EXPEC 7350 series
Triple quadrupole ICP-MS

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EXPEC TECHNOLOGY

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EXPEC TECHNOLOGY 谱育科技
—— 聚光科技成员企业

Brilliant at present after twenty years of deep cultivation

无机质谱新起点

Break through the tradition Push to the peak Trace analysis

Hangzhou Expec Technology Co., Ltd. is the leader of ICP-MS technology in China. Since 2011, it has developed and released a variety of ICP-MS with excellent performance, including the world's first mobile ICP-MS and the first inductively coupled plasma tandem mass spectrometer (ICP-MS/MS) in China.

EXPEC 7350 ICP-MS/MS subverts the tradition and adopts a new advanced process design and breakthrough technology to push the domestic ICP-MS technology platform to the peak. The unique MS/MS mode greatly improves the ability to eliminate interference and easily resolve the difficult problems in the analysis process, which is the ultimate solution for trace element analysis.

EXPEC 7350's unmatched analytical capabilities have successfully broken through the interference problems that traditional ICP-MS cannot overcome. From environment, food, life sciences to semiconductors, EXPEC 7350 is able to deliver incredibly reliable analysis results on even the most difficult and complex samples, enabling analysts to enter many of the more challenging "bottlenecks".

Fifteen years of accumulation and five years of growth
- Concentration and innovation are our constant insistence

2011

A national key scientific instrument and equipment development project, with development and application demonstration of full-component trace heavy metal analysis instrument based on mass spectrometry technology 2011YQ060100

2013

Mars 9000

2015

SUPEC 7000

2016

Development and industrialization of self-excited all-solid-state ICP radio frequency source 2016YFF0100200

2018

EXPEC 7200

EXPEC
"7" 000 series
"3" quadrupole
"5"-channel collision reaction gas
"0" base to get started

2020

EXPEC 7350

Mars 9000	SUPEC 7000	EXPEC 7200	EXPEC 7350
First generation Collision-free cell	Second generation With collision cell	Third generation With collision reaction cell	Fourth generation Triple quadrupole

Technological innovation, configuration in place

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Highly sensitive electron multiplier

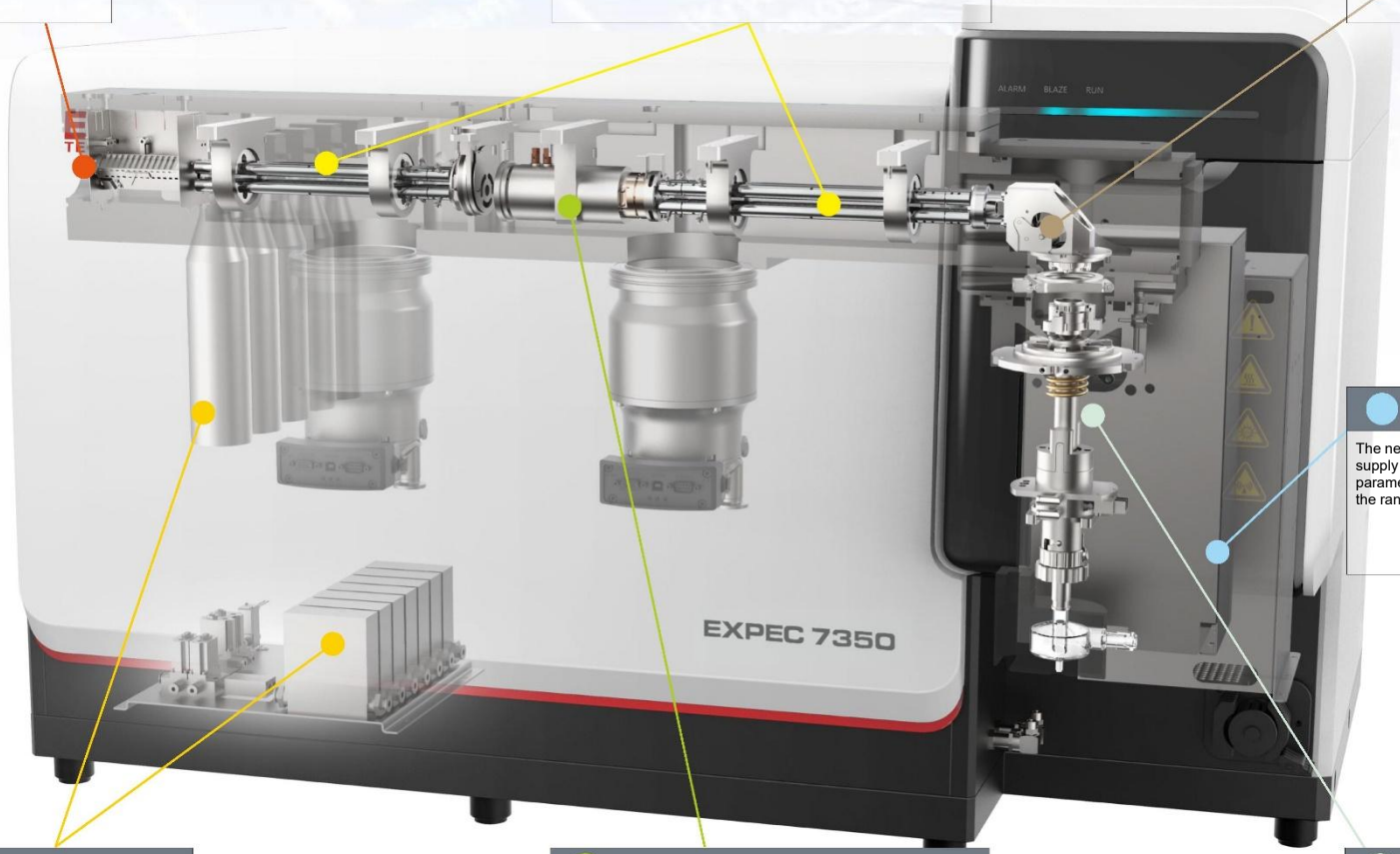
Customized digital/analog dual-mode detector with dynamic range of 10 or more orders of magnitudes.

