

Risk assessment and fractional distribution of thallium in paddy soil and its uptake by riceXuexia Huang¹, Jingyong Liu¹, Ning Li², Dinggui Luo¹, Xiaowu Huang¹ and Dongmei Li¹¹Guangzhou University, China²Environmental Monitoring Station, China

To investigate the mobility and availability of thallium (Tl) in the paddy soil and rice in a Tl contaminated area near the Yunfu pyrite mining site (Guangdong, China), the topsoil (0-20 cm) and rice samples were collected from 24 sampling sites and analyzed for the total Tl concentrations. Moreover, the modified European Community Bureau of Reference four-step sequential extraction procedure was applied to determine the concentrations of various Tl fractions in the paddy soil. The results showed that the pH of the paddy soil samples from 24 sampling sites ranged from 3.78 to 4.97 with a mean value of 4.50, which is lower than the mean of paddy soil pH (5.8) in Guangdong Province. The total Tl concentration in the paddy soil varied from 4.99 to 8.25 mg kg⁻¹, which is about 4 to 8 times higher than the Canadian Tl guideline value (1 mg kg⁻¹) for the agricultural land uses. The mean ecological risk index of Tl was 483, indicating that potential hazard of the paddy soil was serious. The Tl contents in rice ranged from 0.97 to 2.16 mg kg⁻¹ with a mean value of 1.42 mg kg⁻¹. The ranges of hazard quotient (HQ) values were 4.08~24.50 and 3.84~22.38 for males and females, respectively. Males have higher health risk than females in the same age group. In childhood age groups (2 to <21 years) and adult age groups (21 to <70 years), the highest health risk level was observed in the 11 to 16 age group and 21 to 50 age group, respectively. Based on the operationally defined extraction procedure, the distribution of various Tl fractions in the paddy soil was determined as follows (in the order of extractability): Easily reducible fraction (40.3%)>acid exchangeable fraction (30.5%)>residual fraction (23.8%)>oxidizable fraction (5.4%). Correlation analyses showed that the soil pH was negatively correlated with the Tl content in both the soil and rice and with the acid exchangeable fraction of Tl and the easily reducible fraction. Tl content in rice was more strongly correlated with the exchangeable fraction of Tl than the total Tl content in the soil. It is suggested that the bioavailability of Tl in more acidic soil is higher and the bioavailability of Tl in the paddy soil largely depends on its speciation, especially the content of acid exchangeable fraction.

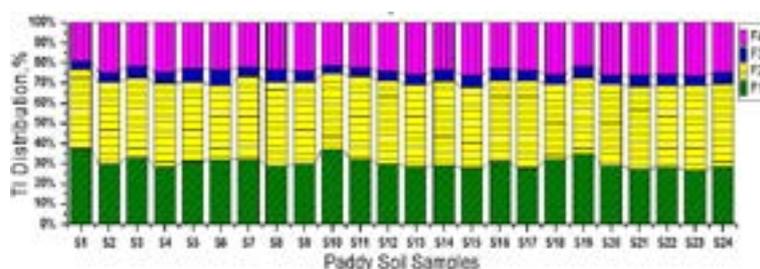


Figure.1: Various fractions of Tl in paddy soil samples from 24 sampling sites based on the modified BCR extraction procedure.
F1: Acid exchangeable fraction; F2: Easily reducible fraction; F3: Oxidizable fraction; and F4: Residual fraction.

Biography

Xuexia Huang is a teacher of School of Environmental Science and Engineering of Guangzhou University, China. She has completed her PhD from South-West Agriculture University. Her current research interests include remediation technology of contaminated soil, chemical processes and biological availabilities of contaminants in soil and food safety and risk assessment.

xuexia66@gzhu.edu.cn

Notes: