EASE OF USE OF AAS AND ICP HARDWARE

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ABSTRACT

- Atomic Absorption Spectroscopy (AAS): technique for determining metal elements in a sample by measuring absorption of light at characteristic wavelengths.

- Inductively Coupled Plasma (ICP) hardware: advanced technique for elemental analysis using a high-temperature plasma source.

- AAS simplicity and ease of operation: user-friendly design, minimal training and expertise required.

- AAS versatility: can analyze liquid, solid, and gaseous samples, useful in various fields.

- ICP hardware complexity: advanced automation and intuitive software interfaces have improved user-friendliness.

- ICP hardware sensitivity and multi-element capabilities: can detect and quantify multiple elements simultaneously, suitable for demanding applications.

- Advancements in technology have improved accuracy and efficiency of elemental analysis.

- AAS and ICP hardware have revolutionized the field of elemental analysis.

- Increased accessibility to elemental analysis has advanced scientific knowledge and product/process development.

Keywords: Chemical composition, Elemental analysis, Atomic Absorption Spectroscopy, Inductively Coupled Plasma, Accuracy, Metal elements, Concentration, Light absorption, Spectroscopy, Sample types, Environmental monitoring, Pharmaceutical analysis, Food safety, Metallurgy, Inductively coupled plasma source, Plasma, Argon gas,Radiofrequency coil, Industries, Product development, Process development.

Analyzing the chemical composition of materials has always been a crucial aspect of scientific research and several industries. Over the years, advancements in

technology have significantly improved the accuracy and efficiency of such analysis. Two widely used techniques for elemental analysis are Atomic Absorption Spectroscopy (AAS) and Inductively Coupled Plasma (ICP) hardware. These methods offer incredible ease of use and have revolutionized the field of elemental analysis.

AAS is a well-established technique that allows researchers to determine the concentration of specific metal elements within a sample. It works by measuring the absorption of light at characteristic wavelengths when it passes through a sample containing the metal of interest. AAS instrumentation typically consists of a light source, a sample chamber, a monochromator to isolate specific wavelengths, and a detector to measure the intensity of the absorbed light.

One of the major advantages of AAS hardware is its simplicity and ease of operation. The design and functionality of the instrument make it user-friendly, even for beginners. Setting up and operating an AAS system usually involves minimal training and expertise, allowing researchers to quickly get accurate results without significant effort.

AAS hardware also offers versatility in terms of sample types that can be analyzed. Whether it's liquid, solid, or even gaseous samples, AAS can handle a wide range of materials. This flexibility makes it invaluable in various fields, such as environmental monitoring, pharmaceutical analysis, food safety, and metallurgy.

On the other hand, ICP hardware is a more advanced and versatile technique for elemental analysis. It employs an inductively coupled plasma source, which is a high-temperature plasma generated by passing argon gas through a radiofrequency coil. The sample is then injected into the plasma, and the high temperature breaks down the sample into its constituent elements. The resulting ionized atoms emit characteristic wavelengths of light, which are detected and measured by the instrument.

Despite its complexity, ICP hardware has become more user-friendly in recent years, thanks to advanced automation and intuitive software interfaces. The instruments are equipped with comprehensive pre-set methods, databases, and calibration curves, allowing users to perform analysis with minimal manual intervention. Additionally, the software provides real-time monitoring and analysis, making it easier to obtain accurate and precise results effortlessly.

Moreover, the ICP technique offers unmatched sensitivity and multi-element capabilities, surpassing the capabilities of AAS. It can simultaneously detect and quantify numerous elements in a sample, making it ideal for applications such as environmental analysis, geological studies, and pharmaceutical research.

In conclusion, both AAS and ICP hardware have greatly simplified elemental analysis, making it accessible to a wide range of users. AAS is renowned for its user-friendly design and ease of use, suitable for basic elemental analysis needs, while ICP

hardware's advanced automation and multi-element capabilities excel in demanding applications. Researchers and scientists can now perform elemental analysis with enhanced accuracy, efficiency, and convenience, ultimately advancing scientific knowledge and the development of innovative products and processes.

Atomic Absorption Spectrophotometer AA-7000 Series Shimadzu

Environmental factors: in the assessment of air quality indicators of atmospheric air, air of working environment and indoor air of residential buildings;

Liquid quality analysis: drinking water, surface and waste water, waste water from enterprises, technical water analysis and evaluation of quality indicators;

Biological fluids: in assessing the amount of metals in the blood and urine of workers working in harmful and dangerous working environments;

In determining the level of soil contamination with metals and assessing its quality;

Other additional cases: it creates an opportunity to evaluate various quality and quantity indicators in other types of industry, such as food products, drug production enterprises.

