

A Review of Lead Contamination in Environmental Matrices

Lead, a toxic heavy metal, poses significant threats to both environmental ecosystems and human health. Its persistence in the environment, coupled with its potential for bioaccumulation, are key factors contributing to its harmful impact. Given the interrelated nature of environmental components, lead can easily infiltrate the food chain, resulting in serious health risks for both humans and animals. This study aims to assess the concentration of lead across various environmental matrices including soil (both surface and profile), water (drinking, surface, groundwater, and packaged), vegetation, and aerosols in selected urban and industrial areas of Albania. A total of 250 samples were collected and analyzed using Atomic Absorption Spectrometry (AAS), with both flame atomic absorption spectrometry (FAAS) and graphite furnace atomic absorption spectrometry (GFAAS) employed for accurate and sensitive quantification of lead. The results reveal substantial variation in lead concentrations across the analyzed environmental components. The highest concentrations were detected in surface soils, profile soils, and aerosols, particularly in regions near industrial activities such as the metallurgical complex in Elbasan, the former battery production plant in Berat, and certain locations in Tirana. These findings highlight the elevated risk of lead contaminating the food chain and pinpoint specific areas at increased environmental and public health risk. Certified reference materials (CRMs) from the International Atomic Energy Agency (IAEA), which correspond to the environmental matrices being analyzed, were used to ensure the accuracy, precision, and reliability of the analytical procedures. This study underscores the critical need for continuous environmental monitoring and provides crucial data for identifying specific urban and industrial zones in Albania at risk of lead contamination. The results support the development of evidence-based strategies for environmental management and public health protection, promoting a cleaner, healthier environment by mitigating heavy metal pollution, especially lead, which remains highly toxic even at low concentrations.

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