

## **Heavy metal contamination in *Oryza sativa* L. at the Eastern Region of Malaysia and its risk assessment**

### **ABSTRACT**

Paddy plants tend to accumulate heavy metals from both natural and anthropogenic sources, and this poses adverse risks to human health. The objective of this study was to investigate heavy metal contamination in paddy plants in Kelantan, Malaysia, and its health risk assessment. The bioaccumulation of heavy metals was studied by means of enrichment (EF) and translocation factors (TF). The health risk assessment was performed based on USEPA guidelines. The EF for heavy metals in the studied areas was in the descending order of Cu > As > Cr > Cd > Pb. Meanwhile, Cr and Pb exhibited higher TF values from stem to grain compared with the others. The combined hazard index (HI) resulting from five heavy metals exceeded the acceptable limit (HI >1). The lifetime cancer risk, in both adult and children, was beyond the acceptable limit ( $10^{-4}$ ) and mainly resulted from exposure. The total cancer risk (CR<sub>t</sub>) due to simultaneous exposures to multiple carcinogenic elements also exceeded  $10^{-4}$ . In conclusion, intake of heavy metal through rice ingestion is likely to cause both non-carcinogenic and carcinogenic health risks. Further research is required to investigate the extent of heavy metal contamination in agricultural soils and, moreover, to establish human exposure as a result of rice consumption

**Keyword:** Heavy metals; Enrichment factor; Translocation factor; Health risk assessment