Assessing risk to human health for heavy metal contamination from public point utility through ground dust: a case study in Nantong, China

Yanping Wang
Nantong University
Peng Qian (dapeng_96@sina.com)
Nantong University
Dongming Li
Nantong Water Conservation Project Management Office of Tonglv Canal River
Haifeng Chen
Nantong Branch of Jiangsu Hydrology and Water Resources Survey Bureau
Xiangqian Zhou
Helmholtz Center for Environmental Researchh

Research Article

Keywords: Heavy metal, Ground dust, Health risk, Public point utility, Magnetic property

Posted Date: May 13th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-461491/v1

Version of Record: A version of this preprint was published at Environmental Science and Pollution Research on July 10th, 2021. See the published version at https://doi.org/10.1007/s11356-021-15243-0.

Abstract

Heavy metal contamination in ground dust presents potential environmental and human health threats. However, the heavy metal contamination status of ground dust in the vicinity of public point utilities remain poorly explored. Therefore, this study has been designed to analyze the heavy metal contaminations in the ground dust collected monthly near a public bronze sculpture in an urban campus of Nantong, China, using geo-accumulation indexes (Igeo), enrichment factors (*EF*), potential ecological risk indexes (RI), and health risks (non-carcinogenic risks-*HI* and carcinogenic risks-*CR*). This study revealed that the maximum Cr, Cu, Mn, Ni, Pb, and Zn concentrations in ground dust samples were 156.2, 708.8, 869.8, 140.8, 180.5, and 1089.7 mg kg^{-1} respectively in which the mean Cu and Zn concentrations were 9 and 7 times higher than the background level in soil. Temporally speaking, for the majority of heavy metals (with the exception of Ni), the high concentration seasons tend to mainly be the summer and autumn, as indicated by the higher Xlf and SIRM values during those seasons. It was observed that Cu and Zn exhibited significant enrichment (*EF* = 11.7 and 8.4, respectively), moderate to strong pollution (Igeo = 2.4 and 2.0, respectively), and moderate and low potential ecological risks (Eir = 45.6 and 6.6, respectively). The non-carcinogenic risks which adults exposed to the heavy metal concentrations suffered were found to be insignificant. However, the carcinogenic risks related to Ni (1.3E-04) had exceeded the acceptable level. Based on the obtained PCA and correlation analysis, the heavy metal concentrations in the ground dust of urban campuses could be related to public utilities, traffic-related exhaust sources, and industrial activities. This study's findings demonstrated that urban public utilities require increased attention due to their significant enrichment, ecological risk factors, and the significant carcinogenic risks to the population.

Full Text

This preprint is available for download as a PDF.

