

DEPARTMENT OF BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY

INDIAN INSTITUTE OF TECHNOLOGY DELHI

HAUZ KHAS, NEW DELHI – 110016

20.01.2014

Subject: Notice Inviting Quotation (NIQ) for purchase of ICP-MS

Sealed quotations are invited for purchase of 1 (one) ICP-MS with Microwave Digestion system in the CRF, IIT Delhi addressed to Dr. Z. A. Shaikh, DBEB, IIT Delhi on or before 10. 02. 2014 by 2:00 P.M. All the interested parties are requested to read the specifications given below carefully before submitting the quote. The quotation must include all taxes, handling, shipping and installation charges. Also all details of guarantee/warranty should be clearly mentioned. The Technical and Financial bids should be in separate sealed envelopes and both should be placed inside a large sealed envelope inscribed with "Quotation for purchase of ICP-MS". The Technical and Financial bids must provide all information about the components asked in the sections "Specifications of Essential Items" and "Specifications of Optional Items".

Item Name: ICP-MS with Microwave Digestion system

Quantity: 01 (One)

NOTE: Kindly do not send any unnecessary documents, like advertisements containing the product range list of vendors/distributors etc., copies of recent PO's of supplies made by vendor, along with the bids.



Dr. Z. A. Shaikh

DBEB, IIT Delhi

SPECIFICATIONS OF ESSENTIAL ITEMS

All components of the integrated ICP-MS (with optional IC/HPLC) system must be manufactured by the company submitting the quotation. Entire system should be computer controlled by appropriate software.

Minimum required specifications for the ICP-MS and IC/HPLC (optional) systems are given below.

ICP-MS System specification

1. ICP-MS sample introduction system

Should have capability to handle high TDS (>10 %) and hydrofluoric acid containing samples

- A. Peristaltic pump: A multichannel which can support variable flow rate, with at least three channels
- B. Nebulizer: It must include a PFA nebulizer as standard having high resistance to acid and capacity to have very low sample flow rate (0.25 ml/min or better).
- C. Spray chamber: Temperature controlled PFA spray chamber with efficient peltier cooling (-5 °C to + 20 °C).

2. ICP Torch

- A. ICP Torch: Quartz torch with 2.5 mm or smaller ID Pt injector.
- B. Precision torch adjustment: Complete computer controlled adjustment of the position of three torch in X, Y and Z directions with independent movements in the three directions. Should have automatic alignment option.
- C. Precision gas control: Three computer controlled mass flow controllers for controlling all the plasma gas lines precisely (nebulizer, plasma and auxiliary gas flow).

3. RF Power source for ICP torch :

- A. RF Generator (source): ~27/40 MHz frequency, solid state power source, crystal controlled.
- B. Forward Power: 500-1600 Watts variable.
- C. Plasma shut down: Automatic shutdown of the plasma by the system after completion of analysis.
- D. Appropriate cooling system for RF generator and coil.

4. Interface

High matrix tolerance interface with high purity nickel cones having apertures of at least samples cone ~ 1 mm or better. Skimmer cone $\sim \leq 1$ mm or better diameter. A set of platinum cones should also be supplied as standard accessory.

5. Collision – reaction cell

- A. The system must have the state-of-the-art technology for analysis in both Collision (with KED) and reaction modes and also have the capability to remove polyatomic and isobaric interferences.
- B. The system should be capable of running the Reaction, Collision and Standard Mode in a single run.
- C. The system must have the capability to switch between modes.
- D. Should have the capability to handle pure He, H₂, O₂, NH₃ and CH₄
- E. Should have at least three cell gas lines.

6. Ion Optics

Ion optics should have excellent focusing with 90° deflection system or similar state-of-the-art technology to analyzer and detector for elimination of photons and neutrals. Background noise should be less than <1 cps in all modes.

