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Integrated Approach of Heavy Metal Evaluation Using Geostatistical and Pollution Assessment Index in Soil of Bauxite Mining Area

(2022) *Pertanika Journal of Social Sciences and Humanities*, 30 (2), pp. 1545-1566.

DOI: 10.47836/pjst.30.2.38

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Abstract
Heavy metals contamination in soil is one of the global issues, posing a threat not just to the environment but also to human health. Identifying the source and distribution of heavy metal pollutants around mining areas can provide a scientific basis for future environmental control. Distributions of the heavy metals (Cd, Cr, As, and Ni) in this study were evaluated using descriptive and multivariate statistics and further described using a geostatistical approach and pollution indices. The total content of Cr Cd and Ni in surface soil was observed with a higher concentration level according to the Dutch target values and the 95% Investigation Levels determined for Malaysia soil. Statistical analyses, geostatistics, and GIS mapping suggested that Cd, Cr, and Ni were derived mainly from anthropogenic sources, including mining and agricultural activities, while As could be derived from lithogenic and anthropogenic sources. Geoaccumulation index analysis demonstrated that the contamination that occurred with Cd posed the greatest risk of contamination, followed by Cr, Ni, and As. A spatial interpolated map showed a higher concentration of heavy metals in the vicinity of the mining area. These findings highlight the effectiveness of principal component analysis, geostatistics, and geospatial analyses in evaluating heavy metal contents in the study area. The obtained results could be used by authorities to identify areas requiring remediation management and establish scientific baseline data related to soil quality. © Universiti Putra Malaysia Press

Author Keywords
Bauxite mining; geoaccumulation index; GIS; heavy metals; semivariogram

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Publisher: Universiti Putra Malaysia

ISSN: 01287702
Language of Original Document: English
Abbreviated Source Title: Pertanika J. Soc. Sci. Humanit.
2-s2.0-85131052442
Document Type: Article
Publication Stage: Final
Source: Scopus