Figures

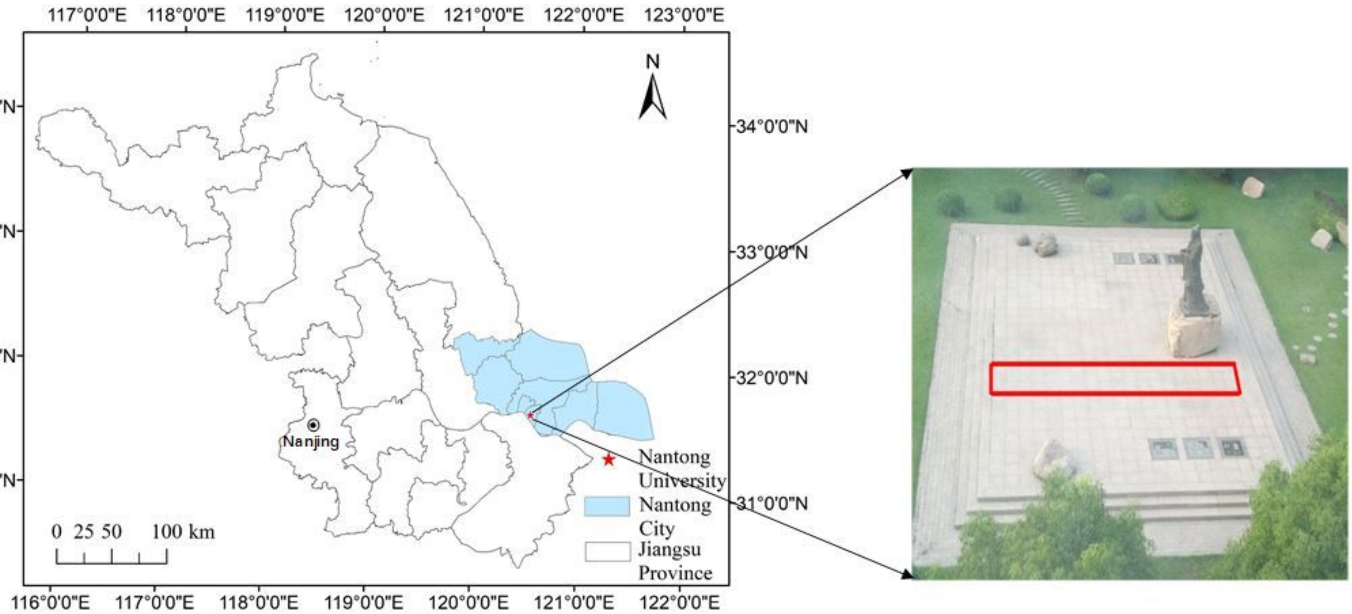

Figure 1

Location of the sampling site. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

