

云南泚江流域农田土壤重金属Pb、Zn、Cd、As的地球化学特征

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中文摘要:以流经中国铅锌矿储量最大的兰坪金顶铅锌矿区的澜沧江支流——泚江周围农田土壤为研究对象,通过实地调查采样、室内实验测定和统计分析等方法,测定分析了土壤中Pb、Zn、Cd、As的含量及其化学形态分布,以探讨矿产开发对农田土壤重金属含量的影响。结果表明:(1)泚江流域农田土壤中的重金属蓄积量大,以国家《土壤环境质量标准》(II级)衡量,Pb、Zn、Cd、As含量超标率分别为66.667%、91.667%、100%、16.667%,污染程度为Cd > Zn > Pb > As;(2)土壤中Pb和Cd的化学形态均以水溶态为主,活性大,迁移能力强,水溶态元素能够直接进入生态链,通过植物吸收进入食物链将给人类健康造成一定的威胁。而Zn和As化学形态分别以铁锰氧化物结合态和残渣态为主,这两种形态在一般环境条件下较稳定,迁移能力弱;Pb和Cd的环境有效态(水溶态、离子交换态、碳酸盐结合态、腐殖酸结合态之和)含量较高,如果发生酸雨或酸性矿山废水的排出,它们的环境有效态会大量增加,对流域具有潜在的危害;(3)土壤中Pb、Zn、Cd、As含量分布和化学形态分布,整体上均为随着与矿区的距离增大而降低的趋势,分布曲线分为单峰状、双峰状两类。另外,Cd、Pb、Zn的化学形态分布与总量分布趋势基本一致,As的腐殖酸结合态、残渣态与总量分布一致。

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The Geochemical Characteristics of Heavy Metals in Agricultural Soils of the Bijiang Watershed in Yunnan Province

Abstract:The Lanping lead-zinc ore district has the largest lead-zinc reserves in China's lead-zinc deposits. The upstream of the Bijiang River originates from the Lanping lead-zinc ore district. Therefore, the Bijiang River has been affected by mining activities of the Lanping lead-zinc ore district, and has become a river typically polluted by heavy metals. With the agricultural soils irrigated by the Bijiang River as the study object and according to the methods of field survey sampling, laboratory experiment and statistical analysis, the authors analyzed the content and the distribution of chemical constitutions of Pb, Zn, Cd, and As in the agricultural soils. Some conclusions have been reached: (1) Heavy metals have been highly concentrated in the agricultural soils of the Bijiang watershed. Examined on the basis of the National Soil Environmental Quality Standards (Class II), the concentrations of Pb, Zn, Cd, and As have respectively exceeded the set standards by 66.667%, 91.667%, 100% and 16.667%, and the contamination degrees of the heavy metals are in order of Cd > Zn > Pb > As. (2) Pb and Cd in soils mainly occur as the water-soluble state which is easy to migrate and can directly become part of the ecological cycle, and hence their environmental risks are serious. Zn and As mainly occur as Fe-Mn oxides binding state and the residual state, which are relatively stable and reluctant to migrate under the common conditions. The concentrations of environmental available states (the total content of the water-soluble state, the ion exchangeable state, the carbonate binding state, the humic acid binding state) of Cd and Pb are relatively high. There exists great potential danger to the eco-environment of agricultural soils once acid rain or acid mine drainage occurs. (3) The content distribution and chemical states of Pb, Zn, Cd, and As in soils tend to decrease with the distance from the Lanping Pb-Zn deposit. Their distribution curves are of single-peak shape and bimodal-peak shape. The chemical states distribution of Cd, Pb and Zn are similar to their content distribution, but the humic acid binding state and residual state content distribution of As is similar to its content distribution.

keywords:[Pb-Zn deposit](#) [heavy metals](#) [morphologic analysis](#) [distribution characteristics](#) [Bijiang watershed](#)

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