

Translocation and Accumulation Characteristic of Heavy Metals in Soil-Maize System from a Typical Lead-Zinc Mining Area in Guizhou Province, China

G.FEI^{1,2}, M.HONGHONG^{1,2*}

¹ Institute of Geophysical&Geochemical Exploration, Chinese Academy of Geological Sciences, Langfang 065000, China (*827587535@qq.com)

² Research Center of Geochemical Survey and Assessment on Land Quality, China Geological Survey, Langfang 065000, China

High concentrations of heavy metals in the soil which spread through the food chain are potentially harmful to human health. In this study, a total of 62 sets of soil-maize samples are collected from the soil surrounding a lead-zinc mining area in Guizhou (0–20cm in depth) to analyze the concentrations of eight heavy metals, including As, Cd, Cr, Cu, Hg, Ni, Pb and Zn to discuss their translocation and accumulation in the soil-maize system. Cumulative risk assessment shows that the soil in the study area is severely polluted with Pb ($I_{geo}=3.3$), moderate-severely polluted with Zn ($I_{geo}=2.5$), moderately polluted with Cd ($I_{geo}=1.4$), non-pollution-moderate pollution with As ($I_{geo}=0.1$) and pollution-free with other heavy metals. It can be seen that mining activities have caused serious pollution of Pb, Zn and Cd to the surface soil of farmland. The average concentration of heavy metals in maize seed is Zn (27.86mg/kg) > Cu (1.66mg/kg) > Pb (0.23mg/kg) > Ni (0.15mg/kg) > Cr (0.07mg/kg) > Cd (0.03mg/kg) > Hg (0.003mg/kg), in which the concentration of lead exceeds the Chinese food safety standard (0.2 mg/kg), and the exceeding rate is 21.0%. Pb is the main hazard factor affecting maize safety in the study area. Besides root absorption, atmospheric bulk deposition may be an important source of Pb in plants [1], which may be one of the important reasons for the excessive Pb in maize seeds in the study area. The average value of bioconcentration factor of heavy metal in maize seeds ($BCF = C_{maize} / C_{soil}$) is Cu (0.0359) > Zn (0.0318) > Hg (0.0138) > Cd (0.0041) > Ni (0.0022) > Cr (0.0005) > As (0.0003) > Pb (0.0002), the bioconcentration factors of heavy metals are all less than 0.05. It may be inferred that the bioconcentration ability of maize seeds to heavy metals is relatively weak, while Cu, Zn and Hg are more easily to be concentrated in maize seeds.

[1] Nicholson F A, Smith S R, Alloway B J, *et al.* An inventory of heavy metal input to agricultural soil in England and Wales[J]. Science of the Total Environment, 2003, **311**(1-3): 205-219.