

INTERDISCIPLINARY CENTRE FOR WATER RESEARCH
Indian Institute of Science
BENGALURU



PRAVEEN C. RAMAMURTHY
Professor & Chair

Inquiry Number: ICWaR/PCR/

Dated: 09/08/2024

Global Tender

Request for Quote for the procurement of Single Quadrupole Inductively Coupled Plasma Mass Spectrometer for Determination of Elemental Concentrations Indian Institute of Science, Bengaluru
(Last Date: 30th August 2024)

This is an RFQ (Request for Quote) for setting up a Single Quadrupole Inductively Coupled Plasma Mass Spectrometer for Determination of Elemental Concentrations at IISc, Bengaluru. The RFQ covers all the requirements for the ICPMS instrument. The purchase for each of the systems will be processed independently (as a separate PO). So, vendors are NOT required to quote for items. Vendors are encouraged to quote for just one or a subset of the items. To help fair comparison, vendors are required to quote the prices separately for each item.

We are seeking a quote for a Single Quadrupole Inductively Coupled Plasma Mass Spectrometer for Determination of Elemental Concentrations

Procedure & Other conditions:

1. The decision of the purchase committee will be final.
2. Any questions can be directed to the undersigned at praveen@iisc.ac.in.
3. The quotation should be addressed to: The Chair, Attention: Prof. Praveen C Ramamurthy, Interdisciplinary Centre for Water Research, Indian Institute of Science, Bengaluru – 560 012.
4. The deadline for submission of hardcopy of the quotes is **10 00 hours (IST) on 30th August 2024**. The quotes should be addressed to the undersigned at the address given below.
5. Vendors will be required to submit a technical proposal and a commercial proposal in two separate sealed envelopes. Only vendors who meet the technical requirements will be considered for the commercial negotiation.
6. The technical proposal should contain a compliance table with four (4) columns. The compliance table should list all the items in the requirements section given below in the same order. The first column should describe your compliance in a “Yes” or “No” response. If “No,” the second column should state the extent of the deviation. The “third” column should state the reasons for the deviation, if any. The fourth column can be used to compare your tool with that of your competitors or provide details as requested in the technical requirements table below. Any other feature that you would like to bring to the attention of the purchase committee can be listed at the end of the compliance table.
7. The technical specifications given below are “highly desired”. However, the committee reserves the right to lower technical specifications to obtain a more competitive price.
8. The commercial proposal should have the price of the item. All the accessories needed for the tool to function as per the technical specification must be listed. Please provide itemized quotes for the tool and any other attachments/software.
9. The validity period of the quotation should be at least 90 days.
10. Necessary training to operate the procured setup and required literature support should be provided without additional cost.

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11. Your quotation should clearly indicate the terms of delivery, HSN Code and Income terms if freight charges applicable, delivery schedule, entry tax, and payment terms.
12. Final installment will be made only after satisfactory installation and demonstration of critical capabilities.
13. Vendors should undertake to support the system with spares and software bugfixes, if any, for at least next 5 years or more.
14. Please indicate the warranty provided with the tool. Warranty of at least 3 years or more is preferred. No travel claims must be made by vendor for servicing during the warranty/guarantee period.
15. Provide itemized cost for required spares for 2 years of operation. For sake of this calculation, the vendor may assume active tool usage of 10 hours/ week. This number will be used to estimate the life cycle cost of the tool.
16. The vendor should be able to repair and maintain the equipment, once it is installed in India. Clarify if periodic (preventive) maintenance can be done by a trained on-site engineer (i.e. IISc employee) or requires a specialist from the OEM.
17. If the maintenance can be done by training a IISc employee, please specify the cost of this training, as an additional option.
18. If maintenance must be done by OEM, in the form of an annual maintenance contract (AMC) for 3 years, post warranty. The AMC must cover 4 scheduled and 2 emergency visit per year. It must also indicate who will service the AMC, an Indian agent or the OEM. The AMC cost must also include an itemized list of spares that are essential for the scheduled visits.
19. The vendor should have a good track record of delivering such equipment to universities/research institutions in India and high rank institutions worldwide. The RFQ must include references of 3 previous installations in the last 5 years in India. Please provide the names and contact addresses of the users, so that the committee can contact them independently.
20. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.
21. If multiple systems can fulfill the requirements, vendors can submit multiple bids.
22. Firms can seek an exemption to some qualification criteria. IISc follows GFR2017 for such details.

