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基于GIS的黄淮海平原典型潮土区土壤重金属积累研究

GIS-based research on soil heavy metal accumulation in a fluvo-aquic soil area typical of the Huang-Huai-Hai Plain

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中文摘要:

以黄淮海平原典型潮土区——河南省封丘县为例,基于GIS数据统计分析方法和地统计学空间插值方法,其目的是为了:(1)明确土壤重金属Cr、Hg、As、Cu、Zn的当前含量水平及其历史变化趋势;(2)通过与潮土自然背景值(背景值)、国家土壤环境质量标准一级标准(一级标准)和绿色食品产地环境质量标准(绿色标准)的比较,阐明各重金属元素符合不同标准的土壤面积及其空间分布;(3)在上述研究基础上采用内梅罗综合指数法定量评价基于一级标准的土壤重金属综合环境质量及其县域分布。结果表明,5种重金属含量平均值除Hg与背景值相当外,其余均略高于背景值而远低于一级标准,除As外,土壤Cr、Hg、Cu、Zn含量均有随年限增加的趋势;占全县土壤总面积98%以上的Cr、As、Zn含量,100%的Hg含量,91%以上的Cu含量符合一级标准,超过99%以上的土壤符合绿色标准;基于一级标准的内梅罗综合指数进一步表明封丘地区土壤综合环境质量良好,仅有不足3%的土壤受到轻度污染。表明就重金属污染角度,当前状况下的封丘土壤适宜种植各类农作物,但个别超过绿色标准的地点应引起重视并及时采取防治措施。

Abstract:

Heavy metal pollution of soils is an issue that has aroused high concerns among scientists the world over, and it is the premise of establishing related regulatory measures to specify trend of the spatio-temporal variation of heavy metal content in the soil. A case study was performed of Fengqiu County of Henan Province, a fluvo-aquic soil area typical of the Huang-Huai-Hai Plain, based on statistical analysis and geostatistical spatial interpolation of GIS data. The study was aimed at specifying current contents of soil heavy metals (Hg, As, Cu, and Zn) and their variation trends in the past years; determining areas and spatial distributions of the soils up to separately various standards for soil heavy metals, such as the natural background values, Criteria of Grade I of the National Standard for Soil Environmental Quality and the Standard of Soil Environmental Quality for Green Food Production; and eventually based on the two preceding researches quantitatively evaluating comprehensive soil heavy metal environment quality of the soils up to the criteria of Grade I of the National Standard with the Nemerow integrated pollution index method and their distributions within the county. Results show that the average contents of the five heavy metals, except Hg of which the average content was nearly on the same level as the background value, were slightly higher than the background values, but far below the Criteria of Grade I. And all the five heavy metals, except As, showed an increasing trend in content with the years passing by. The county had over 98% of its area of soils exceeding criteria of Grade I of the National Standard in content of Cr, As and Zn, 100% in content of Hg, and over 91% in content of Cu, and 99% beyond the Standard of Soil Environmental Quality for Green Food Production. Based on the criteria of Grade I, analysis with the Nemerow integrated pollution index method revealed that the soils of Fengqiu were good in comprehensive soil environmental quality except for less than 3% slightly polluted, which means that the soils in Fengqiu are suitable to cultivation of all kinds of crops in view of current condition of soil heavy metal pollution. However, in some individual localities where the soils are beyond the standard for green food production, special attention should be paid to timely preventive measures for the issue of heavy metals pollution.