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UNVEILING THE HIDDEN HAZARD: INVESTIGATING SOIL POLLUTION & HEALTH RISKS OF BLACK DIAMOND EXCAVATION

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Globally the coal mining has raised significant environmental and health concerns due to heavy metal (HM) contamination in agricultural soils and water. This study investigates the extent of HM in agricultural soils and rice crops near coal mining sites. The study reveals elevated concentrations of HMs in soils and rice grains from the mining zones, with soil concentrations of Pb ranging from 108.24±72.97 to 139.56±69.46 mg/kg, Cr from 180.05±46.90 to 245.46±70.66 mg/kg, Ni from 70.79±25.06 to 95.46±22.89 mg/kg, and Cd from 8.44±2.76 to 8.95±2.57 mg/kg. Rice grains showed concentrations of Pb from 0.96±0.8 to 1.27±0.84 mg/kg, Cr from 4.78±1.89 to 8.6±1.58 mg/kg, and Ni from 11.74±4.38 to 11.50±2.46 mg/kg, all exceeding permissible limits. Using various models, including Monte Carlo simulations, the Free Ion Activity Model (FIAM), and the Severity-Adjusted Margin of Exposure (SAMOE), the research quantifies the carcinogenic and non-carcinogenic risks to human health. The findings show that long-term rice consumption from these zones presents significant health risks, especially for children, due to high levels of Ni, Cr, and Cd. Source identification using Self-Organizing Maps (SOM) and Positive Matrix Factorization (PMF) reveals that coal mining, vehicular emissions, and mining waste deposition are the primary contributors to HM contamination. Geostatistical mapping further highlights the spatial distribution of pollution, with highest contamination near mine. The study emphasizes the urgent need for effective mitigation strategies to address HM leaching from coal mine waste and its impact on soil and food safety.

Reference

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