M, Higueras P, Horvat M, Loredo J. (2010). XANES speciation of mercury in three mining districts-Almadén, Asturias (Spain) Idria (Slovenia). Journal of Synchrotron Radiation; 17 (2): 179-186.

Loredo J, Ordo´n˜ez A, Gallego JR, Baldo C, Garci´a-Iglesias J. (1999). Geochemical characterisation of mercury mining spoil heaps in the area of Mieres (Asturias, northern Spain). J. Geochem. Explor; 67: 377-390.

Molina JA, Oyarzun R, Esbri´ JM, Higueras P. (2006). Mercury accumulation in soils and plants in the Almade´n mining district, Spain: One of the most contaminated sites on Earth. Environmental Geochemistry and Health; 28 (5): 487-498.

Patra M, Sharma A. (2000). Mercury toxicity in plants. Botanical Review; 66: 379–422.

Senesi GS, Baldassare G, Senesi N, Radina B. (1999) Trace element inputs into soils by anthropogenic activities and implications for human health. Chemosphere; 39: 343–77.

Viladevall M, Font X, Navarro A. (1999) Geochemical mercury survey in the Azogue Valley (Betic Area, SE Spain). Journal of Geochemical Exploration; 66: 27–35.