7. Quadrupole mass analysis

- A. RF generator: Should be 2 MHz or higher
- B. The system should have the facility for overcoming the low mass based interferences.
- C. Vacuum system: Should have three stage or better turbo molecular pump with split flow for extremely high gas throughput. Vacuum should be: Better than 1×10^{-5} mbar in open valve condition and shall be better than 5×10^{-5} mbar in closed valve condition. The system should include vacuum chamber isolation valve which automatically close as plasma is extinguished or with system faults. The pumping system should have the capacity to reach operating vacuum from atmospheric pressure within 20 minutes.
- D. Quadrupole material: made of molybdenum or stainless steel rods with RF
- E. Pre- filters.
 - Mass range: (2-260) amu or better.
 - Scan rate: ≥ 3000 amu/sec
- F. Resolution: Computer controlled settings for quadrupole resolution adjustments are to be demonstrated. The best possible quadrupole resolution should be separately indicated in the offer.

G. The analyzer quadrupole must have the ability to discretely control the resolution of selected mass regions dynamically, without affecting the overall nominal resolution of the system

H. The Dwell time should be as short as 0.2 ms for fastest settling.

I. No need to manually start the vacuum system following a long (overnight) power failure.

J. MS/MS Capability: The instrument having the MS/MS capability using state-of-the-art technology is preferred.

8. Detector

A. Ion detection with electron multiplier shall ensure better than 9 orders of linear dynamic range using simultaneous analog/pulse counting. It shall be possible to measure major and minor concentrations in a single analytical run.

B. Should have over range protection and fully automated detector cross calibration with good linearity. The detector shall be easily replaceable by the user. Both the analog and pulse counting modes should be protected against overload. Minimum dwell time 100 μ S in both pulse counting and analog mode.

9. Performance criteria

I. Sensitivity:

Li/Be $\geq 50.0 \times 10^6$ cps/ppm

Co $\geq 100.0 \times 10^6$ cps/ppm

In / Y $\geq 300.0 \times 10^6$ cps/ppm

U /Tl/Th $\geq 110.0 \times 10^6$ cps/ppm

II. Detection limit (ppt):

Li/Be < 0.4

In / Y < 0.1

Bi < 0.1

III. Signal stability (Li, Y, Tl):

Short term stability (%SD), less than 3% (over 10 minutes) and Long time stability (%SD) less than 3% (over 4 hours) have to be demonstrated for all mass ranges.

A. Oxide ratio: CeO/Ce (%) < 2

B. Doubly charged ratio (%): Ce²⁺/Ce (%) < 3 , Ba²⁺/Ba (%) < 3

C. Isotope ratio precision: (%SD) Ag 107/Ag 109 < 0.1

D. Mass Stability: <0.05 amu/Day

10. System control and data acquisition

The system should perform auto optimization of plasma parameters like plasma power, plasma gas flow etc. The instrument software shall allow auto-tuning to enable the instrument to be used with the consistent and reproducible day to day performance independent of the operator.

A. Acquisition mode:

Peak jumping, scanning, Time resolved analysis, Isotope Ratio measurements using integral software.

B. Analysis mode:

Should allow for semi quantitative analysis, external calibration and internal standard addition methods for fully quantitative analysis, allowing parts per trillion level analysis and isotope ratio measurements with precision better than 0.2 %.

C. Report Generation:

Output results formatted in mixed concentration units e.g. ppt, ppb, ppm etc.

D. Quality control and software:

a. Software should have features to accommodate IC/HPLC connected before ICP-MS

b. Software for automated QA/QC during unattended operation.

c. It must have all the features of CFR 21 Part 11 audit trails offered as standard.

d. Offline data processing and exportability of data to other standard packages should be available.

e. Matrix specific databases to provide preferred isotope selection should be available.

f. Software should provide multi-level user logon control for enhanced security and audit.

Note:

Master copies of all relevant software must be supplied. All instruction manuals and service manuals must be supplied along with the instrument.

Latest PC (Intel Core i7, 4GB RAM, 1 TB HDD, DVD writer, network card, LED monitor (minimum 19")), along with Laser printers (one automatic duplex B/W laser printer and one automatic duplex colour laser printer) should be supplied at no extra cost.

