

Contamination by arsenic, manganese and barium in groundwater and human health risk in Vietnam

AGUSA, Tetsuro^{1*} ; KUNITO, Takashi² ; INOUE, Suguru¹ ; MINH, Tu binh³ ; TUE, Nguyen minh¹ ;
HA, Nguyen ngoc⁴ ; TU, Nguyen phuc cam⁴ ; TRANG, Pham thi kim³ ; TAKAHASHI, Shin⁵ ; TUYEN, Bui cach⁶ ;
VIET, Pham hung³ ; IWATA, Hisato¹ ; TANABE, Shinsuke¹

¹Center for Marine Environmental Studies (CMES), Ehime University, Japan, ²Faculty of Science, Shinshu University, Japan,
³Hanoi University of Science, Vietnam National University, Vietnam, ⁴Faculty of Fisheries, Nong Lam University, Vietnam,
⁵Faculty of Agriculture, Ehime University, Japan, ⁶Research Institute for Biotechnology and Environment (RIBE), Nong Lam
University, Vietnam

In this study, we investigated contamination by arsenic and other trace elements in groundwater and in the Red River and the Mekong River Deltas, Vietnam. In addition, we evaluated human health risk from consumption of the contaminated groundwater. Concentrations of arsenic in groundwater were in the range of $<0.1 - 502 \mu\text{g/l}$, with about 39% of these water samples exceeding WHO drinking water guideline of $10 \mu\text{g/l}$. Interestingly, 31% and 5% of groundwater samples had higher concentrations of manganese ($400 \mu\text{g/l}$) and barium ($700 \mu\text{g/l}$) than WHO guidelines for drinking water, respectively. Concentrations of arsenic, manganese and barium in hair of local residents were positively correlated with those in groundwater. Estimation using hazard quotient showed that about 43 % of groundwater samples have potential human health risks associated with intakes of these elements. These results suggest that people in these regions are exposed to arsenic, manganese and barium through the consumption of groundwater and hence potential health risks of these elements are of great concern for these local people.