EST – 03

INFLUENCE OF NUTRIENT SUPPLEMENT IN THE SINGLE HEAVY METAL (Pb$^{2+}$, Cd$^{2+}$, Cr$^{3+}$) UPTAKE AND MINERAL NUTRIENTS ABSORPTION BY WATER KANGKONG (Ipomea aquatica Forsk.)

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The present study investigated the effects of Cd$^{2+}$, Pb$^{2+}$, and Cr$^{3+}$ stress on mineral contents (K$^+$, Na$^+$, Ca$^{2+}$, P, Mg$^{2+}$, Fe$^{2+}$, Cu$^{2+}$, Zn$^{2+}$ and Mn$^{2+}$) in the different parts of water kangkong (Ipomea aquatica Forsk.) by point analysis method using Horiba XGT-72000, as well as the influence of nutrients on the uptake and accumulation of these heavy metals. I. aquatica cuttings were grown in tap water supplemented with a very small amount of NPK fertilizer and treated with Pb(NO$_3$)$_2$, Cd (NO$_3$)$_2$.4H$_2$O, and K$_2$Cr$_2$O$_7$ under two soaking solutions – hydroponics solution and tap water solution. Results revealed that Cd$^{2+}$, Pb$^{2+}$, and Cr$^{3+}$ alter the mineral nutrient absorption of I. aquatica. Particularly, the approximate concentrations of most mineral ions (K$^+$, Ca$^{2+}$, Fe$^{2+}$, Cu$^{2+}$, Zn$^{2+}$ and Mn$^{2+}$) in the leaves and stems were reduced by Cd$^{2+}$, Pb$^{2+}$, and Cr$^{3+}$ exposure, thus making I. aquatica deficient in nutrients when consumed as food. It was also observed that these heavy metals caused a disturbance in K$^+$/Ca$^{2+}$ and K$^+$/Na$^+$ ratio, which could have a great impact on water balance. Data also suggest that nutrient optimization may help I. aquatica to develop tolerance to Cd$^{2+}$, Pb$^{2+}$, and Cr$^{3+}$ and can be a good strategy to alleviate the accumulation of heavy metals by I. aquatica. The mechanisms of translocation of Cd$^{2+}$, Pb$^{2+}$, and Cr$^{3+}$ from roots to shoots behave differently in the presence of nutrients.

Keywords: Ipomea aquatica Forsk., absorption, heavy metal uptake, mineral nutrients, nutrient supplement