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NUANNAT CHANMEKHA : A CONTINUOUS-FLOW SEQUENTIAL EXTRACTION
WITH ETAAS DETECTION FOR CHEMICAL SPECIATION OF ARSENIC IN SOIL AND
SEDIMENT. THESIS ADVISORS: JUWADEE SHIOWATANA, Ph. D., DUANGJAI
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The total arsenic (As) content in a heterogeneous solid material such as soil does not provide adequate information about their potential bioavailability or toxicity. Sequential extraction followed by determination of concentration in each fraction can help identify the proportion of the element in different phases of the material. As fractionation can be used for the prediction of the As bioavailability or toxicity. Sequential extraction using a batch procedure, which is currently widely used is tedious, time consuming and can be erroneous owing to a lengthy process involved.

This work developed a continuous flow sequential extraction system to fractionate arsenic in soil samples into 5 fractions of varying mobility. The extractants used were 1) water 2) 0.5 M NaHCO₃ 3) 0.1 M NaOH and 4) 1.0 M HCl. Electrothermal atomic absorption spectrometry was used to determine As in all extracts and residues. The As extracted in water and NaHCO₃ can be considered as mobile and highly bioavailable. Arsenic in NaOH fraction is likely to be associated with amorphous Fe and Al minerals in soils and As in the HCl fraction is associated with calcium carbonate. The final fraction is difficult to dissolve and is considered non-bioavailable.

The optimum ETAAS conditions for determination of As in each extract and residues were investigated. The reliability of the method was checked by analysis of the soil and sediment certified reference materials (CRM).

The proposed flow system was assessed by analysing three soil and sediment CRMs (SRM 2704, SRM 2710, and SRM 2711). The summation of concentration of all fractions was found to agree with the certified value. The results of fraction distribution obtained were compared with those of the batch method. The method was also used to analyse the soil samples from Ronphiboon, Thailand and cattle dip sites, Australia. Extractograms obtained were used to evaluate the association of As, Fe, Al and Ca in those samples.