The Silent Intruder: A Deep Dive into Lohsar Dumpsite's Soil Heavy Metals Crisis

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Abstract

Municipal solid waste landfills present substantial environmental challenges, including the generation of leachate containing heavy metals, organic and other inorganic pollutants. The current study evaluates the impact of Lohsar landfill near Rawalpindi, Pakistan, on soil contamination. Heightened heavy metals content were found in leachate, surpassing recommended standards. Soil analysis revealed spatial variations in contamination levels, with heavy metal concentrations exceeding safety thresholds. The study underscores the urgent need for proper waste management and leachate treatment to mitigate environmental risks. Recommendations include utilizing agricultural byproducts for treatment and implementing strict waste management policies to ensure environmental sustainability.

Introduction

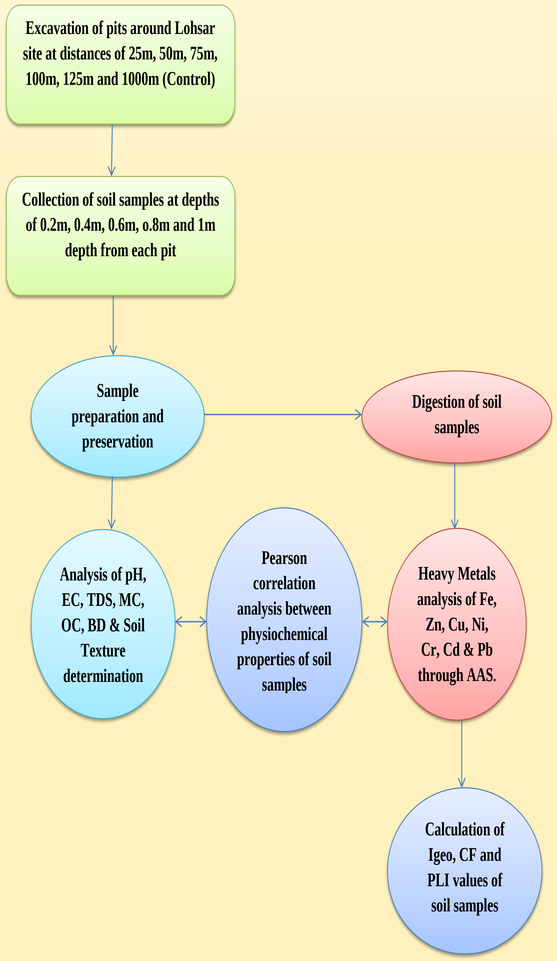
- Municipal solid waste landfills pose environmental risks: greenhouse gases, leachate formation, odors.
- As rainwater penetrates across open dump sites, it generates leachate, a highly contaminated substance that may contain significant levels of heavy metals, organic pollutants, and other hazardous materials (Priyanka et al., 2018).
- Leachate can become an important component of soil degradation when it is not adequately treated before its discharge into the environment (Norouzi et al., 2022).
- When the agricultural soils are contaminated with the heavy metals, they are taken up by the plants and accumulate in their tissues (Beinabaj et al., 2023; Perkovic et al., 2022).
- The present research focused to access the level of heavy metals in leachate and investigate its impending to pollute soil proximity to the Lohsar dumpsite, Rawalpindi.

Objectives

- Assessing the contamination potential of Leachate from open dumps
- Evaluating the soil contamination due to leachate migration from open dumps.

Methodology

The detailed methodology of the study is described below in flow diagram.

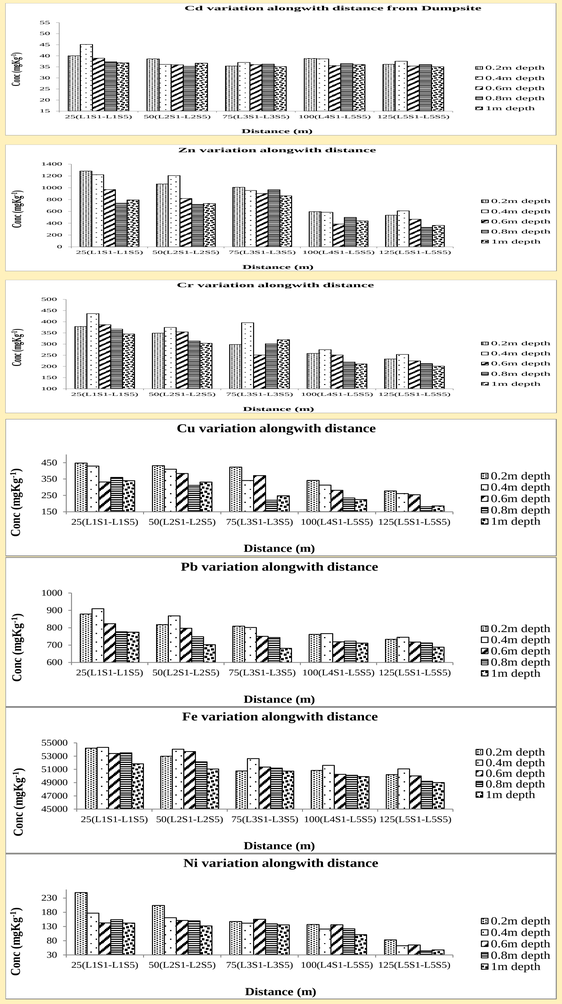


Results

- Leachate exploration reveals high levels of inorganic and organic elements.
- Soil investigation shows composition and changes with distance from dump.

Results

- Heavy metal concentrations surpass NEQS (National Environmental Quality Standard) and WHO (World Health Organization) thresholds.
- Geoaccumulation index suggests moderate contamination, contamination factor indicates heavy contamination.
- Pollution load index shows overwhelming pollution.
- Heavy metal contamination ranks as Cd > Pb > Ni > Cu > Cr > Zn > Fe according to CF values.
- Pearson correlation analysis reinforces leachate-associated pollution.



Conclusions

- Open dumpsites have been conclusively identified as sources of extensive soil contamination.
- The analysis revealed that leachate contains very high levels of organic and inorganic contents beyond the desired limits.
- Except for Zn, Cr & Ni, other heavy metals Fe, Cd, Pb & Cu concentrations were found beyond Pakistan NEQ standard to discharge municipal and industrial effluents.
- The migration of the leachate from the dumpsite through the soil layers has a prominent impact on physiochemical properties of the soil.
- The study recorded alarming levels of pollutants in soil samples, surpassing established safety thresholds.
- This contamination raises concerns about the safety of the local soil quality.
- Mitigating measures are recommended, including proper waste disposal, leachate treatment, and adherence to pollution control standards.
- The study suggests utilization of local agricultural byproducts for leachate treatment and implements efficient landfill practices, emphasizing strict adherence to waste management policies, including segregation and continuous monitoring.

Acknowledgements

The author extends heartfelt gratitude to Associate Professor Dr. Zaki ul Zaman Asam for his pivotal support and generous funding, without which our research project would not have been possible. . Special appreciation is extended to the esteemed faculty members of the Department of Environmental Sciences, University of Gujrat, for their insightful guidance and unwavering support throughout the study.

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