

Inorganic Comparison of Inorganic Element Detection Technology in Soil

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Abstract

Soil pollutants include inorganic substances (heavy metals, acid, salt, etc.), organic matter, chemical fertilizers, pesticides (pesticides, sterilizers and herbicides), radioactive substances, parasites, pathogenic bacteria, and viruses. New pollutants (such as veterinary drugs, antibiotics, bromide flame retardants, all -fluoride compounds, etc.) have also become research hotspots in the soil.

Keywords

Soil Pollutants; Soil Monitoring; Soil Testing.

1. Introduction

At present, most soil monitoring methods are targeted at inorganic and organic matter in the soil. It can be divided into two types according to the measurement method: after sampling, laboratory measurement (also known as heterogeneous measurement) and on-site determination (also known as in-situ measurement).

In the laboratory measurement method, for the inorganic objects in the soil, there are optical analysis methods (such as atomic absorption spectral method, atomic launch spectrum method, atomic fluorescence spectrum method, X-ray fluorescent spectrum method, etc.) Body-mass spectrometry (ICP-MS), as well as electrochemical method (such as polar spectrum analysis method) and chemical analysis methods based on specific chemical reactions.

Among them, the optical analysis method has a wide range of applications, high sensitivity, convenient operation, and wide application; instrumental use method can realize qualitative and quantitative analysis, detect high sensitivity and good reproducibility, but the instrument is more expensive; The linear range of the measurement group is wide and can achieve continuous determination, but it is easy to cause mercury pollution; the chemical analysis method is simple, but the processing of the sample is complicated, the sensitivity and selectivity are low, and the current use is less.

For the organic matter in the soil, the analysis methods mainly include chromatographic analysis method [such as gas phase chromatography (GC), high-efficiency liquid chromatography (HPLC)], and chromatography-mass spectrometer combined And high-efficiency liquid chromatography-mass spectrometry method (HPLCMS)].

In the on-site measurement method, for inorganic pollutants and organic pollutants, the measurement methods include portable X-ray fluorescent spectrum methods and portable gas chromatography-mass spectrometry method.

For the national soil detailed check tasks, there are 17 kinds of inorganic metal projects involved in the country. They are lead, arsenic, cadmium, mercury, copper, zinc, nickel, chromium, cobalt, crickets, tadpoles, molybdenum, manganese, and crickets. And tin.

2. ICP-MS Method

At present, there is no ICP-MS method for soil testing standards in the domestic environment. In the "Technical Regulations of the Test Method of soil pollution status in the country" (hereinafter referred to as the "Technical Regulations"), according to the "measurement inductor of solid waste metal elements" Coupling Plasma Statistics (HJ 766-2015) prepares the ICP-MS measurement method of the soil.

In addition, in the release of the "Conducting Microlysis Method of the total metal elements of soil and sedimentary metal elements" (HJ 832-2017) standards, it is The 11 elements used the ICP-MS method to perform the precision and accuracy test of the method.

3. ICP-OES Method

For the current domestic environmental field of ICP-OES soil testing standards, in November last year, the Ministry of Ecology and Environment released the "Ratial Alkali-Meltry-inductor coupled plasma launch spectrum method of 11 elements of soil and sediment" (HJ974-2018) The ICP-OES detection standard is used to detect 11 elements in soil and sediments, including manganese, crickets, crickets, titanium, calcium, magnesium, iron, aluminum, potassium, and silicon.

In addition, the detection standards of the acid-soluble -ICP-OES have also been solicited by the comments draft. The standard is called "Measurement of acid-soluble/inductive plasma launch spectrum of 22 types of inorganic elements of soil and sediments". The elements include aluminum, cricket, calcium, cobalt, chromium, copper, iron, potassium, lithium, magnesium, manganese, molybdenum, nickel, phosphorus, lead, titanium, titanium, zinc, and zinc. 22 elements have 22 elements. Essence.

In the "Technical Regulations", the ICP-OES measurement method of the soil is compiled based on the "22 metal elements of solid waste" (HJ 781-2016).

In addition, in the release of the "Conducting Microlysis Methods of the Total Metal Elements of Soil and Segue" (HJ 832-2017) standards, 9 species of nine types of cobalt, cobalt, chromium, copper, manganese, nickel, lead, zinc, zinc The element used the ICP-OES method to test the precision and accuracy of the method.

4. About ICP-MS and ICP-OES Method Comparison

Both methods are high -throughput element analysis methods. One in -law can detect most elements at a time, which is not comparable to other metal element analysis instruments. The sample patterns of these two instruments are consistent. Both are lifted through the peristaltic pump, and then introduced into a high -temperature plasma to decompose into an atomic state after atomization.