Triple quadrupole design

It is the true triple quadrupole design, Q1 and Q2 use pure molybdenum quadrupoles of the same specification, which can achieve high-quality resolution of <0.3amu. The latest FM version driver is adopted to achieve quick calibration of Q1, Q2 mass axis and resolution with one click without manual tuning.

Right-angle ion optics

The ion transmission system with 90° off-axis design can completely eliminate the interference of neutral particles and improve the signal-to-noise ratio while efficiently transmitting ions.



Stable ICP ion source

The new generation of self-excited all-solid-state RF power supply is based on the dual power supply design with precise parameter matching, and the output power is more stable and the range is wider.

Embedded cylinder design

The creative 5-channel collision reaction gas is built-in, and up to 10 high-precision MFCs can be configured, with multiple choices and fast switching, making it more convenient and flexible to use.

High-speed dynamic collision reaction cell

(DFC: Distributed Falls Cell) The patented waterfall-flow distributed gas diffusion method greatly improves the collision/reaction efficiency, and combined with triple quadrupole technology, greatly improves the detection ability of S, P, Si and other elements that are susceptible to interference.

Vertical ion plasma

The innovative vertical torch design effectively reduces argon consumption and increases the service life of the torch and ion interface. The integrated mobile design of the torch coil ensures that the torch is centered mechanically, without software adjustment, and is more reliable.

Powerful and stable injection system

The world's first vertical torch

The vertical torch design is introduced in ICP-MS for the first time, which greatly reduces the accumulation of salt in the torch, prolongs the service life of the torch, and solves the problem of analyzing high-salt complex matrix samples. At the same time, argon consumption is greatly reduced, and heat and exhaust gas naturally enter the exhaust system upward, requiring less cleaning and less downtime.

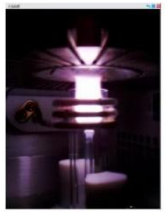
A new generation of all-solid-state ion source

The unique patented dual RF power supply has the fastest impedance matching mode, which makes the response faster and the anti-interference ability stronger. Without any moving parts, it provides a more stable ICP torch, and improves the stability of the analysis while being small in size. It can be directly injected to analyze 100% ethanol and other highly volatile organic compounds.

Combined with ultra-high matrix direct injection system and organic injection system, it can ensure long-term stable and reliable analysis in any complex matrix.

