Chapter 4: ICP-MS (01 unit) funded under BIONEST Incubation Centre, Biotechnology Industry Research Assistance Council (BIRAC), Government of India

Technical Specifications

Specification should be available on vendor's website. System should be compatible to be upgraded with LC-ICP-MS operation for speciation studies, GC-ICP-MS operation etc. All submitted technical documents' with part number should be available on vendor's public website. All the quoted components should have proper part number. The instrument and software should have 21 CFR Part 11 compliance as a standard. The system should have GLP/GMP compliance and should strictly meet 21 CFR Part 11 guidelines. The system should enable for audit trails, electronic signature and other requirements related to GLP compliance. Further, required IQ and OQ reports should be generated to meet GLP regulatory requirements during installation and operation by your service personnel.

Proposed Application: Analysis of trace metals in pharmaceutical samples including herbal extracts, blood, serum, urine trace level of metals, waste water/ ground water samples and Ayurveda formulations. It should be further attached with liquid chromatography in future

S. No.	Specification	Amended Specifications
	General Specifications	
1.	Minimum sample intake for analysis of maximum elements with very high sensitivity and resolution. Measurement techniques for qualitative as well as quantitative analysis for trace/ultra-trace elements should be at ppb level or better	No change
2.	The system should have a Universal cone interface for high matrix as well as low matrix samples without changing any hardware in the interface to achieve full sensitivity and detection limit.	No change
3.	The system should be operative in standard, collision & reaction mode.	No change
4.	The system should be able to operate in standard, collision and reaction mode in single run without changing any hardware and software parameters	No change
5.	Instrument should be supplied with gas line for collision gas and reaction gas with dedicated mass flow controller. In collision	No change

	mode it should be able to handle more than 99.99% pure gasses like He and in reaction mode pure or pre mix form of H_2/NH_3 CH_4/O_2 as per system hardware requirement.	
6.	Collision reaction cell should be included. Two separate gas lines for $O_2/H_{2//}$ammonia along with MFC must be quoted for collision and reaction gases with automated & software controlled changeover.	Collision reaction cell should be included. Two separate gas lines for $O_2/H_{2//}$ammonia along with MFC must be quoted for collision and reaction gases with automated & software controlled changeover. ***Instrument should have the provision for 100% NH_3.***
7.	Auto-sampler with 140 or better sample capacity. The system shall include a random access auto sampler capable of holding 100 or more 15 mL or sample vessels.	No change
8.	Facility for Automated Solvent Blending, online pH, ionic strength & organic modifier blending from solvents must be present to attain a perfect pH without human intervention. The pump shall have a means within the method for the on-line blending of eluents to a specific pH based on experimental pH calibration files that are created by the user.	No change
9.	Argon gas dilutor or equivalent technology for auto dilution should also be quoted along with the ICP-MS system.	No change
10.	Instrument should have chiller with coolant circulating device for plasma.	No change
11.	The background noise and signal should be < 1cps	No change
12.	The system should be capable of doing TDS Matrix (20 % or better) of pharmaceutical, food products and biological matrix samples with software controller argon dilution	No change

	system with humidifier sample precondition technology.	
Sample Introduction System		
1.	Sample introduction system should be composed of nebulizer and spray chamber that provides means of getting samples into the instrument.	No change
2.	Dedicated HF kit must be offered with separate injector, nebulizer, torch, spray chamber, tubing set and one set of Platinum cones.	No change
3.	Separate organic kit, torch, nebulizer and injector should be quoted along with the system.	No change
4.	A quartz ICP torch should be demountable, rugged and easy to maintain	No change
ICP Torch & RF Coil		
1.	Should be able to generate argon plasma which serves as source of the ICP-MS.	No change
2.	Instrument should have the capability to run pure reactive gas like O_2/CH_4/H_2/Ammonia as per system suitability complying the application requirement.	No change
3.	Quartz ICP torch should be short, rugged and easy to maintain and operation in hot screen mode must provide increase in sensitivity for all types of elements without affecting the mean background count rate.	No change
4.	Factory fitted Peltier cooled spray chamber with suitable temperature range as per system hardware requirement for food, pharma and environmental samples	Factory fitted Peltier cooled spray chamber with suitable temperature range as per system hardware requirement for food, pharma and environmental samples ***including DMSO.***
ICP-MS Interface		
1.	Instrument should have mass shift mode capability/mass filter mode/suitable mode	No change

