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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 44343-2024

**Soil quality - Determination of 22 elements - Acid digestion and
inductively coupled plasma mass spectrometry**

土壤质量 土壤中22种元素的测定 酸溶-电感耦合等离子体质谱法

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1. Structure and drafting rules for standardization documents" Drafting is required. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed by the Ministry of Agriculture and Rural Affairs of the People's Republic of China. This document is under the jurisdiction of the National Technical Committee on Soil Quality Standardization (SAC/TC 404). This document was drafted by: Nanjing Institute of Soil Science, Chinese Academy of Sciences, Chinese Academy of Environmental Sciences, Agricultural Quality Standards, Chinese Academy of Agricultural Sciences Institute of Standardization and Testing Technology, Heilongjiang Provincial Geological and Mineral Experimental Testing Research Center, Jiangsu Provincial Quality and Standardization Research Institute, Jiangsu Shenda Inspection Co., Ltd. The main drafters of this document are: Gong Hua, Han Yong, Zhang Yahui, Mao Xuefei, Zhang Xu, Zhao Min, Zhou Xiaolong, Wang Xiaowei, Guo Zhiying, Tu, Y., Li, Y., Zhang, X., and Li, X. Soil quality Determination of 22 elements in soil Acid dissolution Inductively

coupled plasma mass spectrometry

1 Scope

GB/T 44343-2024 specifies the determination of twenty-two elements in soil by acid digestion and inductively coupled plasma mass spectrometry. Soil contamination surveys are one of the larger environmental programmes running in China, and they turn on a small number of elements, cadmium, lead, arsenic, mercury, chromium, nickel, copper and zinc above all, measured against the risk control values in GB 15618 and GB 36600. A single multi-element method that covers those and fourteen others in one digestion is what makes a survey affordable. This standard supplies it: the principle, the interferences and their correction, the reagents and the preparation of the standard solutions, the apparatus and the recommended operating conditions, the drying, grinding and sieving of the sample, the acid digestion, which for soil is the step that decides whether the result is total or merely extractable, the calibration, the measurement, the calculation of results, the quality control, the precision and the limit of quantification for each element. For an environmental laboratory or a site assessor in China, this is the prescribed method.

This document describes the acid dissolution-inductively coupled plasma-mass spectrometry method for the determination of 22 elements in soil. This document applies to lithium (Li), beryllium (Be), scandium (Sc), vanadium (V), chromium (Cr), manganese (Mn), Cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), arsenic (As), strontium (Sr), molybdenum (Mo), cadmium (Cd), antimony (Sb), Determination of the total amount of each element barium (Ba), tungsten (W), thallium (Tl), lead (Pb), bismuth (Bi), thorium (Th) and uranium (U).

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies. in this document.

GB/T 33087 Specifications and test methods for high purity water for instrumental analysis

GB/T 36197 Soil quality - Guide to soil sampling techniques

3 Terms and definitions

There are no terms or definitions that require definition in this document.

4 Principles of the method

The soil sample is decomposed using hydrofluoric acid, nitric acid, perchloric acid, and hydrochloric acid system to transfer the target elements to the solution to be tested. The detection is carried out by plasma mass spectrometry, and the qualitative analysis is based on the mass spectrum of the element or the characteristic ion, and the quantitative analysis is based on the internal standard method.

5 Reagents and Materials

5.1 Unless otherwise specified, the water used in the experiment shall comply with the relevant requirements of GB/T 33087 High Purity Water.

5.2 Nitric acid. $\rho(\text{HNO}_3)=$

1.42 g/mL, extra pure.

5.3 Hydrochloric acid. $\rho(\text{HCl}) =$

1.19 g/mL, extra-pure.

5.4 Hydrofluoric acid. $\rho(\text{HF})=$

1.15 g/mL, extra-pure.

5.5 Perchloric acid. $\rho(\text{HClO}_4)=$

1.68 g/mL, extra pure.

5.6 Hydrochloric acid solution. Take 20 mL of hydrochloric acid (5.3), slowly add it into 100 mL of water and mix well.

5.7 Nitric acid solution. Take 20 mL of nitric acid (5.2), slowly add it into 980 mL of water and mix well.

5.8 Standard solutions. lithium (Li), beryllium (Be), scandium (Sc), vanadium (V), chromium (Cr), manganese (Mn), cobalt (Co), nickel (Ni), Copper (Cu), zinc (Zn), arsenic (As), strontium (Sr), molybdenum (Mo), cadmium (Cd), antimony (Sb), barium (Ba), tungsten (W), Thallium (Tl), lead (Pb), bismuth (Bi), thorium (Th) and uranium (U) use single element or multi-element standard substances/standard samples.

5.9 Internal standard element stock solution ($\rho=100 \text{ mg/L}$). rhodium (Rh), rhenium (Re), using single element or multi-element internal standard standard substance/standard sample.

5.10 Mass spectrometer tuning solution ($\rho=10 \text{ } \mu\text{g/L}$). It is advisable to use a solution containing elements such as Li, Y, Ce, In, Tl, and Bi as the mass spectrometer tuning solution.