- It is specially designed for the analysis of high-salt samples, with strong matrix tolerance, and has two modes of high-salt sample injection and on-line dilution.
- High-salt tolerance mode: direct sample injection to analyze high-salt samples with a salt content >10% to improve analysis efficiency.
- On-line dilution mode: samples with content in percent are directly injected for analysis, which perfectly solves the limitation of ICP-MS in the analysis of high content.

Perfect cold plasma mode



The unique self-excited all-solid-state RF source provides cold flame mode as low as 500w, reduces the ionization of Ar-based ions, improves the signal-to-noise ratio of analyte ions such as 39K+, 40Ca+, 56Fe+, and the lower limit of detection of elements is greatly extended.

Advanced and excellent structural design

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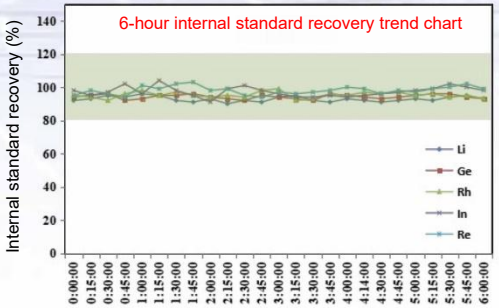
With the matrix-resistant vertical ion plasma design, combined with the new generation of self-excited all-solid-state RF power supply and the ultra-high matrix direct injection system, it can still guarantee the long-term stability of the instrument even in the face of soil solution with complex matrix, to avoid signal drift caused by the matrix and ensure the accuracy and reliability of data.



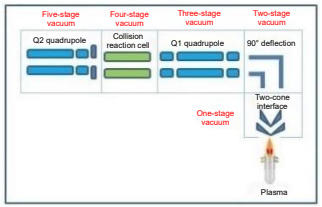
Excellent structural design makes the mass spectrometer with superior performance

Embedded cylinder design

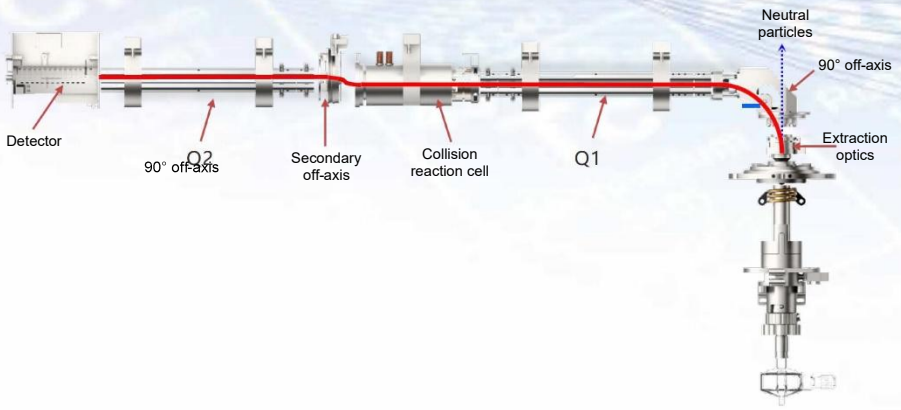
- The shortest gas pipeline design can quickly realize gas replacement and meet the needs of high-throughput analysis
- It can be configured with 5-channel collision reaction gas, and supports any ratio on-line to meet the application requirements in various scenarios
- There is no need for an external gas cylinder, saving laboratory space and providing a more friendly experimental environment

Three turbomolecular pumps and five-stage vacuum design

- Provide higher vacuum, and increase ion transmission effectiveness
- The vacuuming time is shorter and the efficiency of the instrument is improved
- Differential vacuum design to reduce ion transmission loss
- Reduce the load of molecular pump and improve the service life of turbomolecular pump



True triple quadrupole design



The strong analytical capability creates unparalleled analytical performance, and each sample can be tested and analyzed under the most suitable conditions.

