

計畫名稱：以ICP-MS建立環境中重金屬檢測技術 (II)

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計畫執行單位：清華大學原子科學技術發展中心

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成 果 摘 要

為因應國內對土壤及底泥樣品中微量金屬元素監測的需求，本計畫係延續行政院環保署環境檢驗所九十年度委託之研究計劃「以感應耦合電漿質譜儀 (ICP-MS) 建立環境中重金屬檢測技術計劃-排放管道中重金屬」，於本年度中接續探求利用ICP-MS進行底泥及土壤樣品中微量金屬元素分析方法的可行性及其限制，並進行分析方法的驗證工作，以確認其作為標準檢驗方法的可行性。

本計畫將依循環境檢測標準方法驗證程序準則，並參考NIEA S331.60B(土壤、沈積物、污泥及油脂中金屬元素總量之檢測方法—微波消化原子光譜法)及NIEA S321.61C(土壤中重金屬檢測方法—王水消化法)，進行上述環境樣品的消化處理，消化後的樣品溶液係依美國EPA Method 6020a標準檢測方法進行分析。為確認美國EPA Method 6020a在測定土壤或底泥消化液中微量元素的可行性，本研究乃分別針對ICP-MS各種可能發生之質譜性及非質譜性干擾進行探討，另外，為求得一可行之定量方法，本研究亦針對利用基質稀釋法及內標準法進行實際樣品消化液中微量元素的定量的可行性進行評估，結果發現基質稀釋法不論是在使用的方便性上，或是對非質譜性干擾的克服上，均可獲得不錯的效果。在確認利用ICP-MS配合基質稀釋法的可行性後測定，本研究中亦實際分析數種不同來源之土壤及底泥參考樣品，並依循標準方法驗證程序準則，完成美國EPA Method 6020a之精密度、準確度及偵測極限等方法效能參數的評估。

With the rapidly increasing industrial development in the second half of this century, elemental analysis has received more attention and the responsibility for securing high quality standards for quality of life in general. The main driving force in this development is the continuously increasing demand for quantitation with lower detection limits. With the increasing social awareness of the environmental pollution problems, risks and hazards connected with soil and sediment, inorganic analytical chemistry on the other hand began to play a major role in risk assessment and environmental control. In this field, elemental analysis is an indispensable requirement in many applications such as pollution studies for water, soil and air. Inductively coupled plasma mass spectrometry (ICP-MS) for elemental analysis has been dominated since its introduction by instruments with quadrupole-filters for mass separation. Although considerably impeded by isobaric ion interferences, ICP-MS with quadrupoles has nevertheless matured to become the most prominent MS technique for element analysis with widespread applications, providing extremely low detection limits in combination with true multi-element capabilities. In order to provide a feasible analytical method for the determination of trace elements in solid environmental samples, such as soil and sediment, an ICP-MS technique has been verified in this project. Both of spectral and non-spectral interferences were carefully investigated and the applicability of internal standardization method and matrix dilution method proposed illustrated by USEPA Method 6020a were also tested. According to the experimental results, matrix dilution was suggested for overcoming the matrix interference resulting from the complex matrices of soil and sediment samples. The performance of verified method has also been evaluated by analysis of several soil and sediment samples. Accordingly, ICP-MS method is considered as applicable method for the determination of trace elements in tested solid environmental samples.