BIOACCUMULATION AND DISTRIBUTION OF ARSENIC IN AQUACULTURAL FISH RAISED IN CONTAMINATED GROUNDWATER: POTENTIAL RISKS FOR HUMAN INTAKE

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Aquacultural tilapia (*Oreochromis mossambicus L.*) and shrimp (*Penaeus monodon L.*) from groundwater-cultured ponds in southwestern Taiwan (Budai, Yichu and Beimen) were analyzed to estimate the arsenic (As) bioaccumulation and the potential health risk to human intake. Most of the aquacultural ponds exhibited higher arsenic concentrations than the government-mandated safe limit (50 μg L^{-1}) of Taiwan. Arsenic concentrations in tilapia in Budai (0.33-1.58 mg kg^{-1}) were found to be higher than those in Yichu (0.791.07 mg kg^{-1}) and Beimen (0.73-0.78 mg kg^{-1}). Mean arsenic concentration in shrimp was found 0.36 ± 0.01 mg kg-1 in Beimen. Bioaccumulation of arsenic in tilapia is highly correlated (r^2=0.80) with arsenic concentration of pond water. Arsenic concentration in total fish is also highly correlated with that in bone (r^2=0.98), head (r^2=0.97) and tissue (r^2=0.96). Among three different arsenic species studied, organic species of DMA (dimethyle arsenic acid sodium salt) was found higher relative to inorganic species of As(III) and As(V). The bio-concentration factors (BCFs) of fish were 10.3 to 22.1. The values of TR (target cancer risk) for all fish were very high (2.9×10^{-4} to 13.9×10^{-4}) in comparison to the USEPA safe standard ($1x10^{-6}$). The THQ (Target Hazard Quotient) values were also very high (1.5-7.2) in comparison to the USEPA safe standard (1.0). These results suggest that the local inhabitants in this region were subjected to arsenic exposure at levels known to cause carcinogenic and non-carcinogenic health effects.

Keywords: groundwater arsenic, tilapia, bioaccumulation