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典型沙漠绿洲城市表土磁性特征及环境指示意义

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Magnetic properties of urban soils from typical oasis cities and their environmental implications

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摘要

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摘要

选取典型沙漠绿洲城市(乌海、石嘴山、银川)表土为研究对象,对其环境磁学性质、土壤质地与重金属含量分布进行系统研究.结果表明,乌海市和石嘴山市表土为典型砂土,银川市为砂壤土.三个城市表土样品均以较粗的MD-PSD颗粒的亚铁磁性矿物(磁铁矿)主导,磁化率均值分别为 152×10^{-8} 、 104×10^{-8} 和 $117 \times 10^{-8} \text{ m}^3 \cdot \text{kg}^{-1}$.乌海市表土磁性矿物含量和磁性颗粒大小都显著高于石嘴山和银川市.重金属(Cr、Cu、Pb、Zn、Fe)的污染负荷指数(PLI)均显示,三个城市表土均存在轻度污染特征.同时磁化率和污染负荷指数在非工业区表现出点状高值分布,在工业区表现为面状高值分布特征.乌海市表土磁参数与重金属的相关系数显著高于石嘴山和银川,表明磁参数对于污染来源单一地区的污染程度评估更具优势.尽管三个城市表土磁学性质存在较大差异,但其磁化率均随污染负荷指数的增加呈现相同程度的递增.磁化率可以作为宁夏平原地区表土重金属污染程度评估的统一有效的代用指标.

关键词 环境磁学, 重金属, 绿洲城市, 污染负荷指数, 磁化率

Abstract:

This study is a systematic analysis on the environmental magnetic properties, soil texture and distribution of heavy metals content in topsoil sampled from typical oasis cities in desert like Wuhai, Shizuishan and Yinchuan. The results indicated that the topsoil in Wuhai and Shizuishan is typical sandy soil, while that in Yinchuan is sandy loam. Magnetic properties of topsoil samples are all predominated by ferrimagnetic magnetic mineral (magnetite) coarse pseudo single domain (PSD)-multi domain (MD) particles with magnetic susceptibility of 152×10^{-8} , 104×10^{-8} , and $117 \times 10^{-8} \text{ m}^3 \cdot \text{kg}^{-1}$ respectively for the three cities. The magnetic mineral content and magnetic particles size in topsoil samples of Wuhai are significantly higher than that of Shizuishan and Yinchuan. Pollution Load Index (PLI) of heavy metals (Cr, Cu, Pb, Zn, Fe) showed that there is slight pollution in the three cities. Dotted distribution of high values of magnetic susceptibility and Pollution Load Index is shown in nonindustrial area, whilst planar distribution with high value is shown in industrial area. The correlation coefficient between magnetic parameters and heavy metals of topsoil in Wuhai is significantly higher than that in Shizuishan and Yinchuan, which suggests that magnetic parameters are more advantageous for evaluation on pollution degree in regions with single pollution source. There is an increase by the same degree in magnetic susceptibility in parallel with the increase of Pollution Load Index, despite of the significant difference of magnetic properties among three cities. Therefore, magnetic susceptibility can be used as the unified and effective substitute indicator to evaluate the pollution degree of heavy metals in topsoil of Ningxia plain.

Keywords [Environmental magnetism](#), [Heavy metal](#), [Oasis town](#), [Pollution Load Index](#), [Magnetic susceptibility](#)

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