論文要旨

The contents and spatial distribution of mercury (Hg), including soil-Hg fractionation and Hg-containing native earthworm *Bimastos parvus* (*B. parvus*) species, were investigated in the leachate-contaminated zone of a large traditional landfill, Japan. Soil-Hg was fractionated into 5 categories: F1/water soluble Hg (Hg-w), F2/human stomach acid soluble Hg (Hg-h), F3/organic-chelated (Hg-o), F4/elemental Hg (Hg-e), and F5/mercuric sulfide (Hg-s). The total mercury (T-Hg) and methylmercury (MeHg) of native *B. parvus*, and the geochemical properties of soils were examined in this study. Soil T-Hg concentration ranged between 0.227 and 2.919 mg kg^{-1} dry weight (dw). The T-Hg and MeHg concentrations of *B. parvus* species ranged from 1.242 to 6.775 mg kg^{-1} dw and from 0.031 to 0.218 mg kg^{-1} dw, respectively. Percentages of soil-Hg fractions were in the order of F3/Hg-o > F4/ Hg-e > F5/ Hg-s > F1/Hg-w > F2 / Hg-h, and the fractions of Hg-o and Hg-e were 55.50% and 35.31%, respectively. Similar distributions and close correlations between the levels of *B. parvus* Hg and soil Hg-o, Hg-e, and Hg-s were observed in this study. The distribution of Hg in *B. parvus* was associated with soil organic matter (SOM) content and particle size (sand, clay); however, it was not correlated with Hg-w or Hg-h. The results indicated that easily bioavailable and soluble Hg fractions (Hg-w, Hg-h) of the soil were not appropriate to illustrate the distribution of Hg in native *B. parvus*. Instead, the stable soil-Hg fractions (Hg-o, Hg-e, and Hg-s) demonstrated good relationships of spatial distribution with *B. parvus* Hg in leachate-contaminated soil. It is advisable to preclude the evaluation of Hg biological distribution using soluble Hg fractions only. Stable Hg fractions in leachate-contaminated soil should also be included for assessing the biological distribution of Hg in leachate-contaminated soils.

Total mercury (THg) and methylmercury (MeHg) bioaccumulation was explored in the *Bimastus parvus* species of earthworm (*B. parvus*) native to the leachate-contaminated forest soils around a Hg-polluted traditional landfill in Japan. General soil properties and concentrations of THg and MeHg in forest soils and in *B. parvus* were determined. The results indicated that the average THg concentrations in *B. parvus* and in forest soils in the leachate-contaminated sites were 10.21 and 14.90 times higher than those in the reference sites, respectively, whereas similar average MeHg concentrations were observed in forest soils (< 0.01 mg kg^{-1}) and in *B. parvus* (0.100–0.114 mg kg^{-1}) across all sampled sites. The average bioaccumulation factors of THg in *B. parvus* (BAF_{THg}) in forest soil were similar between the leachate-contaminated sites and the reference sites. Cluster and regression analyses demonstrated that the *B. parvus* Hg (THg and MeHg) and soil THg were positively correlated with each other and with soil organic matter (SOM) and clays, but were negatively correlated with sand and hardly correlated with silts and pH in leachate-contaminated forest soils. From these results, it was proposed that Hg exposure to food chains is possible through *B. parvus*, because *B. parvus* showed a high ability to accumulate THg and MeHg in both leachate-contaminated and reference forest soils. Together, these findings indicated that the role of *B. parvus* in MeHg production is not clear, and it is possible that the MeHg in *B. parvus* was firstly formed within forest soils and then accumulated in their tissues.