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Topic of Research: Investigation of Soil Contamination in terms of Heavy Metals in Industrial area of Delhi and NCR

FINDINGS

This study investigates heavy metal contamination in the soil of the Okhla Industrial Area, South Delhi, focusing on Chromium (Cr), Lead (Pb), Iron (Fe), Zinc (Zn), Copper (Cu), and Manganese (Mn). Soil samples were collected from 10 locations across various depths (0–2.5 meters). A total of 270 samples were collected to cover variability across different industrial phases (I to IV) during year 2023 in Pre-monsoon (April-May), Monsoon (June-September) and Post-monsoon (October-December) to evaluate contamination levels and seasonal variations respectively. Each sample was processed using standard procedures for pH measurement, electrical conductivity assessment and heavy metal concentration analysis through Inductive Coupled Plasma–Optical Emission Spectrometry (ICP-OES).

The results revealed that heavy metal levels exceeded permissible limits in several locations, particularly near industrial hotspots. Seasonal variations showed higher surface concentrations during the pre-monsoon season, redistribution during monsoon rains, and deeper penetration post-monsoon, raising concerns about groundwater contamination. Spatial analysis highlighted contamination hotspots and the extent of vertical pollution.

The study emphasizes the ecological and health risks posed by industrial activities and suggests biological and chemical remediation strategies to mitigate these impacts. This research provides a comprehensive assessment of heavy metal contamination, contributing to targeted remediation efforts and informed policy-making for sustainable urban industrial management.

The study underscores the significant impact of industrial activities on soil contamination in urban areas. Seasonal and spatial analyses provide critical insights into contamination dynamics, while the proposed remediation strategies (biological and chemical methods) offer pathways to mitigate environmental risks.

In the last part of the study various health risk from heavy metal contamination have been discussed, on the basis of result obtained from ICP-OES analysis, the heavy metal contamination of each metal was observed in exact amount at different depths of locations and calibration curves were discussed. Due to contamination negative impact, remediation is important for controlling contamination of industrial waste before discharge on surface, sewage, pond, river, lakes etc. There are various remediation technologies, which are economical and easily available in the market for those small industries try to minimizing contamination in industrial waste.

Keywords: Heavy Metals, Soil Pollution, Human Health Hazards, Industrial waste, Remediation strategies.