E. Warranty:

The system should carry comprehensive warranty with spares for 3 years from installation. The warranty should be a part of the total ICP-MS system supply. All consumables (except sample vials) needed for the operation of the ICP-MS for three years after installation should be included in the offer. An analyst having sound experience in ICP-MS operation should be provided for three years from the date of installation to operate the instrument at IIT Delhi and appropriate cost should be included in the offer. The supplier has to take responsibility to keep the instrument at running condition without asking any money for three years after installation.

Comprehensive on-site training to the users after installation should be provided.

Catalogue in original with all technical specifications printed on the catalogue should be provided. Principal needs to declare the year of launch of the quoted model.

- a. Multi-element NIST traceable standard – 1 No
- b. Fume exhaust for ICP-MS system - 01 set
- c. Gas supply system to ICP-MS system - 01 set

The gas supply system is meant to provide required gases to the ICP-MS system at specific purity (99.999%), pressure and flow rates. Such a gas supply system should include:

- i. Gas cylinders for Plasma formation - Argon (4 nos)
 - ii. Gas cylinder for Collision cell gases – Helium (1 no)
 - iii. Gas cylinder for Reaction cell gases – Hydrogen (1 no)
 - iv. Gas cylinder for Reaction cell gases – Oxygen (1 no)
 - v. Gas cylinder for Reaction cell gases – CH₄/NH₃ (1 no)
 - vi. 2 stage Gas pressure regulators (SS) for each cylinder
 - vii. Gas purification panels
 - viii. Gas supply manifold for switching gas cylinder
 - ix. SS tubing
- d. UPS system with 1 Hour battery backup - 1 Set
 - e. Water recirculation chiller for ICP MS system as standard accessory-1
 - f. HF Kit - 01 no
 - g. IC/HPLC System kit capable of coupling with ICP-MS – 01 no

Microwave Digestion System

1. Microwave heating system must have a minimum power output of 1500 watts or more with dual magnetron.
2. System software must automatically adjust the power delivery based upon sample load and pre-programmed control settings.
3. System must have a device to protect the magnetron from reflected energy to ensure even heating it must be located external to the cavity.
4. System must have automatic vessels recognition & counting facility with a possibility to start the reaction through push of button without the manual loading of reaction parameter. All the reaction parameter must be uploaded by the system through software.

Hardware & Operating System Specifications

1. System must have a built in operating system with high resolution touch screen display and alphanumeric keypad. System must operate stand-alone and must not require the use of any external computer for operation.
2. System must incorporate a dual IR sensor to measure and control temperature of each vessel in order to insure the accurate measurement and control of temperature in every vessel.
3. System must continuously display the temperature of the running average of ALL vessels being processed.
4. System must have active pressure control (vent-and reseal) mechanism on each vessel for releasing the excess pressure to avoid any explosion. It should have capability to monitor and control in individual vessel.

Vessel Specifications

1. System must be quoted with 8 or more self-regulating vessels made of PTFE. Each vessel must be capable to have working temperature up to 260°C or more with a working pressure of 50 bar or more and should have option to monitor and control temperature and pressure in individual vessel.

Warranty

The system should carry comprehensive warranty with spares for 3 years from installation. The warranty should be a part of the total ICP-MS system supply. All consumables needed for the operation of the MW digestion system for three years after installation should be included in the offer. The supplier has to take responsibility to keep the instrument at running condition without asking any money for three years after installation. Comprehensive on-site training to the users after installation should be provided. Catalogue in original with all technical specifications printed on the catalogue should be provided. Principal needs to declare the year of launch of the quoted model.

SPECIFICATIONS OF OPTIONAL ITEMS

Autosampler for ICP-MS

Appropriate autosampler with at least 170 samples vial capacity including peristaltic pump and rinse station.

Appropriate material of construction (PEEK) of the system to handle samples containing hydrofluoric acid, environmental samples, organic samples, small amount of sample (blood), samples of different pH (0-14).

IC (Ion Chromatograph) Specifications

An Integrated HPLC-ICP-MS Interface to be provided. The system must have Automatic switch valve to transfer Column elution from Column outlet to ICP-MS without any manual Intervention. It should be programmable & control using software. The full configuration of IC-ICP-MS & transfer valve must be under software control. The vendor must demonstrate the functional operation of speciation for all elements for performance verification.

