

Assessment of Heavy Metals Contamination (Pb, Cd, Fe, Zn, Mn) in Drinking Water from Dispensers at UiTM Shah Alam

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Structured Abstract

Background: Heavy metal contamination in drinking water is a major global public health concern, particularly in urban settings and large institutions like universities. This research specifically evaluated Lead (Pb), Cadmium (Cd), Iron (Fe), Zinc (Zn), and Manganese (Mn) pollution in drinking water dispensers at Universiti Teknologi MARA (UiTM) Shah Alam. Objectives included determining metal concentrations, comparing findings to Malaysian National Drinking Water Quality Standards and WHO guidelines, and identifying predominant contamination pathways within the university's water system.

Methods: A quantitative, cross-sectional methodology was adopted. Twelve water samples (dispenser and tap water QA/QC points) were collected from four distinct faculties across the UiTM Shah Alam campus. Metal concentrations were precisely measured using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). A one-way ANOVA was subsequently conducted in SPSS version 29 for statistical analysis.

Results: Results showed extensive and alarming contamination. Lead (up to 1.5333 mg/L) and Cadmium (up to 0.6200 mg/L) concentrations significantly exceeded health-based limits in both Malaysian and WHO guidelines (Pb by 63-153 times; Cd by 151-206 times). Furthermore, Iron (up to 4.0600 mg/L) and Manganese (up to 0.5733 mg/L) frequently exceeded Malaysian and WHO Limits. Zinc levels (up to 7.3167 mg/L) were mostly reasonable, with only localized exceedances. Statistical analysis revealed no significant variation in metal levels across faculties ($p > 0.05$), strongly implying a systemic, widespread problem rather than individual building issues.

Conclusion: The research outlined both localized contamination pathways (internal plumbing corrosion, dispenser component leaching) and widespread pathways (municipal water supply, extensive campus-wide plumbing system corrosion). In summary, UiTM Shah Alam's drinking water is largely non-compliant with key health parameters, necessitating immediate and comprehensive intervention. This includes an elaborate audit of the water distribution system and ongoing monitoring to provide potable water to the university community.

Keywords: heavy metals, drinking water, water dispensers, contamination pathways, UiTM Shah Alam

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