

# **Arsenic Distribution in a Tilapia (*Oreochromis mossambicus*) Water-Sediment Aquacultural Ecosystem in Blackfoot Disease Hyperendemic Areas**

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摘要

## **Abstract**

Arsenic (As) contamination of groundwater is a major environmental concern (Smedley and Kinniburgh, 2002). In Taiwan, high arsenic concentrations in deep well water have been verified to be associated with blackfoot disease (BFD), which was once common on the southwestern coastal area (Tseng, 1997). From 1999 to 2004, the Taiwan Sugar Company undertook a groundwater quality survey at monitoring wells in this area (Taiwan Sugar Company, 2004). The As concentration in groundwater was  $0.30 \pm 0.35$  mg/L. At around 95% of monitoring in wells, the As concentrations exceeded the World Health Organization (WHO) guideline of 0.01 mg/L. Nowadays, even though this well water is not directly ingested by most inhabitants in this hazardous region, it is still extensively provided to meet domestic, irrigation, aquacultural and industrial needs. In the aquacultural sector, in particular, high As concentrations are bioaccumulated in tilapia (Han et al., 1998). The inorganic As concentrations of the farmed fish have increased with the As concentration of pond water in this area (Huang et al., 2003), causing a potential cancer risk (Liu et al., 2005). The decreased survival and reduced reproductive ability of the fish were related to the accumulation of metals in aquatic organisms (Liao et al., 2003). The Taiwan Environmental Protection Administration (2001) investigated the As concentration in 160 wells in the BFD area. The As concentrations in 106 samples collected from these wells exceeded 0.05 mg/L, and water from 44 out of the 106 wells was used for fish cultivation, especially for tilapia. (*Oreochromis mossambicus*) farming. To understand the impact of As-containing groundwater on the accumulation and transformation of As in tilapia, researchers have evaluated the bioconcentration factor (BCF) using data collected from laboratory and field measurements (Suhendrayatna et al., 2002). The BCF, which relates the concentration of a metal in water to its concentration in an aquatic animal at equilibrium, is generally used to estimate the propensity to accumulate the metal in the organism. Chen and Liao (2004) measured the uptake and depuration rate constants of As by tilapia in the laboratory and found that the BCF was 3.2 ml/g. Huang et al. (2003), however, estimated an average BCF of  $41.8 \pm 31.4$  ml/g, based on As concentrations of pond water and

tilapia collected from 21 ponds in the BFD areas.

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