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不同添加剂对铅冶炼污染石灰性土壤的修复及土壤性质的影响研究 

### Remediation of a lead-smelter contaminated calcareous soil with different amendments: Their effects on metal availability and soil properties

关键词: [石灰性土壤](#) [重金属](#) [冶炼](#) [污泥](#) [枯草](#) [磷矿粉](#)

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摘要: 探讨了污水处理厂脱水污泥、枯草和磷矿粉对受铅冶炼污染的石灰性土壤(全Pb、Cd、Zn含量分别为2337、21.4、486 mg·kg<sup>-1</sup>, DTPA提取态Pb、Cd、Zn含量分别为1035、14.5、68.7 mg·kg<sup>-1</sup>)中重金属的稳定效果及对土壤性质的影响。其中, 污泥和枯草均按200 g·kg<sup>-1</sup>(干重)的用量施用, 磷矿粉按n(P):n(Pb)=2:1比例施用, 培养80 d。研究表明, 单独施用污泥可使土壤DTPA-Pb含量降低18.0% (p<0.05), 并可显著降低土壤pH, 增加土壤氮、磷有效性和电导率、DTPA-Cd、DTPA-Zn含量, 其中, DTPA-Cd、DTPA-Zn含量增加比例均达到10%以上。单独施用枯草可使土壤DTPA-Pb含量降低10.7% (p<0.05), 土壤有机质含量增加26.4% (p<0.05), 对土壤其它性状影响较小。磷矿粉单独施用对土壤性质影响较小。与污泥单独施用相比, 磷矿粉与污泥配合施用, 可使土壤DTPA-Cd含量降低11.9%。

**Abstract:** Henan province in northern China produces about one tenth of the lead (Pb) in the world, with heavy metals released from stacks of lead smelters as a by-product. Soils in the vicinity of these operations have elevated heavy metal concentrations, which affects the health of local people through heavy metal uptake via food or dust ingestion. This paper reports efforts to remediate a heavy metal contaminated soil collected near a lead smelter in Henan province with dehydrated sludge from a waste water treatment plant, dry grass (mainly *Setaria viridis*) and phosphate rock powder. Total concentrations of Pb, Cd and Zn in the soil are 2337, 21.4 and 486 mg·kg<sup>-1</sup>, respectively, while DTPA-Pb, Cd and Zn concentrations are 1035, 14.5 and 68.7 mg·kg<sup>-1</sup>, respectively. The sludge and the dry grass were applied at the rates of 200 g·kg<sup>-1</sup> (dry weight) while the phosphate rock powder was applied at a n(P):n(Pb)=2. After amendment, the soil was incubated for 80 days. The sludge resulted in an 18.0% reduction of DTPA-Pb concentration (p<0.05), lower soil pH, significantly higher availability of nitrogen, phosphorus, Cd, Zn and electrical conductivity (EC), and more than 10% increase of DTPA-Zn and Cd concentrations. The dry grass treatment reduced DTPA-Pb concentration by 10.7%, increased organic matter content by 26.4%, and had less significant effect on other soil properties. The phosphate rock powder did not affect the soil properties significantly (p>0.05). Compared with the sludge-only treatment, the combined treatment of sludge and phosphate rock powder resulted in an 11.9% reduction of DTPA-Cd concentration.

**Key words:** [calcareous soil](#) [heavy metals](#) [smelting](#) [sludge](#) [dry grass](#) [phosphate rock powder](#)

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