Single Quadrupole Inductively Coupled Plasma Mass Spectrometer for Determination of Elemental Concentrations

The ICP-MS (Inductively Coupled Plasma Mass Spectrometry) device plays a crucial role as a testing instrument for analyzing elemental concentrations in various samples. This sophisticated instrument is essential for the precise quantification and characterization of metals and non-metals at trace levels. It finds application in both environmental monitoring and advanced research fields. The ICP-MS system is equipped with various features designed for high accuracy and sensitivity in elemental analysis. It enables simultaneous multi-element detection, providing comprehensive data on sample composition. The device operates by ionizing the sample with an inductively coupled plasma and then analyzing the ions using mass spectrometry. This allows for the determination of

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isotopic ratios and the identification of unknown elements. Key features of the ICP-MS include high sensitivity, a wide dynamic range, and low detection limits, making it suitable for detecting trace elements in complex matrices. It supports different sample introduction techniques, such as nebulizers and laser ablation, ensuring flexibility in sample preparation. The system also includes advanced data processing software for real-time monitoring and analysis, enhancing the accuracy and efficiency of measurements.

The ICP-MS device offers robust performance with automated calibration, background correction, and interference removal, ensuring reliable results. Its user-friendly interface facilitates easy experiment setup and operation, while built-in safety features protect both the user and the instrument. The device's modular design allows for customization based on specific research needs, and its compact construction ensures adaptability in various laboratory environments. Notably, the portability of the ICP-MS system makes it an excellent choice for field applications, enabling researchers to perform real-time elemental analysis on-site. This enhances its practicality for dynamic research scenarios, including environmental studies, industrial applications, and quality control processes.

We are seeking a Single Quadrupole Inductively Coupled Plasma Mass Spectrometer for Determination of Elemental Concentrations under various environmental conditions. The instruments should have the following specs.

Specifications for Supply of ICP-MS

A single quadrupole ICP-MS for determination of elemental concentration including radioactive elements & their isotopes, rare earth elements (REE) & precious elements etc. ranging from high concentration (ppm) to ultra-trace concentrations (ppt) in liquid samples through direct nebulization.

a. Sample introduction, ion source, RF plasma:

- i. Sample Introduction Kit including Peltier Cooled Spray Chamber (Temp Range -5 to 20 Deg C), PFA/ Glass/Quartz Nebulizer, Ni (or Pt) Sample and Skimmer cones.
- ii. Computer controlled 27 MHz RF generator operating from 500 to 1600 watts for automatic control of torch ignition, shutdown, and system warm up.
- iii. The system should be able to change over from normal Plasma conditions to cool Plasma with direct control from software.
- iv. The Plasma torch should have provision for software-controlled alignment for horizontal position, vertical position and sampling depth.



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- v. Standard large orifice Ni sampling (≤ 1.1 mm ID) and skimming (≤ 0.5 mm ID) cones with suitable diameters.
 - vi. The ion deflection system should have an efficient mechanism for removing all neutrals from the Ion path.
 - vii. The Ion path must be maintenance free.

b. Gases, cell technology and mass flow controllers

- i. System should have dedicated MFCs to control plasma, auxiliary, nebulizer, additional / dilution gas, reaction gas & collision gas.
- ii. For chemical resolution: The system should have reaction and collision cell with capability to remove any polyatomic interferences formed in the cell.
- iii. ICPMS shall incorporate Cell offering operation: Standard Mode, Collision Cell (He) Mode with KED and Reaction mode for interference removal in a single analytical method simultaneously.
- iv. Cell must be non-consumable with zero maintenance. If consumable, then additional 2 cell should be quoted along with main system.
- v. There should be four gas specific mass flow controllers for control plasma, auxiliary, nebulizer, collision and reaction gas in a safe premix or pure form and compliant manner. The offered instrument should have factory fitted MFCs as a standard feature.
- vi. System must have separate gas lines (total two gas lines) along with dedicated MFC for collision and reaction gas. Suitable reaction gas/gases (at least one) should be offered along with standard collision reaction gas line to fulfil above specified application. Instrument with Single collision/reaction gas line/channel Or Universal gas line/channel won't be accepted.

c. Mass Analyser

- i. User definable resolution variable from 0.3 to 1.0 amu across entire mass range of instrument for improved true linear dynamic range & sensitivities.
- ii. Minimum Unit mass (1 amu) resolution capability across entire mass range of instrument.



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- iii. Mass calibration assessed and automatically updated.
 - iv. The Mass range should be from 5-260 amu or better.
 - v. Scan speed: ≥ 3000 u/sec or better at 40 mass intervals.
 - vi. Mass stability: ≤ 0.05 amu per day or more.

d. Detection and performance specifications

- i. The ion detector should be a dual mode discrete dynode electron multiplier (or equivalent) with 10 order or more magnitude of dynamic range.
- ii. The dual-mode detector assembly must come standard with the system.

e. Sensitivity specifications (must be demonstrated during installation):

Sensitivity (Mcps/ppm):

- Li or Be: ≥ 45
- In or Y: ≥ 140
- U or Tl: ≥ 80

Detection limits (ppt):

- Li/ Be: < 0.5
- In/ Y: < 0.1
- U/ Bi: < 0.1
- Oxide ratio: CeO/Ce $< 2\%$ or better
- Ba⁺⁺ or Ce⁺⁺/ Ba or Ce $< 3\%$ or better
- Background mass 4.5/9/220: No gas < 1 cps
- Short Term Stability $\leq 2\%$ RSD or better
- Long Term Stability $< 3\%$ RSD or better
- Mass Stability $< \pm 0.05$ amu per day

f. Software and control PC

- i. Suitable Data Station with all Software controls & future upgrade controls with Instrument software.
- ii. Software should provide comprehensive functionality for analysis through fully