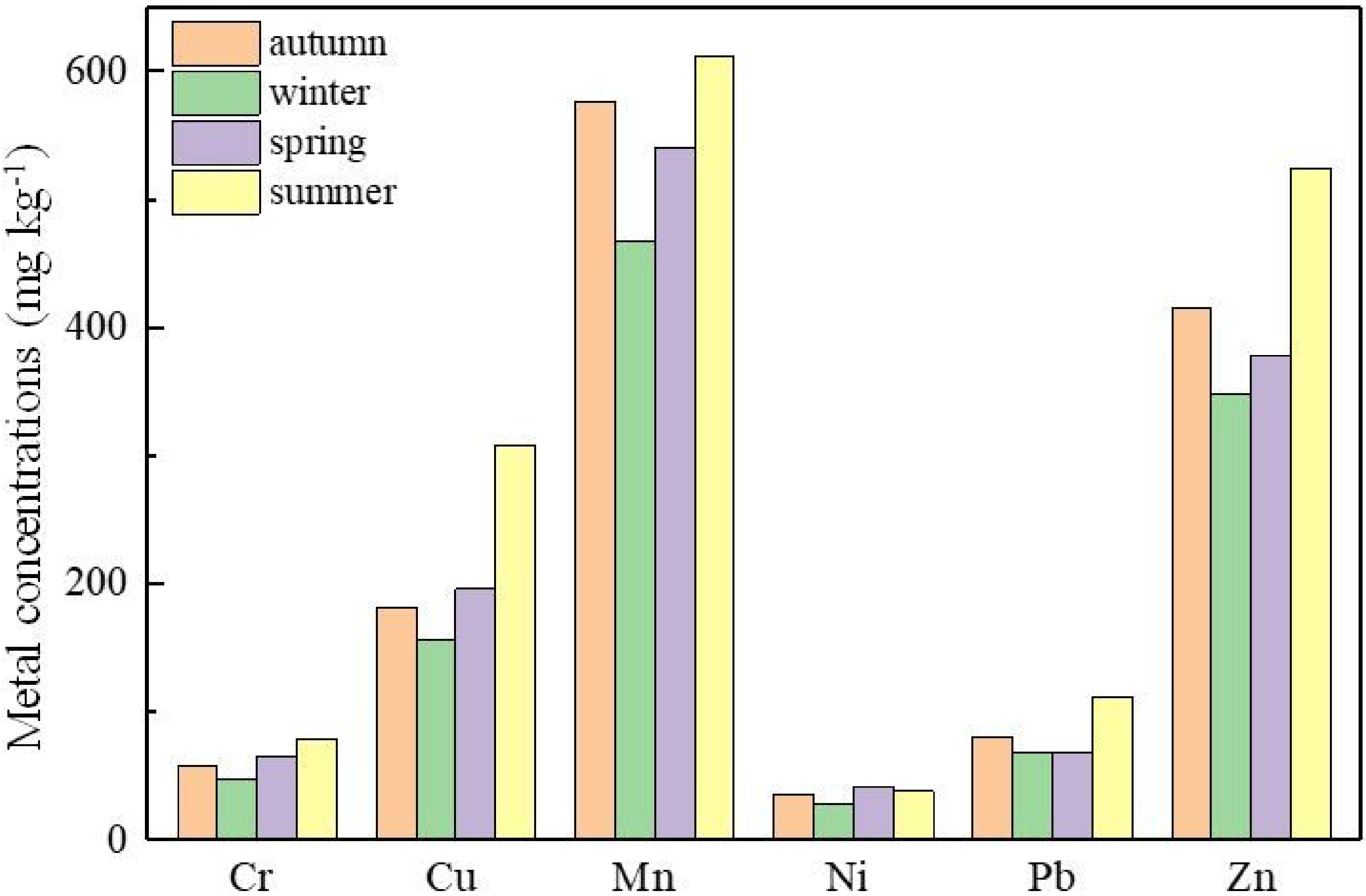

Figure 2

Seasonal variations in the metals detected in the examined ground dust

