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Studies on the accumulation and transformation of arsenic in ecosystem in Guandu Wetland, Taiwan

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High arsenic (As) is naturally occurred in geothermal areas, it may result in pollution of downstream wetland and estuary ecosystem. Arsenic concentration is up to 4.32 mg/L in geothermal spring water and overly exceeded the drinking water guideline of WHO (0.01 mg/L) that may result in wetland ecosystem damage. The influence of aqueous, solid and plant phase on As mobility in Guandu wetland, Taiwan, is not properly distinguished yet. The mangroves are particularly growing in study area and Kandelia obovata is one of the most dominant plant species. The purpose of this study is to discriminate that integration of aqueous, solid and plant phase is affected by As redox cycling. The chemical compounds (As, Fe, Mn, TOC, SO_4^{2-}, FeS_2) and isotopic compositions ($\delta^{34}S$) in surface water and soil samples were analyzed, to characterize of As distribution. The sequential extraction of As and total As in plant samples were analyzed, to estimate the bioconcentration factor (BCF) and transfer factor (TF), and understand the accumulation and transformation of As for Kandelia obovata in aqueous and solid phase. The As concentration in plants (23.69 mg/kg) are higher than the surrounding water (0.0028 mg/L) and soils (16.33 mg/kg). Arsenic concentration in various plant tissues at maturity follow the order: roots (19.74 mg/kg) $>$ stems (1.76 mg/kg) $>$ leaves (1.71 mg/kg) $>$ seedlings (0.48 mg/kg), and they are mostly accumulated in the roots. However, the result of As sequential extraction in the sediments indicate uptake of chemical compound in plant from sediments is difficult, depending on low bioavailability in plants. Besides, low transfer factor ($TF_{stems/roots}$=0.088, $TF_{leaves/roots}$=0.088 and $TF_{seedlings/roots}$=0.024) indicate that the transformation of As in various plant tissues is very low. The results show that Kandelia obovata content low As bioavailability and low TF, cause of easy adaption to grow on As contaminated wetland ecosystem. $BCF_{plants/porewater}$ (10742.68) is higher than $BCF_{plants/soil}$ (1.49). High BCF between plant and pore water or soil indicates that uptake and bioaccumulation of As of Kandelia obovata are significant, therefore, Kandelia obovata is an As hyperaccumulator. The mechanism of plant uptake might be depending on the oxidation of As-contained FeS_2 in the aerial roots, causing that uptake of As in the plants is from water rather than soil.