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Application of Atomic Absorption Spectrometry in Soil Environmental Monitoring

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ABSTRACT: *This paper analyzes the advantages and main types of atomic absorption spectrometry technology, and expounds the application contents and methods of this technology in soil environmental monitoring, mainly in sample pretreatment, heavy metal pollution assessment, metal element speciation analysis and so on.Through the research in this paper, the function and advantages of this technology will be brought into full play, the soil environmental quality will be effectively improved, and more efforts will be made for environmental protection.*

KEY WORDS: *Atomic absorption spectrometry; Soil environmental monitoring; Application measures*

Introduction

At present, economic construction has caused great damage to the soil environment, so it is urgent to introduce advanced technology to monitor the soil environment and alleviate the current pollution situation. Atomic absorption spectrometry (AAS) is a way to measure the content of an element on the basis of sample steam. In application, the ground state atoms of the measured element in steam phase resonate and absorb the characteristic narrow-frequency radiation, thus monitoring the specific content of this element, which can provide reliable reference for soil treatment and has great practical significance for restoring soil environment.

1 Atomic absorption spectrometry technology

This technology is widely used in soil environmental monitoring, which is mainly based on one of the means that the light to be measured emitted by the light source is absorbed by the ground atoms in the steam when passing through the steam, and the content of the elements to be measured is determined according to the weakening degree of the radiation characteristic spectral line.According to practical research, the intensity of resonance line radiated by sharp line light source is directly proportional to the radiation atom of the element to be measured. Under specific

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conditions, the absorption degree and concentration meet the requirements of Beer's Law, so the concentration of the element to be measured can be analyzed based on absorbance.This technology can be applied to the monitoring of heavy metals in soil and water, with relatively small interference, large concentration range, convenient operation, flexible and accurate monitoring, and can be one of the most widely used technologies at present, thus providing strong data support for the analysis of soil trace elements and heavy metal monitoring.In the aspect of soil environmental monitoring, its advantages are mainly reflected in strong selectivity, strong anti-interference, and the ability to monitor the main factors and low factors.At the same time, it is also suitable for monitoring non-metallic elements and organic matter;The most important thing is that the sensitivity of this technology is high, and the PPb concentration range can be accurately measured in the inspection, so that its advantages and functions can be brought into full play. This technology mainly includes the following types [1].

1.1 Flame method

At present, this technology has a wide application range, mature research, less external interference, convenient operation and control, and low equipment price.At present, the air-acetylene flame is widely used in the laboratory, but because of its relatively low temperature, it is easy to form refractory oxide elements and difficult to atomize them.Therefore, the birth of premixed oxygen-acetylene flame can raise the temperature to about 3000℃, which can not only effectively solve the problem that some elements are difficult to atomize, but also significantly improve the atomization efficiency and effectively overcome the problem of chemical interference.

1.2 Graphite furnace method

The method adopts graphite material to make an atomizer, which promotes the atomization and decomposition of elements under the condition of current heating, and has the characteristics of simple structure, convenient operation and the like.However, there are some problems in atomization, such as uneven temperature distribution, great background influence and poor signal reproducibility.With the continuous development of science and technology, the transverse heating graphite furnace was born, which effectively relieved the temperature gradient phenomenon of the longitudinal heating graphite tube, effectively improved the atomization efficiency, and improved the sensitivity by 3-4 levels. It became a milestone invention in the development of this technology, and the measurement results were more accurate and reliable.

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1.3 Hydride generation method

The method is a sensitive monitoring method, which is suitable for the measurement of hydride forming elements, such as Bi, Pb, Sn, As, etc., and the sensitivity of these elements is relatively low when determined by flame method. If sodium borohydride is used in acidic medium, the concentration will be easily affected.Therefore, the content of arsenic and mercury in soil can be monitored by flow injection of hydride.According to the test results, the detection limit of arsenic is 2ng/L, and the accuracy is between 93.6% and 106.1%.The detection limit of mercury is 2ng/L, and the accuracy is between 93.2% and 109.6%.This method is simpler and faster, and its precision and accuracy can meet the testing requirements of environmental samples.

2 Specific application of atomic absorption spectrometry in soil environmental monitoring

Soil, as an important material on the surface of the earth, is also the material basis for human survival.In recent years, with the rapid development of industry and agriculture, a large number of pollutants enter the soil by means of surface runoff and atmospheric sedimentation, resulting in environmental pollution.Therefore, atomic absorption spectrometry can be used for monitoring, which is mainly reflected in sample pretreatment, heavy metal pollution assessment, metal element speciation analysis, etc., so as to expand the monitoring scope of soil environment and provide scientific reference for environmental governance with accurate monitoring results.