Flexible analysis mode

EXPEC 7350 ICP-MS/MS gives full play to the potential of the collision reaction cell. The five-channel collision reaction gas combined with MS/MS mode can ensure sensitivity, completely eliminate interference, and obtain accurate results even when analyzing samples with extremely complex matrices:

- SQ analysis mode: consistent with the traditional ICP-MS analysis mode, Q1 makes all ions pass through
- TQ mass screening analysis mode: Q1 and Q2 screen the same mass number
- TQ mass transfer analysis mode: Q1 and Q2 screen different mass numbers

True triple quadrupole design

- Q1 and Q2 use pure molybdenum quadrupoles of the same specification, providing extremely high mass selectivity and quadrupole stability
- The longest quadrupole in the industry is used to increase the number of ion vibrations and improve the resolution, with the mass resolution of less than 0.3amu
- The ultra-wide bandpass function increases the sensitivity of the instrument by more than 2 times

True triple quadrupole design

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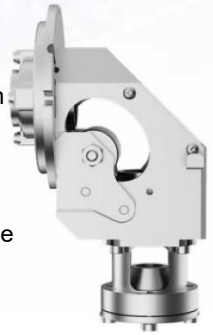
Unique triple pre-quadrupole design

- The "effective length" of the quadrupole is extended to reduce the interference of the edge field, improve the ion incidence efficiency, and easily obtain a million-level detection sensitivity
- The ion transmission efficiency is increased, and the pollution of Q1 and Q2 quadrupoles is reduced, with no need to clean and maintain quadrupoles

Right-angle ion optics design



- The right-angle ion deflection optics deflects the ion beam by 90 degrees to ensure that the analyzed ions enter the quadrupole to the greatest extent. It has an unparalleled filtering function, which can completely remove all neutral components in the ion beam and reduce the background by more than 5 times, greatly improving the signal-to-noise ratio and obtaining accurate and reliable results

The third generation of high-speed dynamic collision reaction cell

- With waterfall-flow distributed inlet collision reaction cell, the collision reaction gas is introduced orthogonally throughout the collision reaction cell, with small cell volume and high ion transmission efficiency
- The new waterfall-flow collision/reaction gas diffuses in the cell to form a good gas distribution, and only 30% of the gas flow can achieve the same effect as other collision reaction cell, greatly improving the efficiency of collision reaction and sensitivity
- Five-channel collision reaction gas can be configured to meet the requirements of trace analysis in various complex matrices and application scenarios

Secondary off-axis design

- The ion to be measured will be deflected 180 degrees to completely separate from the matrix particles, reduce the background of the instrument, and greatly improve the signal-to-noise ratio
- Specialized neutral particle receiver is used, and the ion optics are maintenance-free for life

Easy-to-use Element V workstation

Easy-to-use Element V workstation

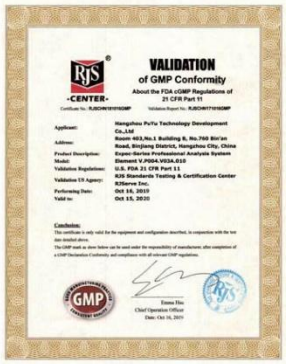
- The all-Chinese Element V workstation adopts central control platform design and supports unified management and control of multiple devices
- Powerful high-throughput data batch processing analysis software supports off-line data processing and improves data processing efficiency
- Rich and open external interfaces, supporting various equipment connection requirements
- Specialized solutions are provided for industry applications, and customized method packages are provided for monitoring and on-line analysis in semiconductor and other fields

Simple and easy to use

- Visual operation monitoring, with on-board self-check function and clear instrument health index
- One-key automatic tuning and quality calibration, reducing use difficulty
- Dynamic adjustment of injection time and flushing time, meeting the QC functional requirements of EPA method

Compliance with regulatory requirements

- With three-level management authority and audit trail function
- Comply with GMP regulatory certification and 3Q certification
- 21 CFR Part 11