2.	Should be able to link the atmospheric pressure to the high vacuum mass spectrometer.	No change
3.	The sampling and skimmer cones should provide high transmission and minimize condensation of sample matrix in the cone orifice or better.	No change
4.	Detection Limit ng/L (ppt) : Li or Be (low mass) < 0.5; In or Y (mid mass) < 0.25, U or Bi Or Ti (High Mass) :0.25 or better	No change
5.	Sensitivity Mcps/ppm: Li/Be (Low mass) :> 5 Mcps/ppm, Y/In (mid mass) >100 Mcps/ppm &Ti/Bi/U (High mass) >80.	No change
Ion Focusing System and Mass Analyser		
1.	The instrument should be able to remove polyatomic, isobaric and double charge interferences using mass shift mode/ mass filter mode/ suitable mode.	The instrument should be able to remove polyatomic, isobaric and double charge interferences using mass shift mode ***and mass filter mode or*** suitable mode.
2.	A high-performance quadrupole mass analyzer.	No change
3.	The mass range of the analyzer should be 2 to 260 amu or better	The mass range of the analyzer should be 2 to 260 amu or better with variable resolution with whole mass range
4.	Abundance sensitivity shall be, High mass < 5x 10^{-7} /0.5ppm	No change
5.	The mass stability should be at least 0.05u/8 hours or better.	No change
Detector		
6.	Counts individual ions exiting the quadrupole.	***Dual time of 100micro seconds***
7.	True Linear Dynamic Range: Minimum 11 orders or more	No change
Vacuum System		
1.	Should provide high vacuum for ion optics,	No change

	quadrupole and detector.	
2.	The spectrometer shall include an integral highly efficient turbo molecular pump.	No change
3.	The capacity of the pumping system ensuring a high-quality mass spectrum with good peak shapes and excellent abundances sensitivity.	No change
4.	The capacity of the pumping system shall enable the use of gases like Helium, Hydrogen, etc. in order to maximize instrument reliability and operator safely.	No change
5.	Vacuum system should be capable to reach operating vacuum from atmosphere	No change
Data Handling and System Controller		
1.	That controls all aspects of instrument control and data handling to obtain final concentration results.	No change
2.	Software diagnostics shall be provided to enable the electronic error file to interrogate locally or remotely via a modem link.	No change
3.	Provision of prevention of clogging and minimization of signal drift	No change
4.	Computer controlled, all solid state 34/27/40 Or suitable MHz ICP-MS source with output power 500 – 1600 watts or better	No change
Software and Hardware		
1.	Full remote diagnostics software to be included in the standard software package	No change
2.	Auto tuning to enable the instrument to be used with consistent and reproducible day-to-day performance, independent of the operator. The software must be capable of	No change

	running performance reports prior to acquiring data.	
3.	Matrix specific databases to provide preferred polyatomic interference selection following user entry or measurement of matrix elements, databases will also include interface correction equations.	No change
4.	Mixed scanning and peak hopping within a single acquisition shall be allowed enabling mixed calibrations such as- quantitative via external calibration/semi- quantitative, standard additions/ semi- quantitative	Mixed scanning and peak hopping within a single acquisition shall be allowed enabling mixed calibrations such as- quantitative via external calibration/semi- quantitative, standard additions/ semi- quantitative***. Isotope ratio and isotope dilution***
5.	Interference corrections should be available in all measurements modes to correct for polyatomic interferences. Elements required for interference correction should be added automatically to element menu. Equations should be user editable.	No change
6.	Independent Wi-Fi enabled Desktop computer to be provided (i7/i5 processor, 16GB RAM, 1 TB hard disk or better) for data analysis and 27 inch TFT/LED monitor. The system should also be provided with multi-function laser printer with scanning.	No change
7.	Laser jet multi-functional printer with high speed USB, wireless connect, up to 26 pages per minute and toner capacity 1200 pages or more for running the equipment and software.	No change
8.	License version of windows professional OS & MS-Office professional and driver with original CD.	License version of latest windows professional OS & latest MS-Office professional and driver with original CD. License version of adobe creative cloud
Microwave Digestion System (Make CEM		No change

