Bioaccumulation of As, Cd, Cr, Cu, Pb and Zn in edible vegetables from the polluted fields and their impacts on ecosystem and human health

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Pollution of As, Cd, Cr, Cu, Pb and Zn has been investigated in an agruicultural ecosystem near a lead-zinc mine. The highest concentration of Pb in the surface irrigation water system was over 15 times higher than the maximum level. The maxima of As, Cd and Pb concentrations in the vegetable soils were 11, 34 and 35 times higher than the environmental quality evaluation standard. The maximum concentrations of As, Cd and Pb in aerosols were 114, 76 and 10296 mg/kg, respectively.

Pb isotope ratios from water, soils, minerals, aerosols, and vehicle exhaust particles revealed that the main source of Pb in the fields was from the minerals and ores of Pb from the mine. Particulate matter was the carrier of pollution to the soils. In return, the polluted soils is a second pollution source.

The heavy pollution in the aquatic and terrestic system would produce high bioaccumulation in the plants. In fact, the investigations show that the high concentrations of metals and metalloid have polluted the whole ecosystem in the area. On the basiss of quantitative analysis of 204 samples from 26 types of vegetables, for example, it was found that in 17 types of the collcected edible vegetables, the concentrations of Pb in 12 types exceeded the maximum level. And the most serious pollution of Pb was found in celery and coriander, and the means of Pb in them were 1.1 and 1.6 (mg/kg), respectively, significantly exceeding the maximum level of 0.3 mg/kg. In parts of spinach, letture and the other edible vegetables, the concentrations of As, Cd and Cr exceeded the maximum levels, too.

How did the toxic elements enter the plants? Did they change their species? Did they damage the plant cells? And expcially, does the bioaccumulation of metals and metalloids in the edible vegetables from the polluted fields make impacts on human health?

Without question, the answer is positive. The change of speciecs of the toxic lements were found and the damages of the plant cells confirmed. Besides the concentrations of Pb in blood, an in vivo X-ray fluorecence analytical set was designed and used in the the determination of Pb in human bone. The results revealed the bioaccumulation of metal and metalloid elements in the edible vegetables and food chains, from the polluted fields made great impacts on the human health in the area.