A. The system quoted should include following modules for speciation of As, Cr, Hg, Sn, Fe, Se:-

1. An appropriate Quaternary or equivalent (in terms of operation) Gradient Pump(s) with flow rates up to 10 ml/min and compatible with Micro bore 2 mm dia and standard bore analytical columns of 4 mm dia, Compatibility with capillary columns will be an added advantage.

2. Thermostatted Detector Chromatography housing model to accommodate injector, columns, switching valves in thermally controlled environment.

3. Polymeric columns for Anions and Cations, Gradient compatible

4. Chromatography control Software

5. Automated sample preparation

6. Standards and Qualification kit

7. PC and Printer

B. Following are the details specification required for each module:-

The complete flow path of the system modules should be non metallic PEEK based compatible for pH 0-14 and 100% reverse phase organic solvent for analysis of Anions, and Cations.

1. QUATERNARY OR EQUIVALENT GRADIENT SOLVENT DELIVERY PUMP(S)

Non metallic PEEK based compatible for 0-14 pH & RP compatibility for 4 solvents gradient and as per the following specification

a. Flow rate Range : 0.001 -10 mL/min

- b. Flow rate accuracy : ± 0.1 at 1 ml/min
- c. No. of mobile phase : Should form a gradient of 1-4 mobile phases
- d. Pressure Range : 50-5000 psi
- e. Pressure Pulsation/Ripples : < 1 % without pulse dampner
- f. Delay volume : $< 500 \mu\text{L}$
- g. Seal wash : On-line automatic
- h. Flow Precision : ± 0.1 % at 1 ml/min.
- i. Vacuum degasser : Built in 4 channels with gradient pump
- j. Gradient Proportioning Accuracy : $\pm 0.5\%$ at 2 ml/min
- k. Gradient Proportioning Precision : $\pm 0.5\%$ at 2 ml/min

ELUENT ORGANISER

A separate mobile phase organizer should be provided to hold and mount 4 mobile phase bottles with Helium/Nitrogen. Sparging option must be available. The eluent organizer must be corrosion proof polypropylene.

2. COLOUMN FOR METAL IONS SPECIATION:

- a. Columns must be of polymeric Ion exchange for better efficiency and high loading capacity. All columns must be solvent compatible, non-metallic and non-corrodible components like Frits, preferably made of PEEK for analysis of Anions.
- b. Columns for Anions must have the separation capability for analysis of Anions & Cations.
- c. Columns must be 100 % solvent compatible and must withstand 0-14 pH.
- d. Online Electrolytic Self Regenerating Membrane Suppressor for anions & cations.

3. CHROMATOGRAPHY SOFTWARE

The Software should be capable to control the complete Ion Chromatography system through ICP-MS console. It should be able to configure any of the detectors available.

Software should be compatible with the windows operating (preferably Windows 7) systems.

IC & ICP-MS should be fully controlled by software.

4. SAMPLE PREPARATION:

Appropriate sample preparation solid phase cartridges must be quoted and included in the system

5. STANDARDS FOR ANIONS AND CATIONS

With the IQ/OQ/PQ qualification kit should be supplied for easy startup and qualification.

HPLC Specifications

An Integrated HPLC-ICP-MS Interface to be provided which should include Quaternary Pump, degasser, flow cells, column heater, Speciation column for As, Cr, Hg, Sn, Fe, Se. The system must have Automatic switch valve to transfer Column elution from Column outlet to ICP-MS without any manual Intervention. It should be programmable & control using software. The full configuration of HPLC-ICP-MS & transfer valve must be under software control. The vendor must demonstrate the functional operation of Speciation for all elements for performance verification.

It should have the following features

1. HPLC control Software
2. Automated sample preparation
3. Standards and Qualification kit
4. PC and Printer

Following are the details specification required for each module:-

The complete flow path of the system modules should be non metallic PEEK based compatible for pH 0-14 and 100% reverse phase organic solvent for analysis of samples.

Pump:

Flow rate 0.02 to 8.0 mL/min or better with a pressure of 6000 psi or better for the entire flow rate range.

