

Investigation of Heavy Metals on Paddy Plants (*Oryza sativa* sp.) and Soil Samples

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Structured Abstract

Background: Heavy metal contamination in paddy fields has emerged as a growing concern due to its harmful effects on human health, soil quality, and food safety. This study was conducted in Sungai Besar, Selangor, to assess the concentration and mobility of selected heavy metals like lead (Pb), cadmium (Cd), zinc (Zn), and manganese (Mn) in paddy soils and various parts of the rice plant (*Oryza sativa* sp.)

Methods: Samples of soil and rice plants were collected from three blocks (A, B, and C). Soil samples were taken from the topsoil (0–15 cm) and plant samples were separated into root, leaf, and grain. All samples were dried, ground, and digested using a mixture of nitric acid and hydrochloric acid. The digested samples were analyzed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). Translocation Factor (TF), Enrichment Factor (EF), and Bioaccumulation Factor (BAF) were calculated to evaluate the mobility and accumulation of heavy metals.

Results: The results showed that manganese and zinc had the highest accumulation in leaves and roots, respectively, due to their role as essential micronutrients. However, lead was found in grains at concentrations exceeding the FAO/WHO safety limit of 0.2 mg/kg, indicating potential health risks. TF analysis revealed high mobility of manganese (TF = 2.84) in leaves, while BAF and EF analyses showed that cadmium was significantly accumulated in grains (BAF = 1.11; EF = 10847.78). Although correlation tests revealed weak relationships, they were notable, possibly due to sample size limitations and spatial variation.

Conclusion: The findings highlight the need for active monitoring and mitigation of heavy metal contamination in rice fields. Recommendations include phytoremediation using hyperaccumulator plants, rice straw composting to reduce metal mobility, and soil amendments such as biochar or lime. This study provides essential insights for policymakers and stakeholders to enhance food safety and promote sustainable rice farming practices.

Keywords: Heavy metals, paddy soil, translocation factor, bioaccumulation factor, ICP-OES

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