VALIDATION
of GMP Conformity

Level 3 authority

Authority management

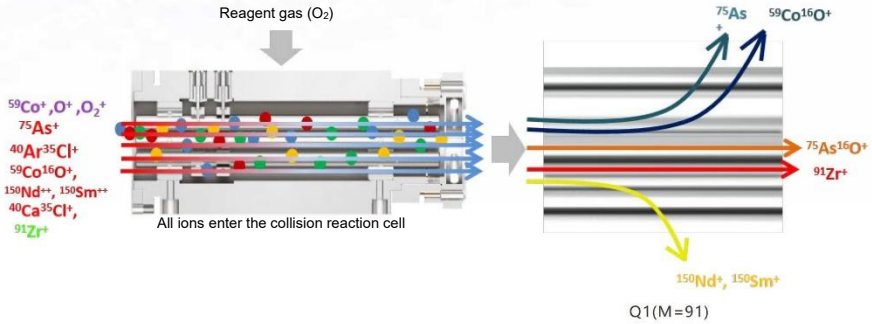
Audit trail

Ultimate solution for trace element analysis

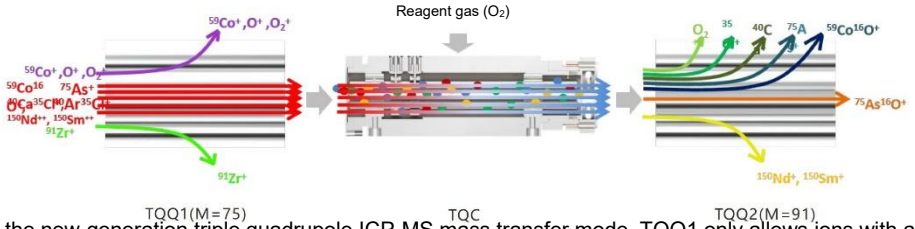
Incredible interference removal capability

It has been proved that the traditional ICP-MS matching He kinetic energy discrimination (KED) effect can effectively eliminate polyatomic interferences in high-matrix samples. However, it cannot eliminate mass spectrum interferences such as isobaric numbers and double charges, and its application range is limited.

In the traditional ICP-MS reaction mode, a large number of unknown ions enter the collision reaction cell and react together with the target ions, generating many by-product ions that form new interferences and causing deviations of the analysis results. The new generation of EXPEC 7350 MS/MS mode adds a quadrupole filter (TQQ1) before the collision reaction cell. TQQ1 only allows the target ions to enter the collision reaction cell and completely eliminates other interferences, greatly improving the sensitivity and signal-to-noise ratio, perfect for all applications.



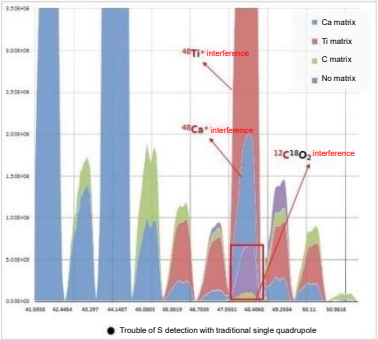
In the traditional ICP-MS reaction mode, the interference of $^{59}Co^{16}O^+$, $^{150}Nd^{++}$ and $^{150}Sm^{++}$ can be eliminated, but the interference of $^{91}Zr^+$ cannot be eliminated, resulting in false positive results.



In the new-generation triple quadrupole ICP-MS mass transfer mode, TQQ1 only allows ions with a mass-to-charge ratio of 75, such as $^{59}Co^{16}O^+$, $^{150}Nd^{++}$, and $^{150}Sm^{++}$, to pass into the collision reaction cell, where 75As+ is transformed into $^{75}As^{16}O^+$. TQQ2 analysis mass number is set to 91 of $^{75}As^{16}O^+$, and $^{91}Zr^+$ interference has been eliminated at TQQ1 and will not interfere with the analysis results.

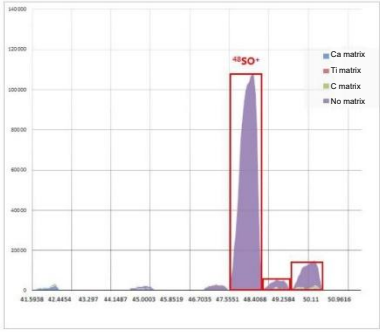
EXPEC 7350 ICP-MS/MS Analysis of ultra-trace sulfur in high purity reagents

It has always been difficult to analyze ultra-trace sulfur. During spectral analysis, the characteristic spectral line of sulfur (S) element belongs to the ultraviolet region, with poor sensitivity and high detection limit, which cannot meet the analysis requirements of ultra-trace sulfur in high-purity reagents. When using conventional ICP-MS, the sulfur element is less ionized, resulting in lower analysis signal. Only $^{32}S^{+}$ with high abundance can be selected as the target ion, and $^{32}S^{+}$ is seriously interfered by $^{32}O_2^{+}$. In the traditional ICP-MS reaction mode, $^{32}S^{+}$ is transformed into $^{32}S^{16}O^{+}$ by mass transfer for analysis. At the same time of mass transfer, there will be new interference such as $^{48}Ti^{+}$, $^{48}Ca^{+}$, $^{12}C^{18}O_2^{+}$, etc., so it is still impossible to realize the accurate analysis of ultra-trace sulfur.
The new generation of ICP-MS/MS adds an additional quadrupole mass filter (TQQ1) before the collision reaction cell. TQQ1 controls the ions that can enter the reaction cell to ensure that the reaction process in the cell is controllable. In this way, the interference of non-target product ions formed by matrix elements and other analyte ions can be avoided, and the detection limit below ppt level can be easily achieved to meet the test requirements of limit analysis.



