

Exploration of digestion method for determination of heavy metal elements in soil by ICP-MS

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In order to improve the wet digestion of soil samples with high organic matter content, this paper by ICPMS compared to analyze Copper (Cu), Chromium (Cr), Lead (Pb), Cadmium (Cd), Nickel (Ni) and Zinc (zinc) in national soil component analysis standard materials (GSS-1a~GSS-8a) by five different digestion systems, and they were the H₂O₂-HF-HNO₃, HCl-HNO₃-HF, HNO₃.3HCl-3 HNO₃.HCl-HNO₃-HF, H₂O₂-HCl-HNO₃-HF and LOI-HNO₃-HF. ¹⁰³Rh was used as the internal standard element in the determination of ICP-MS, and the appropriate monitoring mode was selected for different determination elements. The results showed that the digestion effect of Cu, Cr, Pb, Cd, Ni and Zn was the best when setting the heating rate was 3°C.min⁻¹, calcining at 550°C for 3h, and then digestion with nitric acid and hydrofluoric acid after cooling. The results of standard addition recovery experiment shown that there was no significant difference between the measured value and the standard value of the standard substance. The recovery rate of standard addition was 91~105%, which shown that the accuracy and precision of this method met the requirements. In the hydrogen peroxide-hydrofluoric acid-nitric acid system and hydrogen peroxide-hydrochloric acid-nitric acid-hydrofluoric acid system, the decomposition of hydrogen peroxide was severe when heated, and the digestion solution was easy to splash, resulting in low test results. The test results of hydrochloric acid-nitric acid-hydrofluoric acid system and aqua regia-aqua regia-nitric acid-hydrofluoric acid digestion system were not stable, which might be due to the interference of Cl⁻ on the mass spectrum of the instrument, and in the open system, CrO₂Cl₁₂ was easy to volatilize during the sample decomposition process, resulting in low Cr content. At the same time, the above methods were also applied to the comparative analysis of soil samples with high organic matter collected from the peat land of Lake Dajiu. The result shown that the digestion method of loss on ignition-nitric acid-hydrofluoric acid digestion system was more thorough, with less acid addition and less interference, so this method was suitable for digestion of large quantities of samples with high organic matter content.