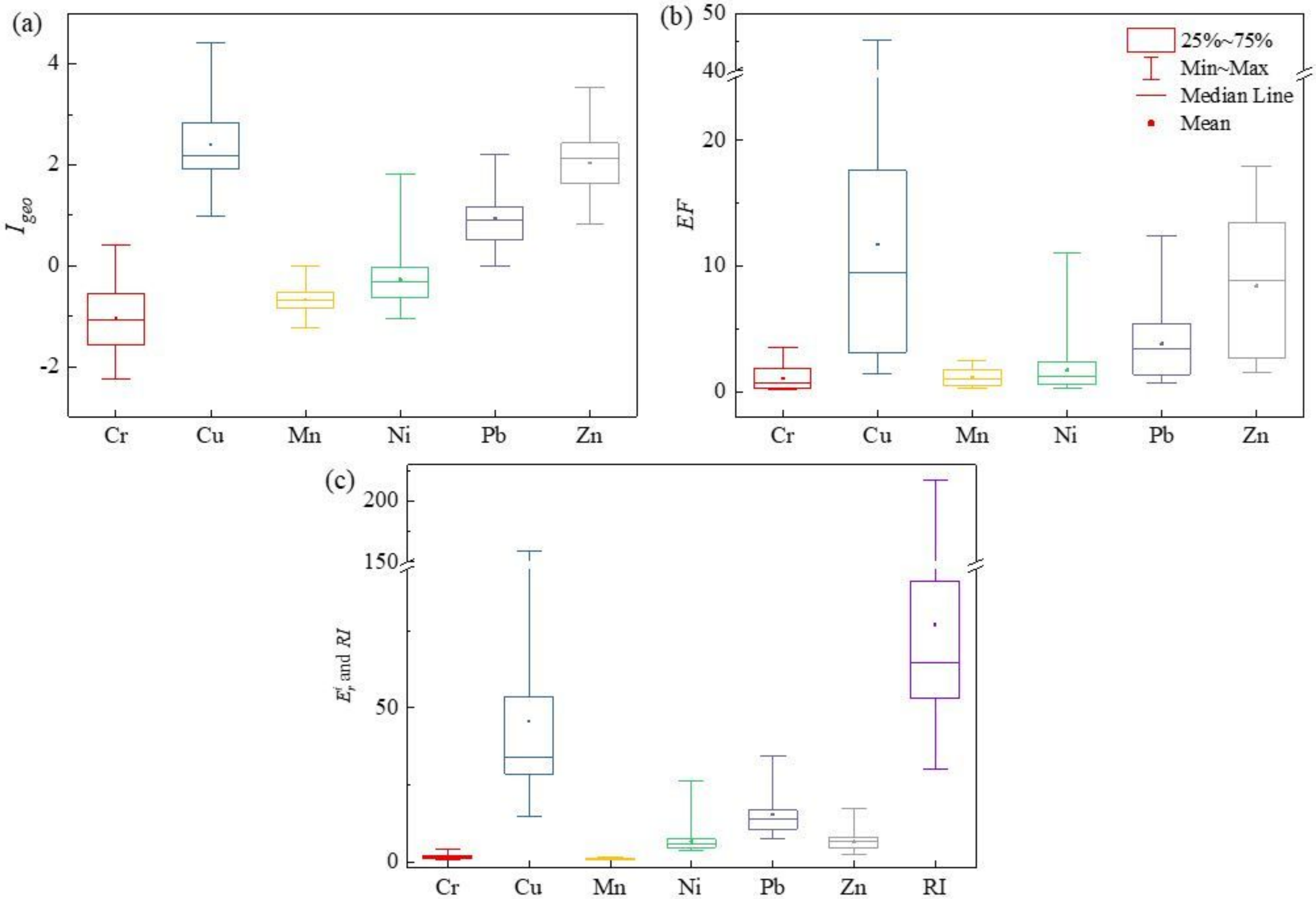

Figure 3

Risk assessment results: (a) Levels of I_geo; (b) Levels of EF; (c) Levels of E_r^i and RI

