环境科学学报
ACTA SCIENTIAE CIRCUMSTANTIAE

研究报告

田林锋,胡继伟,罗桂林,马建军,黄先飞,秦樊鑫.贵州百花湖沉积物重金属稳定性及潜在生态风险性研究[J].环境科学学报,2012,32(4):885-894

贵州百花湖沉积物重金属稳定性及潜在生态风险性研究

Ecological risk and stability of heavy metals in sediments from Lake Baihua in Guizhou Province

关键词：重金属 沉积物 稳定性 生态风险 百花湖

基金项目：国家自然科学基金(No.20967003)

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摘要：为研究贵州高原河道深水湖泊百花湖的重金属污染状况,以该湖泊 10 个采样点的表层沉积物为研究对象,测定了Hg、Cd、As、Pb、Cu、Zn、Cr 7 种重金属的含量,并对其中5 种重金属(Cd、Pb、Cu、Zn、Cr)的存在形态和稳定性进行了研究. 结果表明,Cu、Zn、Cr在百花湖沉积物中各形态的平均含量变化趋势为:残渣态>有机结合态>铁锰氧化物结合态>碳酸盐结合态>可交换态,Cd为残渣态>可交换态>有机结合态>铁锰氧化物结合态>碳酸盐结合态,Pb为残渣态>铁锰氧化物结合态>有机结合态>碳酸盐结合态>可交换态,几种重金属平均浓度均在临界效应浓度值和必然效应浓度值之间. Cd、Pb、Cu、Zn 和 Cr 5种重金属元素稳定度变化范围依次为:6%~35%、8%~23%、8%~11%、8%~18%、2%~14%,稳定性依次为:Cr > Zn >Cu >Cd= Pb,这些元素基本处于稳定-中等稳定状态. 最后,分别以 1990 年贵州省土壤重金属背景平均值和本次采样周边土壤背景值为基本值,对百花湖沉积物进行生态风险性评价. 结果发现,百花湖已经处于中等-很强水平的生态危害程度,说明百花湖水体可能已受到重金属的严重污染,但其稳定性可能推迟或减弱其有效生态危害性,但仍有必要加强该湖泊水体中重金属的监测工作.

Abstract: To reveal the pollution loading of heavy metals in Lake Baihua located in Guizhou Plateau, seven selected toxic elements (Hg, Cd, As, Pb, Cu, Zn and Cr) in ten sediment samples collected from the lake were analyzed, and chemical speciation and stability of five of these elements were studied as well. The results demonstrated that the average concentrations distributed in the different chemical species generally showed the following sequence for Cu, Zn and Cr: residual > organic combination state > iron and manganese oxide combination state > carbonate combination state > exchangeable state; for Cd: residual > exchangeable state > organic combination state > iron and manganese oxide combination state > carbonate combination state; for Pb: residual > iron and manganese oxide state > organic combination state > carbonate combination state > exchangeable state, and the average concentrations of these five heavy metals were between threshold effect level (TEL) and probable effect level (PEL). The stability of Cd, Pb, Cu, Zn, and Cr varied from 6% to 35%, 8% to 23%, 8% to 11%, 8% to 18%, and 2% to 14% respectively, and decreased in the order of Cr> Zn> Cu> Cd = Pb. It was thus suggested that these elements were in a stable to moderate stable state. Ecological risk assessment, based on the soil samples in the surrounding areas and the average background values of the soil in Guizhou Province (1990), indicated that these heavy metals posed a moderate to strong ecological hazard. In conclusion, the sediment from Lake Baihua was polluted severely with heavy metals, however these heavy metals showed low ecological risks at present due to their stability. Therefore, this lake was in a false illusion of safety status, and it was of great importance to monitor heavy metals in the lake continually and regularly in the years to come.

Key words: heavy metals sediments stability ecological risk Lake Baihua

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