Zheng, J Powder Metall Min 2022, 11:6

Journal of Powder Metallurgy & Mining

Review Article Open Access

Evidence from Stable Zinc Isotopes Analysis Zinc in Soil Reflecting the Intensive Coal Mining Activities

Liugen Zheng*

School of Resources and Environmental Engineering, Anhui University, Anhui Province Engineering Laboratory for Mine Ecological Remediation, Hefei 230601, Anhui, China

Abstract

In the mining area affected by coal mining activities for a long time, heavy metal Zn pollution poses a serious threat to soil quality and human health, and direct evidence showing the relationship between Zn accumulation mechanism in soils and mining activities is lacking [1-15]. In this study, the Zn content and isotopes composition (δ66Zn) from soil and environmental samples around mining area were determined and analyzed to clarify the Zn characteristics in soil. Moreover, the distribution and source of Zn content in soil of mining area were analyzed by mathematical statistics, correlation analysis and isotope mass mixing model.

Introduction

The results showed that the Zn content in soil ranged from 95 to 327 mg·kg^{-1} (mean: 233 mg·kg^{-1}), exceeding the control point and the soil background value of Anhui Province the results of Zn isotope analysis showed that Zn in soil mainly derived from the wind dispersion input of fine particles in gangue and fly ash, followed by the natural weathering of parent material isotopic mass mixing model can be used to distinguish the contribution of anthropogenic and natural Zn sources. Mining input was the main contribution source of Zn in soil (mean: 67%), followed by natural background (mean: 33%). The employment of Zn isotopes can effectively evaluate the impact of anthropogenic and natural long-term processes on Zn in the soil of the mining area, and provide important information for the formulation of soil metal

Subjective Heading

Heavy metalThe mining of mineral resources have great economic value, but large-scale mining and processing have posed serious environmental issues soil heavy metal pollution. Long term mining and smelting operations produce a large amount of waste and derivatives, including gangue accumulation, acid mine drainage and dust. Heavy metals from these wastes can be transferred to the ambient soil, through surface runoff or dust particles pathways, resulting in long-term existence in the soil and hard to be absorbed and utilized by biology. Previous studies were limited to the content investigation and pollution risk assessment of soil heavy metals in polluted areas. However, the information on heavy metals sources is still very limited by the scarcity of key data and effective tools, and its pollution sources have not been effectively identified.

Discussion

In the mining area affected by coal mining activities for a long time, heavy metal Zn pollution poses a serious threat to soil quality and human health, and direct evidence showing the relationship between Zn accumulation mechanism in soils and mining activities is lacking. In this study, the Zn content and isotopes composition (δ^{66}Zn) from soil and environmental samples around mining area were determined and analyzed to clarify the Zn characteristics in soil. Moreover, the distribution and source of Zn content in soil of mining area were analyzed by mathematical statistics, correlation analysis and isotope mass mixing model. The results showed that the Zn content in soil ranged from 95 to 327 mg·kg^{-1} (mean: 233 mg·kg^{-1}), exceeding the control point and the soil background value of Anhui Province the results of analysis showed that Zn in soil mainly derived from the wind dispersion input of fine particles in gangue and fly ash, followed by the natural weathering of parent material

The mining of have great economic value, but large-scale mining and processing have posed serious environmental issues - soil heavy metal pollution. Long term mining and smelting operations produce a large amount of waste and derivatives, including gangue accumulation, acid mine drainage and dust. Heavy metals from these wastes can be transferred to the ambient soil, through surface runoff or dust particles pathways, resulting in long-term existence in the soil and hard to be absorbed and utilized by biology. Previous studies were limited to the content investigation and pollution risk assessment of soil heavy metals in polluted areas However, the information on heavy metals sources is still very limited by the scarcity of key data and effective tools, and its pollution sources have not been effectively identified

Description

Appreciable Zn isotope fractionation does not occur during the weathering of the parent material and soil forming, and the δ^{66}Zn value of residual parent material in soil can be expressed by bed-rock (the variation of Zn isotopes in igneous and sedimentary rocks is limited (δ^{66}Zn value ranged from −0.22‰ to 0.28‰), while the heavy Zn isotopes in carbonatite show higher composition (δ^{66}Zn value ranged from 0‰ to 1.13‰)The bed-rock (carbonate) collected in the study area exhibits significant heavy isotopic feature, and the mean value of δ^{66}Zn is 0.12‰. Most of the characteristics of industrial pollution sources of crustal rocks and minerals remain within soil samples, which can be used to represent the contribution of natural sources). In

***Corresponding author:** Liugen Zheng, School of Resources and Environmental Engineering, Anhui University, Anhui Province Engineering Laboratory for Mine Ecological Remediation, Hefei 230601, Anhui, China, E-mail: lgzng@uc.edu.cn

Received: 04-Jun-2022, Manuscript No: jpmm-22-68616, **Editor assigned:** 06-Jun-2022, PreQC No: jpmm-22-68616 (PQ), **Reviewed:** 20-Jun-2022, QC No: jpmm-22-68616, **Revised:** 22-Jun-2022, Manuscript No: jpmm-22-68616 (R), **Published:** 28-Jun-2022, DOI: 10.4172/2168-9806.1000313

Citation: Zheng L (2022) Evidence from Stable Zinc Isotopes Analysis Zinc in Soil Reflecting the Intensive Coal Mining Activities. J Powder Metall Min 6: 313.

the uncontaminated environment, Zn is mainly entered into the soil by the natural weathering of the parent material). Since it is not affected by mining activities, there is only a small difference between the δ^{66}Zn value of the soil at the control point and the bedrock ($\delta^{66}Zn_{bedrock-soil} \leq 0.08‰$) which indicates that Zn in the soil is mainly from natural sources and has a weak impact on Zn isotopic composition during soil formation.