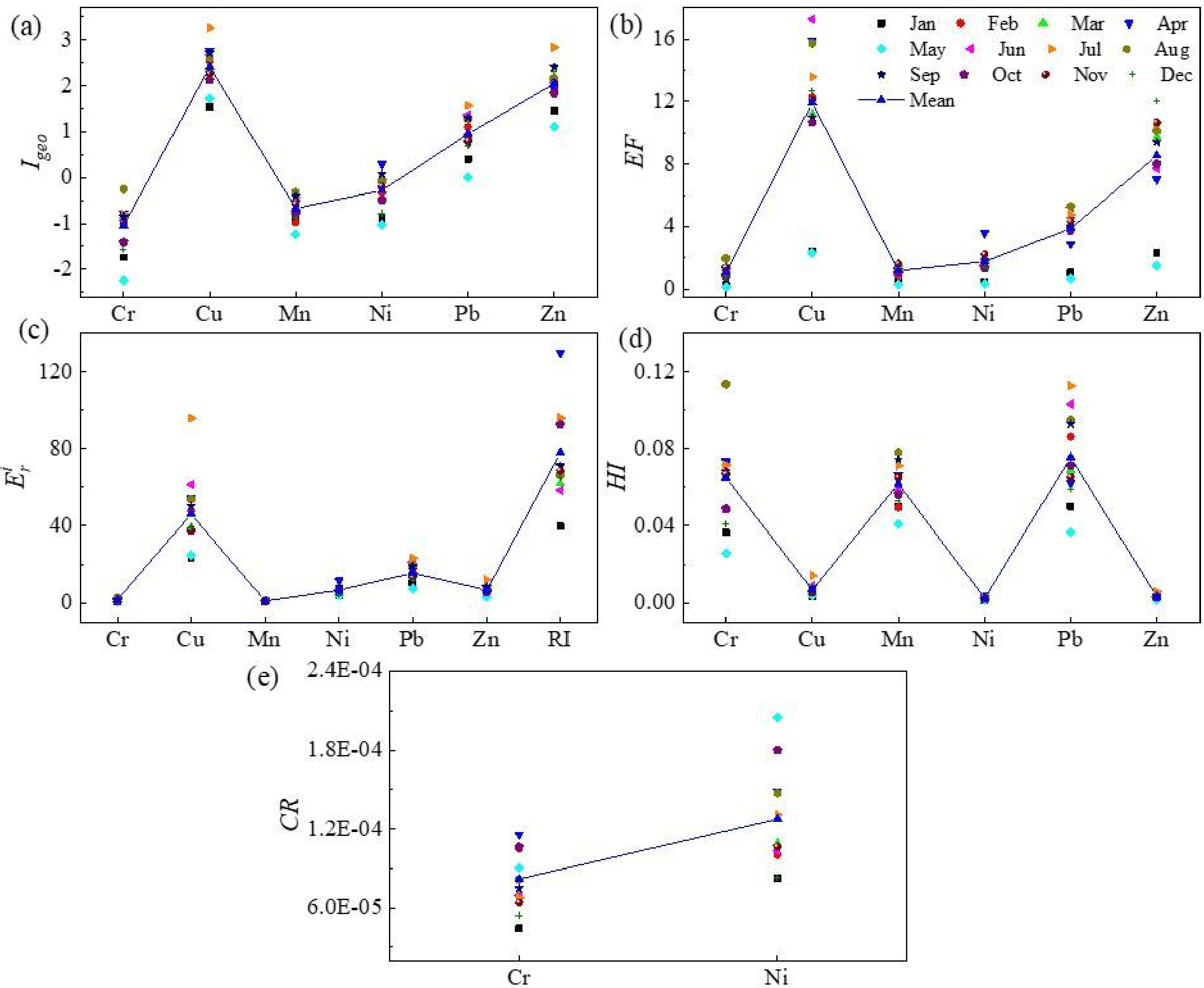

Figure 4

Monthly assessment indexes of the metals detected in the examined ground dust

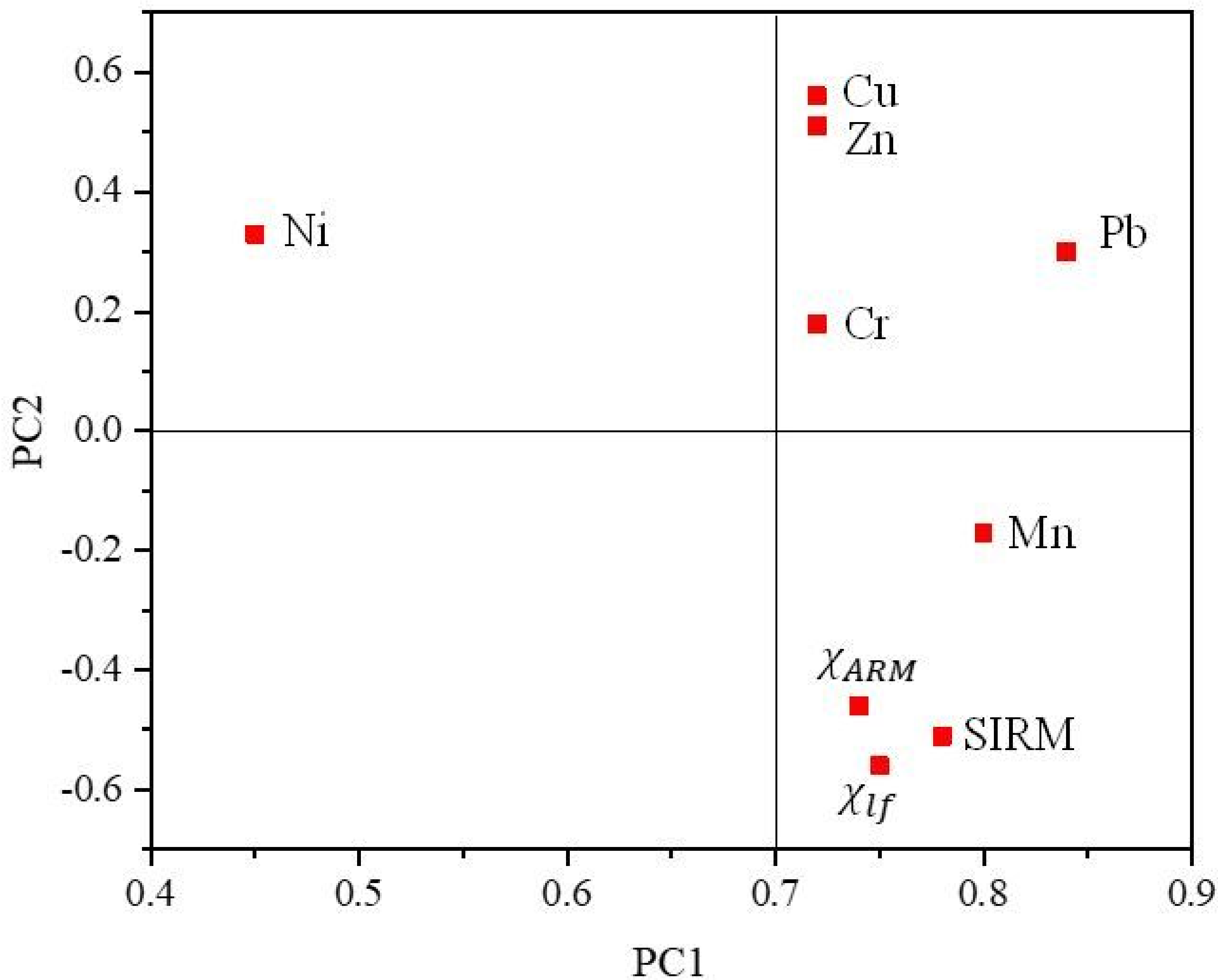

Figure 5

Loading plots of the principal component analysis (PCA) for the metals detected in the ground dust samples from the Nantong urban campus

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementarymaterial.docx