MS and OES correspond to the two different detection principles: MS is the mass spectrometer detector, which detects elemental elements through the lotus ratio of the atom; while OES is collected Test.

From the perspective of the analysis of soil metal elements, due to the lower detection limit, MS can be used to analyze some low-content heavy metal elements, such as cadmium, because cadmium is a very concerned element in soil heavy metals. Methods to detect soil must also be

configured with graphite furnaces for cadmium. This is the biggest disadvantage of ICP-OES compared to ICP-MS.

ICP-MS and ICP-OES foreign analysis methods and soil pre-processing methods.

The following table lists the method of analysis of the two instruments of ICP and the method of soil heavy metals and pre-processing methods for soil for reference.

5. Atomic Absorption

There are two main methods of atomic absorption, namely graphite atom absorption method and flame atom absorption method. Among them, lead and cadmium use the graphite furnace atom absorption method. Copper, zinc, nickel, and chromium are used. The main difference is that the detection limit and linear range are different. The main reason for lead and cadmium to use the graphite furnace method is that the detection limit of the flame method cannot meet the detection requirements of soil samples well.

Atomic absorption method is a very classic element analysis method. The cost of instrument is much lower than the ICP mass spectrum and ICP spectrum. In many laboratories, it is still the main instrument of element analysis, and the two atomic absorption techniques of graphite furnace and flames are very good. Sexual, the detection limit of the graphite furnace is better than ICP-OES.

However, the limitations of atom absorption are also very obvious, and it is impossible to measure the same elements at the same time, so that it seems unsteady when facing the samples that are determined by a large number of diverse categories. For the unique continuous light source technology of some instruments, the detection speed is slow, similar to scanned ICP-OES, so it can only be used in the multi-element detection of the flame method, and cannot be applied to a graphite furnace.

6. Atomic Fluorescence

In addition to arsenic, mercury, and the elements of atomic fluorescence methods in the environment also include selenium. For details, please refer to "Microlytic Microlysis/Atomic fluorescence method of mercury, arsenic, selenium, in the soil and sediments (HJ 680-2013). For the detection of arsenic and mercury, the "Technical Regulations" use the classic national standard analysis method Wang Shui to eliminate-atomic fluorescence method.

The atomic fluorescent spectrum mainly measures the content of the element to be measured by measuring atomic vapor that is waiting for elements to be measured by radiation energy. Among them, mercury is detected by forming cold atomic steam. Hydrogenation is tested. At present, atomic fluorescence spectrometers around the world are mainly independently developed and produced by our country. Related instruments, equipment and analysis methods are internationally leading.

7. Conclusion

In situ monitoring can achieve fast, non-destruction, and large-scale monitoring of soil pollutants. The experimental cycle is short. At present, research hotspots include portable X-fluorescent spectrum, high spectrum remote sensing detection, biological lighting technology (for inorganic objects), portable GC-MS (For organic matter), etc., but mostly technology is in the test stage of qualitative or semi-quantitative quantification. The research ideas can be used for reference, and large-scale promotion and application still need to be verified. When monitoring the area soil, you can first monitor the preliminary investigation with a place in place, and then select the abnormal points or surfaces in a targeted manner, and use the standard method to monitor in-depth monitoring. The overall trend of in-situ monitoring is to

develop the medium view and macro monitoring technology development of more micro - exploration technology and time -saving time costs. Not only can remote sensing technology on -site positioning and observation of soil heavy metals can be used. The changes in soil quality; the remote sensing image, optical detection and correction (LIDAR) detection and calculation of the remote sensing image, optical detection and correction (LIDAR) are obtained by near -infrared and hot infrared.

China's soil monitoring standards include two categories: national standards and industry standards. Among them, national standards and environmental industry standards focus on the testing of soil pollutants, and the standards of the agricultural and forestry industry focus on the testing of soil nutrition elements and their effective states and physical and chemical indicators. Among the current standard methods, the number of pollutants is insufficient. The long -term unspeaks of some standard methods have caused the new technologies and methods to be unable to be determined. There are few basic research on soil environmental monitoring. Insufficient sexual technical support, there are still many tasks to be carried out in terms of standardization and systematic method. It is recommended to strengthen the top -level design of soil monitoring standard methods, and reasonably increase the type of control of soil pollutants; update the standard methods in a timely manner, and develop high -efficiency methods measured by multiple groups at the same time. The exploration of the position monitoring method makes it as accurate and standardized as possible.

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