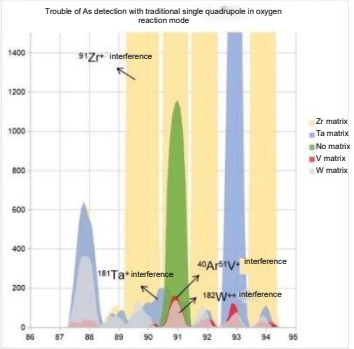
In the traditional ICP-MS reaction mode, the spectrum at the mass-to-charge ratio of 48 is shown in the figure above. After mass transfer, the target product ion $^{32}S^{16}O^{+}$ is subject to two new interferences such as $^{48}Ti^{+}$, $^{48}Ca^{+}$, and $^{12}C^{18}O_2^{+}$, which cannot effectively remove the interference encountered during sulfur element analysis, and cannot meet the analysis requirements of ultra-trace sulfur in ultra-pure reagents.

In MS/MS mode, all interferences such as $^{48}Ti^{+}$, $^{48}Ca^{+}$, $^{12}C^{18}O_2^{+}$, $^{12}C^{+}$ will be eliminated first in TQQ1, so that accurate analysis results can be obtained in reaction mode. The $^{32}S^{16}O^{+}$ mass spectrum is shown in the figure above, all interference peaks are excluded, and there is no interference of overlapping peaks, indicating that ICP-MS/MS can effectively solve the problem of ultra-trace sulfur analysis in high-purity reagents, and realize the accurate analysis of ppt and sub-ppt sulfur elements.



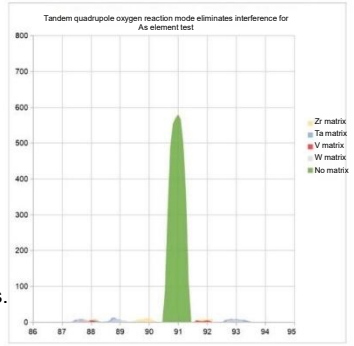
Analysis of trace arsenic in whole blood and serum by EXPEC 7350 ICP-MS/MS

The normal concentration level of arsenic in blood and serum is extremely low, and severe matrix interference is often encountered in ICP-MS analysis. In the past few decades, one of the most important improvements to inductively coupled plasma mass spectrometry has been the introduction of collision/reaction cells to remove polyatomic interferences. However, there are still many challenges in the determination of ppt-level arsenic in complex matrices such as blood or serum by ICP-MS with a collision reaction cell. For example, in the collision mode, although $^{75}As^{+}$ can avoid the interference of $^{35}Cl^{40}Ar^{+}$, it will still be interfered by $^{150}Nd^{++}$ and $^{150}Sm^{++}$; in the reaction mode, $^{75}As^{16}O^{+}$ is also inevitably interfered by $^{91}Zr^{+}$, $^{51}V^{40}Ar^{+}$ and $^{152}W^{++}$, which cannot be effectively and completely removed, resulting in analysis errors.
However, the ICP-MS/MS with two mass screenings does not have such problems, and can easily obtain detection limits below the ppt level in complex matrices such as blood.



In the traditional ICP-MS reaction mode, the spectrum at the mass-to-charge ratio of 91 is shown in the figure above. After mass transfer, the target product ion $^{75}As^{16}O^{+}$ is subject to new interferences such as $^{91}Zr^{+}$, $^{51}V^{40}Ar^{+}$, and $^{182}W^{++}$. Therefore, traditional ICP-MS cannot effectively remove the serious interference caused by complex matrices, and cannot meet the analysis requirements of trace arsenic in whole blood.

