Detection of As, Cd and Pb in walnuts by using EXAFS spectrometry.

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Heavy metals are elements which exist naturally in the soil in small concentrations, however, they may be increased by activities such as mining, agriculture, industry, among others, and reach levels of toxicity that when processed by the plants they enter the trophyc chain and affect humans.

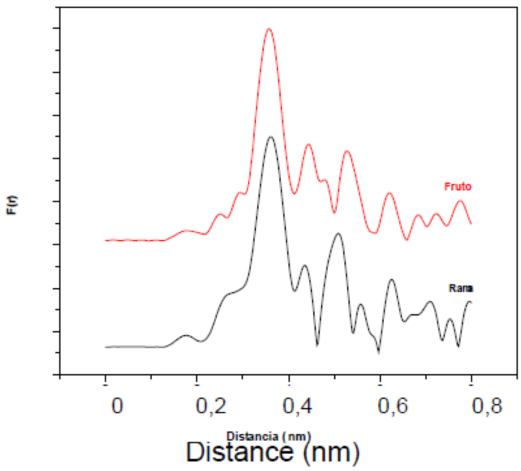
For the heavy metal determination sampling took just two farms with cultivation of walnut, located in the State of Chihuahua, Mexico. Samples from ground, plants, and fruit were taken, properly labeled. Later to the soil samples the quartering method was applied in order to reduce the volume and obtain 5 g the sample to analyze. Samples were dried to 100 0C. XAS experiments were carried out in the Stanford Synchrotron Radiation Laboratory (SSRL). The typical condition of operation was a current of 60 - 100 mA and energy of 3 GeV. All the samples were in excess to a temperature near 15 K, using a liquid helium. The spectra of fluorescence of the samples were taken with the aid of a detector of Canberra germanium of 30 elements. [2]

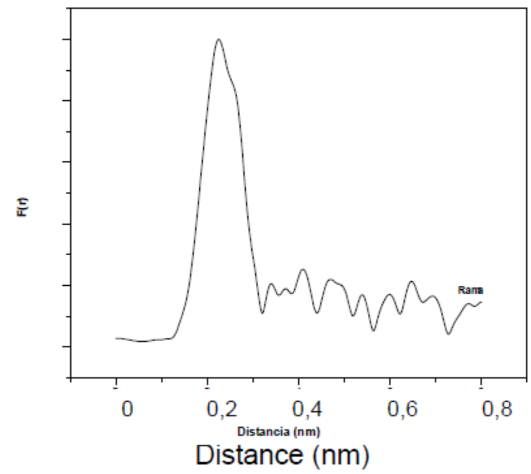
The data collected from Synchrotron were analyzed by the Win XAS program to obtain the penetration in the effect of atomic distances, parameters of the disorder, or the number of layer in $\chi(k)$ of the XAFS function. The spectra of x-rays absorption of the soil samples that contained As have a similar behavior, displaying the edge of absorption in an energy 11,865 to 11,869 KeV (Table 1) reason why we can assume that it is an As (V).[1]. On the other hand the radial distribution function obtained after applying the Fourier transformation to the absorption spectra, have a distance of first neighbors with a slight variation exists and is in R=0.19419 nm to 0.20129 nm which corresponds to the positions As-O [3]. Of similar way for Cd it is observed that all have a similar behavior, displaying the edge of absorption at an energy of 26, 71 KeV, the edge of the samples is identically to the edge form of cadmium nitrate and cadmium acetate. It indicates that he is present like Cd (II) . The atomic position of each sample is observed clearly and we see that for those F(r) a distance of first neighbors with a slight variation exists in R=0.277 nm (Table 1), reason why corresponds to Cd-Cd and R = 0.212 nm(Table 1), that corresponds to Cd-O [4]. For the Pb all have the same behavior and are located so much in branch as in fruit with a energy of 13,057 KeV (Table 1), we can infer that it is Pb (II).[3]. The atomic position of each sample is observed clearly and we see that for those F(r) a distance of first neighbors with a slight variation exists in R=0.362 nm (Table 1), reason why corresponds to Pb-S and R = 0.357 nm(Table 1), that corresponds to Pb-Pb, for the case of the walnut B the distance of first neighbors is of R=0.25 nm that probably corresponds to a certain oxygen contribution (Pb-O).

Table 1 Results of Calibration of Energy (Eo), interatomic Distances (R1 (Å).

Element	**Eo (KeV)**	**R_1(nm)**
Arsenic (A y B)	11.865 a 11.869	0.19419 a 0.20129
Cadmium (A y B)	26.71	0.212 y 0.277
Lead (A)	13.057	0.357 y 0.362
Lead (B)	13.057	0.225

1)





Figures 1 and 2. Radial distribution function of the Lead for the walnut A and B.

2)

References

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