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"Gheorghe Asachi" Technical University of Iasi, Romania

ASSESSMENT OF ENVIRONMENTAL SUSTAINABILITY IN KIRKUK CITY, IRAQ, BY EXAMINING THE ASSOCIATION BETWEEN HEAVY METAL POLLUTION AND THE SPREAD OF COVID-19

Aram Mohammed Raheem

Civil Engineering Department, University of Kirkuk, Kirkuk, Iraq
E-mail: engaram@yahoo.com, aram_raheem@uokirkuk.edu.iq; Phone: +964 7735515468

Abstract

This study attempts to investigate the sustainability of Kirkuk city, Iraq by inspecting the relationship between various heavy metal contaminants and COVID-19 propagation depending on different environmental indices. In particular, a comprehensive dataset on the distribution of heavy metal across the city of Kirkuk has been accumulated and investigated. The process of examining the environmental sustainability for the contamination of heavy metals includes evaluating the conventional heavy metal indices such as pollution index, combined pollution index, Nemerow pollution index, potential ecological risk index, pollution load index, geo accumulation index, integrated pollution index, hazard index, and total cancer risk. On the other hand, the COVID-19 virus propagation of the confirmed cases in Kirkuk city has been studied. In order to examine the discrete sustainability connection of the cumulative total of the verified COVID-19 instances with the heavy metal indices, a linear statistical model incorporated with a correlation between COVID-19 and heavy metals and multi-regression analysis have been presented. Based on the assessment of the total cancer risk, it was shown that both chromium and arsenic have the highest carcinogenic adverse influences on adult and child lives in Kirkuk city, which threatens the environmental sustainability of the studied area. Additionally, the statistical model has demonstrated that the pollution index and combined pollution index, with R^2 values of 0.9748 and 0.9587, respectively, may be utilized as powerful sustainability indicators for the distribution of the confirmed cases of COVID-19 in Kirkuk city. Moreover, most correlations between COVID-19 and heavy metal indices for Kirkuk city are positive, and few are negative, with degrees of correlations ranging from -0.2186 to 0.9873. The highest values of R and R^2 of the multi-regression model were 0.9895 and 0.9790, respectively. Furthermore, the multi-regression analysis shows that the COVID-19 values have a stronger association with PI, CPI, GAI, and IPI than HI-adult, HI-child, TCR-T-adult, and TCR-T-child.

Key words: conventional environmental indices, COVID-19, heavy metals, sustainability, total cancer risk

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