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泉州市不同功能区土壤铅同位素组成及其来源分析

Lead isotope signatures and source identification in urban soils from different functional areas of Quanzhou City

关键词: [铅稳定同位素示踪](#) [城市土壤](#) [重金属](#) [泉州市](#)

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摘要: 为查明泉州市土壤铅的污染来源,采集了泉州市不同功能区表层(0~20cm)土壤及城市环境污染端元(燃煤尘、汽车尾气尘、污泥)样品.采用ICP-MS测定土壤Pb含量,用热电质谱仪测定各样品的铅同位素组成.分析结果表明,泉州市不同功能区表层土壤已受到一定程度铅污染;泉州市土壤铅同位素 $^{208}\text{Pb}/(^{207}+^{206})\text{Pb}$ 和 $^{206}\text{Pb}/^{207}\text{Pb}$ 比值变化较大,分别为1.0769~1.1486和1.1150~1.2142;泉州市区各端元组分铅同位素组成差别比较大,可以有效示踪和鉴别泉州市区环境铅的污染来源.运用铅同位素示踪技术追踪土壤铅的污染来源结果表明,泉州市区土壤总铅同位素和可溶相铅同位素组成变化较大,土壤中铅来源较为复杂.交通繁忙区土壤铅污染主要来源于汽车尾气排放,农业区土壤铅主要来源于城市污泥与当地土壤背景,商业区土壤铅主要来源于城市污泥与燃煤尘及其煤渣的排放,居民区土壤铅污染主要受城市污泥与汽车尾气排放影响.

Abstract. To identify the sources of soil Pb pollution in Quanzhou City, the surface layer (0–20 cm) soils from different functional areas and the urban environmental pollution end-members (coal-fired dust, automobile exhaust dust and sludge) in Quanzhou City were collected. Soil Pb concentration was determined by ICP-MS while Pb isotopic composition of each sample was analyzed by thermal mass spectrometry. Analysis results indicate that the surface soils from different functional areas in Quanzhou City have been contaminated by Pb to some extent. Soil Pb isotopes in Quanzhou City vary widely with the ranges of $^{208}\text{Pb}/(^{207}+^{206})\text{Pb}$ and $^{206}\text{Pb}/^{207}\text{Pb}$ ratios of 1.0769–1.1486 and 1.1150–1.2142, respectively. Relatively large differences in Pb isotope compositions in the urban end-members of Quanzhou City can be used to trace and identify the environmental Pb contamination sources effectively. Application of Pb isotope tracing techniques to track soil Pb contamination sources in Quanzhou City shows that both the total soil Pb isotopic composition and the soluble phase Pb isotopic composition vary widely, indicating the complex sources of soil Pb. In heavy traffic areas, soil Pb pollution mainly comes from vehicle exhaust emissions. Soil Pb of agricultural areas mainly comes from municipal sewage sludge and local soil background. Soil Pb of commercial areas is mainly derived from municipal sewage sludge, the coal-fired dust and coal slag. Soil Pb pollution of residential areas mainly comes from vehicle exhaust emissions and municipal sewage sludge.

Key words: [Pb stable isotope tracing](#) [urban soils](#) [heavy metals](#) [Quanzhou City](#)

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