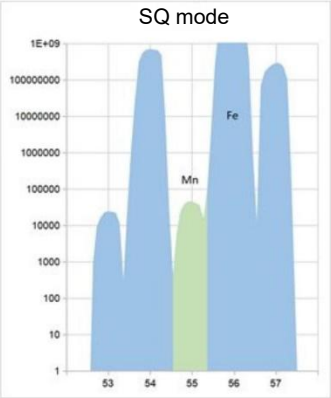
In MS/MS mode, all interferences such as $^{91}Zr^{+}$, $^{51}V^{40}Ar^{+}$, $^{182}W^{++}$, etc. will be eliminated first in TQQ1, so that accurate analysis results can be obtained in reaction mode. The $^{75}As^{16}O^{+}$ mass spectrum is shown in the figure above, all interference peaks are excluded, and there is no interference of overlapping peaks, indicating that ICP-MS/MS can effectively solve the problem of trace arsenic analysis in whole blood and serum,
and realize the accurate analysis of ppt arsenic elements.



Ultimate solution for trace element analysis

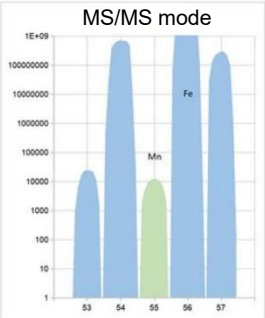
Analysis of trace manganese in iron matrix by EXPEC 7350 ICP-MS/MS

For the analysis of trace Mn in Fe matrix, $^{55}Mn^{+}$ can only be selected as the target ion analysis because Mn does not have isotopes. $^{55}Mn^{+}$ is prone to serious interference from the trailing peaks of $^{54}Fe^{+}$ and $^{56}Fe+$ of the main element, which brings great troubles to the traditional ICP-MS analysis of trace Mn in Fe matrix.
The new generation ICP-MS/MS of Expec Technology is equipped with 90° off-axis and triple quadrupole pre-pole, which reduces the probability of ion collision during transmission, achieves extremely low background noise and unparalleled sensitivity, and increases the abundance sensitivity by more than two orders of magnitude, perfectly solving the interference of adjacent trailing peaks, and meeting the accurate analysis requirements of trace elements in complex matrices.



In the traditional ICP-MS reaction mode, the spectrum at the mass-to-charge ratio of 55 is shown in the figure above. $^{55}Mn^{+}$ is seriously interfered by the tail peaks of adjacent mass numbers $^{54}Fe^{+}$ and $^{56}Fe^{+}$. The traditional ICP-MS cannot effectively remove the interference caused by adjacent component peaks in the analysis of manganese element, resulting in much higher analysis results.

In MS/MS mode, the excellent abundance sensitivity can perfectly separate the mass spectrum peaks of adjacent mass numbers and eliminate interference. The mass spectrum of $^{55}Mn^{+}$ is shown in the figure above. The peaks of adjacent components are separated without the interference of overlapping peaks, indicating that the excellent abundance sensitivity of ICP-MS/MS can effectively solve the problem of trace manganese analysis in iron matrix.



Rich accessory system

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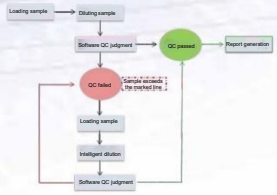
Analysis of trace arsenic in whole blood and serum by EXPEC 7350 ICP-MS/MS

Intelligent dilution system



- Automatic preparation of standard curve without manual operation
- Intelligent sample dilution, up to 200 times on-line dilution

Rapid injection system

- Use a power pump to achieve rapid sample extraction
- Analysis and cleaning are carried out at the same time, saving pipeline cleaning time

Ultra high pressure liquid chromatography - ICPMS coupling system

The combination of ultra-high performance liquid chromatography and ICP-MS technology can realize the speciation and valence analysis of mercury, tin, lead, arsenic and chromium in samples.

Solid direct injection - ICPMS coupling system

Based on the combination of graphite furnace electrothermal evaporation technology and ICP-MS technology, solid samples can be directly injected and analyzed without digestion, which greatly improves the analysis efficiency. It is a typical green analysis technology.

Fully automatic super microwave - ICPMS coupling system

The combination of super microwave and ICP-MS technology forms a set of automatic heavy metal analysis system, which can realize the automatic processing of the whole process of sample pretreatment, analysis and report, and liberate the laboratory manpower.