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- automated process with auto tuning.
 - iii. Minimum three offline software licenses must be provided as standard.
 - iv. The software should be customizable to meet QA/QC functionality needs, and automated QA/QC checks.
 - v. The software must be a 64-bit application for future upgradeability.
 - vi. The future software upgradeable should be free of cost.
 - vii. The system should be upgradable with suitable chromatographic separation system using integrated single window-based software operation for all the modules connected with MS.
 - viii. Branded HP/Dell Personal Computer should be supplied along with instrument from manufacturer.

g. Consumables:

- i. A complete set of essential and comprehensive accessories/consumables/spares/sample should be quoted for 3 years of operation. These include Ni sampler and skimmer cones, nebulizers, spray chambers, plasma torch, preventive maintenance kits, etc.
- ii. Any other consumable required for smooth operation of system must be quoted separately.

h. Other requirements:

- i. Details of installation-site requirements maintenance and service support should be described in detail.
- ii. Details of gases, regulators, cylinders necessary for the ICPMS should be provided and 2 Qty of Argon gas, 1 Qty of Collision gas & 1 Qty of reaction gas cylinders along with suitable gas regulators should be quoted along with system.
- i. Operation and service manual shall come with the equipment.
- ii. Suitable 20KVA UPS with 30 min Backup should be quoted.
- iii. Autosampler of minimum sample vial holding capacity of 200 positions or more should be offered. It should be metal free and should have independent X-Y-Z movement.
- iv. Vendor must give list of references in India and elsewhere in the world where the



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quoted system is working satisfactorily.

- v. Vendor must give at least 5 days on site training after the installation for practical demonstration.

i. Warranty

- i. Warranty service that includes parts and labour for at least 36 months, which shall begin after successful commissioning of the equipment. Please also quote subsequent (i) comprehensive maintenance cost (parts & labour) and (ii) maintenance cost (labour only) after expiry of the warranty period.
- ii. Equipment installation, commissioning tests and training should be included in the tendered price.

j. Support Service

- i. Online support includes phone, e-mail and internet-based remote access within 24-48 hours of initial contact.
- ii. On-site service is included, as deemed necessary, following online evaluation. Goal to provide on-site service within 48 hours once a service call has been entered based on engineer availability.

k. Instrument Performance Guarantee

The quotation **MUST** include full performance figures of merit of the instrument, including sensitivity, detection limit, accuracy and precision for short- and long-term analyses of standard solutions of Li, Be, B, V, Cr, Fe, Cu, Zn, Mo, Cd, As, Se, Sr, Pb, and U. The following are a select few performance guidelines that the supplier must guarantee to demonstrate on the proposed machine during installation.

- (A) The sensitivity, detection limit, accuracy, and precision, determined on standards recognized by the geochemical community / high purity ICP-MS concentration standards at concentrations (i) ≤ 1 ppb and (ii) ≥ 10 ppm for the following elements: Li, Be, B, V, Cr, Fe,

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Cu, Zn, As, Se, Sr, Pb, and U.

- (B) Demonstrated ability to determine Li, B, Mg, Sr, and U to Ca ratio in natural carbonates. Preference will be given to instrument with peer reviewed publication on metal to calcium ratio determination in natural carbonates.
- (C) The tender should include the best sensitivity, detection limit, internal precision (2s), and external precision (2s) for the elements listed below in the format tabulated below. The values for the parameter can be quoted from published results in any recognized peer reviewed journal or from a factory instrument with an undertaking from the company. For reporting of the sensitivity, the exact sample introduction setup should be mentioned, and for internal and external precision the exact number of ratios determined, and the number analyses averaged (n) should be quoted. The total mass of analyte consumed per analyses and detector / amplifier utilized must be mentioned.
- (D) The service engineer should carry out various performance parameters of the instrument(s) according to those mentioned in the brochure and/or quoted in the technical bid submitted by the vendor, whichever is better at IISc after delivery. Towards this the supplier should provide test certificates.
- (E) Quotation to include clear, unambiguous statements of expected routine performance of the various preparation systems in combination with the mass spectrometers. It should state the overall precisions derived from analyses of multiple replicate samples of standard materials, with a clear indication of any effects in relation to sample size.

Elements of key interest: lithium, beryllium, boron, magnesium, silica, potassium, calcium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, zinc, copper, cadmium, molybdenum, arsenic, selenium, antimony, barium, rubidium, strontium, aluminium, rare earth elements, and lead. Demonstrated ability to resolve plasma-based interferences, through utilization of physical or chemical mass resolution, should be part of the performance report.

Note:

The system should be complete in all respects. A supplier must provide point-by-point compliance with documentary evidence, datasheets, and brochures.