2.1 Pretreatment of Soil Samples

Firstly, the total elements in soil were analyzed.Usually, it is treated by digestion or melting in advance, so that the mineral lattice in the soil is destroyed and the components to be measured are moved into the solution.Among the total elements, there are usually two systems, namely alkali dissolution or acid dissolution. The former can be treated by potassium carbonate method, while the latter can be treated by perchloric acid method.In the experimental stage, acid dissolution is usually used, and HF-HNO3-HCIO4 is used to digest the sample. at this time, the internal lattice is destroyed, and SiF4 is formed and volatilized, thus eliminating some elements in the soil.After the soil is completely boiled, the sample is dissolved by 1:1 HNO3 solution, and the content of elements in the sample is determined by flame method.In addition, the soil extract and available elements should be analyzed. There are many elements in the extract that can be measured, such as calcium, magnesium, potassium, sodium, etc., which can be sprayed directly in the flame, and then the element content in the liquid can be measured.Available copper, iron, zinc and other elements in soil can be extracted by one-off multi-element extractant, then extracted by DTPA-CaCl2-TEA extractant, and finally determined in air-acetylene flame [2].

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2.2 Assessment of heavy metal pollution in soil

The role of soil environmental monitoring is to find out the pollution of soil, formulate corresponding control schemes according to pollution elements and promote the implementation of environmental protection work.Therefore, atomic spectrometry can be used to explore the types, contents and forms of pollution elements in soil.Through objective and comprehensive data, the degree and present situation of soil pollution were analyzed, and the distribution, proportion and residue content of various pollution elements were determined, which provided more convenience for the control of key objects in pollution scheme.However, soil pollution can not be avoided simply by treatment, but also needs external cooperation, such as optimizing production methods and adjusting economic structure, so that the problem of soil pollution can be effectively avoided.Therefore, the pollution types, contents, distribution and causes can also be analyzed by measuring structure analysis.For example, due to improper discharge of waste gas and industrial waste residue, the content of heavy metals in soil in a certain place increased and settled continuously, which caused great pollution to the soil environment.By using atomic spectrum technology to evaluate the pollution situation and make clear the proportion of various pollution elements, it can provide scientific basis for the formulation of control measures of local environmental protection departments and the optimization of industrial production structure.

2.3 Speciation analysis of heavy metal elements

Elemental forms mainly refer to the existing forms of elements. Taking heavy metals as an example, they can exist in various forms such as carbonate, exchange state, sulfide and residue in soil environment, and the stability of different forms is different.It can be seen that compared with the total amount of elements, elemental speciation analysis is more complex, which requires higher separation and sensitivity of analytical methods, and has become one of the characteristics of AAS development.In order to explore the harmfulness of heavy metals in soil system, 216 soil samples along Ordos Highway were taken as examples, and various chemical forms of different heavy metals, including Zn, Pb, Cu and Ni, were monitored in the samples.According to the research results, the available state of heavy metals in soil is relatively large, taking organic state and Fe-Mn oxidation combined state as examples.Among the monitored heavy metals, the available content of Zn is relatively high, while the residual content is relatively low, especially paying attention to the potential impact on the local ecosystem.In order to explore the distribution of heavy metals in the soil of Huixi River bank, the speciation of heavy metals in 12 soil samples was analyzed.According to the investigation results, it can be seen that the soil of the river bank is polluted to a high degree, and the monitored Cu, As, Zn and Cd all belong to the heavy pollution level, especially the pollution of As is the most serious, which is distributed in the form of residue;The pollution degree of Cu is second, and it is distributed in the form of organic combination;Fe-Mn is less polluted and distributed in the form of oxide binding

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state.According to the monitoring results, As and Cu belong to the priority targets of heavy metal pollution control in this area.

2.4 External interference treatment

It is inevitable to be interfered by many elements in the process of soil measurement.In order to improve the measurement accuracy, effective measures should be taken to remove the interference elements in monitoring.Taking spectral interference as an example, this kind of interference is common. When the absorption lines of coexisting elements in samples are close to the elements to be measured, it will cause spectral interference.Therefore, other wavelength analysis lines should be selected as far as possible for research.In addition, the frequency of ionization interference is relatively high. For example, the ionization energy of alkali metals and alkaline earth metals is relatively low, which makes them easy to be ionized. After ionization, the particles cannot absorb radiation with specific wavelength, which has a negative impact on the test results.Therefore, the flame method should be used for measurement, which can reduce the degree of metal ionization because of its relatively low temperature. At the same time, some ionization buffers are added to improve this phenomenon, which can provide more data support for soil environmental governance [3].

Conclusion: To sum up, with the development of economy and science and technology, the degree of soil pollution is increasing, so it is urgent to introduce atomic absorption spectrometry to monitor the types, forms and contents of soil pollutants.At the same time, according to the actual situation, the corresponding atomic spectrometry is selected, which can be used efficiently in sample pretreatment, heavy metal pollution assessment, metal element speciation analysis, etc., to overcome the interference of internal and external factors on the spectrum, effectively alleviate the soil pollution phenomenon, and provide more available land resources for people's production and life.

References

[1]Ning Qiuping, Yan Huang. Analysis on the application of atomic absorption spectrometry in soil environmental monitoring [J]. Shandong Industrial Technology (No.15): 96-96.

[2]Xun Shuting, Zhang Lili. Application of atomic absorption spectrometry in soil environmental monitoring [J]. Anhui Agricultural Sciences, 42(36):13174-13176.

[3]Yang Rong. Application of Atomic Absorption Spectrometry in Soil Environmental Monitoring [J]. Comprehensive Utilization of Resources in China, 2018,v.36；;No.375(02):141-142+145.