Sequence of operation of atomic absorption spectrophotometer in flame and furnace methods

Atomic absorption spectrophotometer flame method operation sequence

1. The main button is turned on from the machine
2. [UPS-Battery bank] turns on
3. [AA-7000] turns on
4. Turn on the computer
5. Gas pressures are important (pressure for Ar-: 0.32-0.35 MPa, gas pressure for C2H2- 0.9-0.11 MPa)
6. Enter the [WizAArd] program on the computer screen (for this, double-click the mouse icon on the program)
7. After opening the [WizAArd] window, enter the [Operation] menu and click the [Cancel] button

8. From the [WizAArd] window (Instrument-Connect) the same things are done. (In the fire method [Safety checks] and [gas monitor check] are important). At this stage, the equipment will automatically program itself.

9. When the programming process is complete, click the [OK] button

10. In the resulting window, all conditions are specified and the [OK] button is clicked

11. From the title bar, enter [Parameters], select [Element Selection Wizard], and select the element and lamp type to be tested.

12. Enter [Edit Parameters], select [Lamp mode], press [Lamp on], and after a few minutes, press the [Line search] button, wait until [Line search and Beam balance-OK] and close the window with the [Close] button

13. From the resulting window, enter [Sequence] and select [Continuous].

14. Enter [Repeat Measurement Conditions] and select the required parameters

15. Enter [Calibration Curve Parameters] and select [1 st order] and the unit of measurement (often calculated in "ppm" in the flame method)

16. Focus on the lower right part of the resulting window [GLC]. If [GLC] is "OK", the work will continue

17. In the resulting table [Action], the necessary parameters are entered (1-Autozero, 2-blank, then standards and unknown samples) and in [True concentration values], the concentration of standard solutions known to us is entered

18. Measurements are performed in the sequence of indicators entered in [Action].

19. We can save all measurement results

20. After the analysis process is finished, we can exit the program by going to [File] and pressing the [Exit] button

21. Turn off the computer and, of course, turn off the gas and gas pipes

22. AA-7000 is deleted

23. [UPS-Battery bank] will be removed

24. The machine is turned off and the work process is completed.

Atomic absorption spectrophotometer furnace method operation sequence

1. The main button is turned on from the machine

2. [UPS-Battery bank] turns on

3. The air compressor turns on

4. The cooler is turned on

5. Gas pressures are important (pressure for Ar-: 0.32-0.35 MPa, gas pressure for C2H2- 0.9-0.11 MPa)

6. Turn on the computer

7. The AA-7000, GFA-7000 and ASC-7000 parts of the AAS are turned on

8. Enter the [WizAArd] program on the computer screen (for this, double-click the mouse icon on the program)

9. After opening the [WizAArd] window, enter the [Operation] menu and click the [Cancel] button

10. From the [WizAArd] window (Instrument-Connect) the same things are done. (In the furnace method [Safety checks] and [gas monitor check] are not important). At this stage, the equipment will automatically program itself.

11. After the programming process is completed, enter the [File] heading from the [WizAArd] window and click [New]

12. Enter [Select Element] and select the element to be checked and select [Furnace], [ASC] and [Lamp type] from this window.

13. Enter [Edit Parameter]. From this window, [Lamp mode] is selected and [Lamp on] is pressed, and after a few minutes the [Line search] button is pressed.

14. From the resulting window, enter [Sequence] and select [Continuous].

15. Enter [Repeat Measurement Conditions] and select the required parameters

16. Enter [Calibration Curve Parameters] and select [1 st order] and the unit of measurement (often calculated in "ppb" by the oven method)

17. Enter [Furnace] and select [High density graphite tube], click [OK] and close the window by [Finish]

18. Enter the necessary parameters into the resulting table (1-Autozero, 2-blank, then standards and unknown samples) and enter the concentration of standard solutions known to us in [True concentration values]

19. We place samples in the autosampler (ASC) and bring its position to the correct working position

20. Using the [Rinse] button, we can rinse the [Sampler tube] 2-3 times and carry out measurements

21. We can save all measurement results

22. After the analysis process is finished, we can exit the program by going to [File] and pressing the [Exit] button

23. Turn off the computer and, of course, turn off the gas and gas pipes

24. AA-7000, GFA-7000, ASC-7000, Cooler [cooler], UPS and the machine will be turned off and the work process will be terminated.

Source: Shimadzu Atomic Absorption Spectrophotometer, AA-7000 Series, Instruction Manual

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