Comparison of the distribution and phytoavailability of arsenic and antimony in contaminated soils

L. K. NGO [1*], W. W. BENNETT [2], P. R. TEASDALE [2], D. F. JOLLEY [1*]

[1] School of Chemistry, University of Wollongong, NSW 2522, Australia (*Coresspondence: kln881@uowmail.edu.au; djolley@uow.edu.au)

2 The Environmental Futures Research Institute, Griffith University Gold Coast Campus, Griffith University, QLD 4222, Australia

Introduction

The increasing input of As and Sb into the environment is posing a potential threat to human and environmental health. However, the biogeochemistry and plant bioaccumulation of Sb is poorly studied and generally assumed to be similar to that of As [1, 2]. This insufficient data may lead to mis-interpretation of Sb behaviour.

Methods

In this study, a series of test soils were prepared by mixing historically As and Sb-contaminated soil with an uncontaminated soil at different ratios. Another series of test soils were prepared by spiking with various concentrations of As and Sb. A sequential extraction procedure (SEP) was used to investigate the partitioning and availability of As and Sb in soils. The fractions of As and Sb measured by SEP were then compared with the bioaccumulation of As and Sb in water spinach (*Ipomoea aquatica*) grown in these soils.

Results

The results showed that in historically contaminated soils, As and Sb were strongly bound to solid phases in which As associated with amorphous and crystalline Fe oxides was the dominant phase, while Sb was primarily found in the residual. Conversely, in recently contaminated soils, As was predominantly found in amorphous iron oxides and specifically sorbed fractions, while Sb was dominant in amorphous and crystalline iron oxides, and no residual As and Sb were found in soils. The bioaccumulation of Sb in the water spinach tissues was much less than that of As, especially in aged soils. Both As and Sb were primarily distributed in the roots, and were more strongly correlated with the $(NH_4)_2SO_4$ and $NH_4H_2PO_4$ extractable As and Sb in the soils compared to other fractions. This study provides a better understanding about the behaviour of Sb in contaminated soils and plants compared with that of As.

[1] Filella *et al*. (2009) *Environ. Chem* **6**, 95-105.
[2] Tschan *et al*. (2009) *Environ. Chem* **6**, 106-115