Flow-rate range 0.01 to 10.0 mL/min

Flow-rate increments 0.01 from 0 to 0.99 mL/min

Flow precision 0.3% RSD (typical 0.1%) 1 mL/min water @ 1000 psi

Flow accuracy $\pm 1\%$ of setting at 1 mL/min and 1000 psi with water

Column Oven:

Operating range: 30 °C to 90 °C

Recommended flow range Up to 5 mL/min

Temperature accuracy ± 1 °C over entire range

Temperature stability ± 0.2 °C

Temperature repeatability ± 1 °C

Heating rate: 20 min to set point at 2 mL/min

Temperature ramp Up to 5 °C/min

Column-selection-valve capacity 6 switching positions

Standards for Cations:

With the IQ/OQ/PQ qualification kit should be supplied for easy startup and qualification.

Chromatography Software

The Software should be capable to control the complete HPLC system through ICP-MS console.

Software should be compatible with the windows operating (preferably Windows 7) systems.

HPLC & ICP-MS should be fully controlled by software.

Warranty

The autosampler and IC/HPLC systems should carry comprehensive warranty with spares for 3 years from installation. All consumables (except sample vials) needed for the operation of the system for three years after installation should be included in the offer. The supplier has to take responsibility to keep the instrument at running condition without asking any money for three years after installation. Comprehensive on-site training to the users after installation should be provided. Catalogue in original with all technical specifications printed on the catalogue should be provided. Principal needs to declare the year of launch of the quoted model.

NECESSARY TERMS AND CONDITIONS

1. IIT Delhi is exempted from paying custom duty under notification No.51/96 (partially or fully) and necessary "Custom Duty Exemption Certificate" can be issued after providing following information.
 - a. Shipping details i.e. Master Airway Bill No. and House Airway No. (if exists)
 - b. Forwarder details i.e. Name, Contact No., etc.

Custom Duty Exemption Certificate will be issued to the shipment in the name of the Institute and Bills of Entry should be submitted to IIT Delhi later on.

2. Either the Indian agent on behalf of the Principal/OEM or Principal/OEM itself can bid but both cannot bid simultaneously for the same item/product in the same tender. If an agent submits bid on behalf of the Principal/OEM, the same agent shall not submit a bid on behalf of another Principal/OEM in the same tender for the same item/product.

3. If the bidder is an authorized dealer of any manufacturer, the authorized Indian dealership certificate from the principles should be enclosed. Similarly, proprietary certificate for proprietary items should be provided.
4. IIT Delhi is exempted from paying Excise Duty and necessary Excise Duty Exemption Certificate will be provided for which following information are required. a. Quotation with details of Basic Price, Rate & Amount on which ED is applicable.
5. Please quote prices of imported items at FOB (Freight on Board) IIT Delhi inclusive of all taxes, freight, delivery, installation and onsite training charges. The quotation should provide the total price of the system including all taxes and transportation charges.
6. In case IIT Delhi is imposed with demurrage charge due to import on CIF, the entire demurrage charge has to be borne by the Indian Agent of foreign supplier.
7. A special discount/rebate wherever admissible keeping in view that supplies are being made for educational purpose in respect of public institution of national importance may please be indicated.
8. Payment Options (any one to be chosen by the Department)
 - Letter of Credit: 90% payment against shipping documents & balance 10% after satisfactory installation. For large purchase i.e. costing over Rs. 1 crore, 100% payment be made through LC.
 - Sight Draft: Payment against documents through bank.
 - Against Delivery: Payment by wire transfer after receipt of material.
 - Advance payment: pre-payment by wire transfer (for orders less than Rs. 5 lakh)
 - Against Delivery: Payment by wire transfer after receipt and installation of material.
9. Delivery period: within 1 month from the issue of supply order.
10. Warranty: at least 3 years comprehensive onsite warranty should be provided. AMC price beyond 3 years should be mentioned separately.
11. The quotations must have validity of at least three months.
12. Authority of IIT Delhi reserves the right to reject any or all quotations without assigning any reasons.