Zinc (Zn) is an important micronutrient and ubiquitous in the soil, which is released into the ambient soil in various chemical forms due to the effect of anthropogenic processes The accumulation of Zn in soil may affect the soil quality and limit the transportation of soil nutrients, resulting in the toxic reactions of the reproduction, development and behavior of various soil organisms and plants. In addition, as a sensitive element (Zn may become a potential inorganic toxic pollutant when the concentration in soil environment is too high. Once the Zn intake reaches a certain value, it has affected human oxidative stress therefore becoming a contributing factor of many chronic diseases.

This study was carried out in a typical coal mining contaminated area (Linhuan mining area), which was of considerable coal production base in China because of abundant coal reserves. Although this fact that intensive mining activities may cause the enrichment of heavy metals in the soil has been known, a full appreciation of the Zn pollution characteristics and sources in the soil of the mining area still remains lacking To conclusively address this, we used stable Zn isotopes (δ^{66}Zn) and combined with soil properties and Zn content characteristics. The objectives of this study were (1) to clarify the Zn content distribution and variation characteristics in the soil of the mining area to trace pollution sources of Zn in soil by using Zn stable isotope to quantitatively evaluate different Zn pollution sources based on isotope mass mixing model. The results provide important geochemical information regarding Zn in mining soil and a reference for relevant departments to formulate effective soil metal pollution mitigation strategies.

The content of Zn in the soil of the study area was ranged from 95 to 327 mg·kg^{-1} (mean: 233 mg·kg^{-1}), which exceeded the background value of the control point and Anhui Province. Approximately 60% of the samples exceeded the screening value of soil pollution risk of agricultural land, indicating that there is a certain pollution risk of Zn in soil. The Zn of soil showed that the fine particles from gangue and fly ash were deposited into the nearby soil via wind dispersion, which was the main source of anthropogenic Zn in the soil of the mining area.

Conclusion

The soil samples were dried to constant weighed. After picking out debris such as residual roots and gravel, grind and screen them with agate mortar until the particle size was less than 2 mm for standby. Take water as the extractant, the ratio of water to soil was 1:2. shake horizontally for 2 min, stand for 30 min, and measure the soil pH with a pH meter within 1 h. The contents of total organic carbon (TOC) and total sulfur (TS) in the sample were obtained by directly testing the dried and screened soil sample on the machine. The content of soil organic carbon was determined after eliminating soil carbonate by elemental analyzer the content of soil total sulfur was determined by automatic multifunctional carbon sulfur extractor (HCS-218, Oukai, China), and the content of soil organic matter (OM) was determined using the dichromate oxidation ferrous sulfate titration method

Acknowledgement

I would like to thank my Professor for his support and encouragement.

Conflict of Interest

The authors declare that they are no conflict of interest.

References

1. Acorci MJ, Dias LA (2009) Inhibition of human neutrophil apoptosis by Paracoccidioides brasiliensis Role of interleukin. J Immunol 69: 73-79.
2. Akgu CI, Edwards SW (2003) Regulation of neutrophil apoptosis via death receptors.Cell Mol Life Sci 60: 2402-2408.
3. Alder JD, Daugherty N, Harris ON (1989) Phagocytosis of Treponema pallidum pertenue by hamster macrophages on membrane filters. J Infect Dis 160: 289-297.
4. Alderete JF, Baseman JB (1986) Surface-associated host proteins on virulent Treponema pallidum. Infect Immun 26: 1048-1055.
5. Baker SA, Zander SA (1992) Macrophage-mediated killing of opsonized Treponema pallidum. J Infect Dis 165: 69-74.
6. Acorci MJ, Dias LA, Golim MA (2009)Inhibition of human neutrophil apoptosis by Paracoccidioides brasiliensis Role of interleukin 8. Scand J Immunol 69: 73-79.
7. Akgul C, Edwards SW (2003) Regulation of neutrophil apoptosis via death receptors.Cell Mol Life Sci 60: 2402-2408.
8. Alderete JB, Baseman NJ (1979) Surface-associated host proteins on virulent Treponema pallidum.Infect Immun 26: 1048-1056.
9. Baker AS (1992) Macrophage-mediated killing of opsonized Treponema pallidum.J Infect Dis 165:69-74.
10. Baseman JB, Nichols JC, Rumpp JW (2007) Assessment and interpretation of bacterial viability by using the LIVE/DEAD BacLight Kit in combination with flow cytometry.Appl Environ Microbiol 73: 3283-3290.
11. Byrne R Noritz G (2017) Implementation of early diagnosis and intervention guidelines for cerebral palsy in a high-risk infant follow-up clinic. Pediatr Neurol 76: 66-71.
12. Granild JB (2015) Predictors for early diagnosis of cerebral palsy from national registry. dataDev Med Child Neuro 57 (10): 931-935.
13. Novak C Morgan L, Adde J (2017) Early accurate diagnosis and early intervention in cerebral palsyadvances in diagnosis and treatment. JAMA Pediatr 171 (9): 897-907.
14. Morgan C, Crowle C(2016) Sensitivity and specificity of General Movements Assessment for diagnostic accuracy of detecting cerebral palsy early in an Australian context J Paediatr Child Health 52 (1): 54-59.
15. Bosanquet M, Copeland L (2013)A systematic review of tests to predict cerebral palsy in young children. Dev Med Child Neurol 55 (5): 418-426.