

Speciation Analysis on Various Environmental Materials.

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1. Introduction

Developing analytical techniques for toxicity evaluation is important when the elements of interest have characteristic toxicities depending upon their chemical species. Toxic properties of heavy metal with chemical forms, such as As (As^{3+} , As^{5+}), Cr (Cr^{3+} , Cr^{6+}), Se (Se^{4+} , Se^{6+}), Sb (Sb^{3+} , Sb^{5+}), Hg (inorganic & organic species), Mn (free ion & complexed) and Al (reactive & organically bound), especially among these As^{3+} is more toxic rather than As^{5+} and Cr^{6+} grow toxicity than Cr^{3+} as increase as oxidation number. About Hg, inorganic mercury changes to high toxic form of methylmercury by biomethylation in nature and getting toxic.

However toxic heavy metals such as arsenic and mercury species can be transformed rapidly by slight changes in redox condition. The importance of detecting low concentration of those elements in terms of different chemical species is becoming nowadays environmental concern.

The analytical technique for true separation of different chemical species has been challenging in many environmental samples. Achieving correct analytical results and resolving the lowest detection limit of each species is also desirable. However arsenic species can be transformed rapidly by slight changes in redox condition during experimental manipulation.

It has been documented frequently by researchers such as USEPA to standardize the analytical technique for arsenic, and mercury from many environmental samples. Compare to the previously documented techniques, measurement of total concentration, analytical techniques often called hyphenated or hybrid for analyzing different chemical species are being suggested and is regarded as essential method to resolve toxicities of different species.

This study focus on the developing a analytical method to establish research system in environmental assessment and restoration. A analysis for speciation of toxic elements of interest must be preceded by the hybrid analytical technique which is now expert in KBSI within countries. Our capacity of research and analysis in this project can raise to international level as associate with research institute and university. Also we can provide professional knowledge of global level to environmental researcher.

Key Words: speciation analysis, arsenic, mercury, hyphenated system

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2. Methods

We are proceeding the research as follows ;

1. Correct collection of sample in contaminated area with geological and environmental information.
2. Preparation/separation of chemical species/analytical method of collected sample exactly.
3. Set up a speciation technique for inorganic heavy metal such as As, Cr, (Cr^{6+} , As^{3+} , As^{5+} , MMA, DMA etc), Hg and confirm a world-class technique of environmental assessment.
4. Standardized method of heavy metal speciation.
5. Reinforcement of analysis technique using on-line system such as SPE-HG-ICP-AES, SPE-HG-ICP-MS, HPLC-USN-ICP-MS and HPLC-GC-MS.

3. Results

Application areas for the research can be distinguished as follows;

- Developing and Standardizing "a Hybrid Analytical Techniques" for correct analysis and evaluation of toxicities of many environmental hazardous heavy metals with using the sophisticated analytical instruments such as ICP, ICP-MS, Hydride generation method, SPE, and HPLC could be used as a fundamental tool for resolving toxicity in environmental studies as well as restoration.
- Retaining of the high quality capability of toxicity evaluation upon "Chemical Speciation Analysis of Toxic Heavy Metals." from any environmental samples will made strong background for scientific and engineering part of environmental studies.

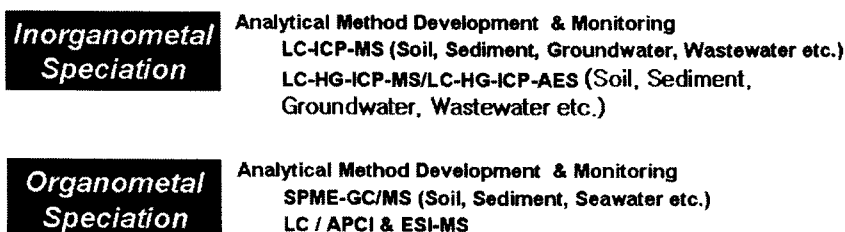
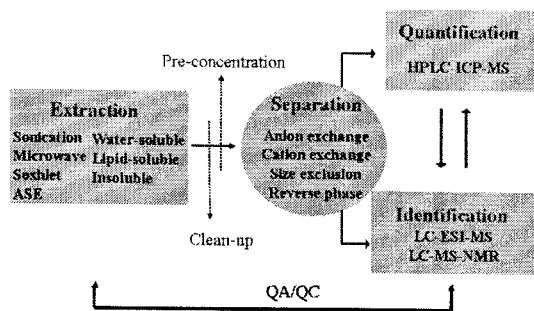


Fig. 1. Schematic diagram of inorganic and organic speciation analytical methods.



Elements & Samples

As : Seafood(Shellfish, fanfish), Seaweed, Soil, Water

Hg : Seafood(Shellfish, fanfish), Water, Soil

Pb : Seafood(Shellfish, fanfish), Soil

Se : Seafood(Shellfish, fanfish)

Fig. 2. Sample preparation techniques for As, Hg, Pb, and Se in various environmental analysis.

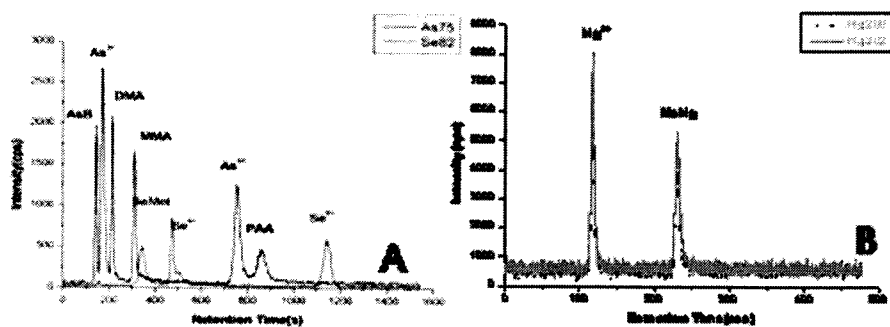


Fig. 3. (A) Speciation analysis results of As and Se using LC-ICP-MS system.

(B) Speciation analysis results of Hg using LC-ICP-MS system.