

Heavy metals pollution sources of the surface water of the Tunggak and Balok river in the Gebeng Industrial Area, Pahang, Malaysia

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ABSTRACT

The heavy metal contamination of surface water is regarded as one of the most serious environmental hazards. The purpose of this study is to identify the origins of 10 heavy metals found in surface water in the Gebeng industrial area rivers. The samples were gathered over the course of a year at ten stations along the Tunggak and Balok rivers. According to the Malaysian heavy metals standard, the surface water of the Gebeng rivers was contaminated with six heavy metals: Cd, Co, Cu, Pb, Mn, and Ni. Inductively Coupled Plasma Mass Spectrometry was used to analyze the data. SPSS version 22.0, a multivariate statistical tool, was used to identify the sources. The heavy metals have been divided into three components using principal component analysis, indicating that the pollution is due to anthropogenic causes. The stations were grouped into three groups using cluster analysis, with high pollution loading falling under industrial zone stations (IZ1, IZ2, and IZ3), indicating pollution from industrial sources. In general, the findings of this research will be useful in future studies aimed to reduce heavy metal contamination in the Gebeng rivers.

KEYWORDS

Heavy metals; Gebeng industrial area; Contamination; Principal component analysis; Cluster analysis

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