Corporation / Milestone Srl / Anton Paar/from same brand of like ICP-MS) ***should be quoted as optional item.***		
1.	The company applying for tender should quote from the above mentioned companies.	No change
2.	24 Vessel for digestion or better	No change
3.	Temperature Control: IR	No change
4.	Liner Material: TFM	No change
5.	Volume Handled: 50ml or better	No change
6.	Maximum Pressure: 500psi/60 Bar or better	No change
7.	Maximum temperature 250 degree Celsius	No change
8.	Power Output: 1800 W or suitable	No change
9.	Fume hood should be quoted optional for micro digestion system for smooth functioning.	No change
10.	System should compliance with safety and emission compliance as per standards	No change
11.	Each vessel should have direct pressure control/direct temp control monitoring.	No change
12.	Application: bioanalytical, Plant materials, animal tissues, foods, fertilizers, feed grains, pharmaceuticals, someprecious metals and alloys, polyethelyene, propylene, and extractions, soils, mixed edible oils,polymers, and wastewater	No change
13.	SuprapureICPMS Grade Nitric Acid(20 Bottles 500ml each) to be provided with the system	No change
14.	Suprapure ICPMS Grade HF Acid, hydrogen peroxide, HCl and H2SO4 (one litereach) should be quoted with the system.	No change
15.	Test tubes (10mL and 20mL) to be provided with the system (1000 numbers each)	No change

16.	0.22 micron filters (2000 numbers) should be supplied with the system.	No change
17.	Sterile plastic syringes 1 mL, 2mL and 5mL should be supplied with the system (each 2000 numbers)	No change
Local Items		
1.	Gas cylinders - Argon (10 No.), He gases cylinder (02Nos), Reaction Gas cylinder for $CH_4/H_2/NH_3/O_2$ (minimum two cylinder), Regulators, Gas purification panels with fittings for supplied gases, 05 stage manifold for Argon gas, Brass double stage Regulators, Fume hood/Exhaust, tuning solution set (2 bottles of 100 mL)	Gas cylinders - Argon (10 No.), He gases cylinder (02Nos), Reaction Gas cylinder for $CH_4/H_2/NH_3/O_2$ (minimum two cylinder), Regulators, Gas purification panels with fittings for supplied gases, 05 stage manifold for Argon gas ***with automatic changeover system***, Brass double stage Regulators, Fume hood/Exhaust, tuning solution set (2 bottles of 100 mL)
2.	Premix oxygen cylinder for oxygen nebulisation to run the organic sample	**Omitted**
3.	20 KVA online UPS system with60 min backup of reputed make may be given for ICPMS and Microwave digestion system.	No change
4.	Four granite tables (1500 x 900 x 900 mm) for ICPMS with 2 Lab stools and rates should be quoted item wise.	No change
Consumables for ICPMS		
1.	Ni sampler and Skimmer cone for high sensitivity and high matrix/TDS (02 sets),	No Change
	Standard torch (02)	Omitted
	Oil Element /Mist Filter (01S et), standard Spray chamber (03 Set), standard Torch(single piece/demountable) (03 Set),Peristaltic pump tubing for drain Pk/12 (20 set), Peristaltic pump tubing for ISTD Pk/12 (03 Set)	Oil Element /Mist Filter (01S et), standard Spray chamber (03 Set), standard Torch(single piece/demountable) (03 Set),Peristaltic pump tubing for drain Pk/12 (20 set), Peristaltic pump tubing for ISTD Pk/12 (03 Set), ***peristalic pump tubing for sample (20 set.)***
	pumpoil 01 Ltr (01 sets)	pumpoil 01 Ltr (01 sets) ***or sufficient amount of oil should be quoted if applicable till the 3 years of the operation.***

	Screw, Spacer & O-ring for cell (03 Set), Tubing for drainage (03 set),	No Change
	RF coil or suitable (03Set)	RF coil or suitable (03Set) **up to the warranty period, if change is required.**
	Platinum Sample and skimmer cone for high sensitivity and high matrix/TDS (01 Set),	No Change
	Cone cleaning detergent (3 gallon), Swab-cotton tipped both ends (200 Nos , 3 sets) , alumina Powder (02set).	Cone cleaning detergent (3 gallon), Swab-cotton tipped both ends (200 Nos , 3 sets) , alumina Powder (02set) **up to the warranty period, if material is required.**
	Auto-sampler Vials 2000 Nos	No Change
	Glass vial 15mL and 50 mL (500 numbers each)	***PTFE or equivalent polymer*** vial 15mL and 50 mL (500 numbers each)
	Autosampler probe and Tubing set (01 Sets). NIST traceable multi-element calibration standard Bottle (10 µg/mL/100ml) Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cs, Cu, Fe, Ga, K, Li,Mg, Mn, Na, Ni,Pb, Rb, Se, Sr, Tl, V, Zn. Separate Bottle 10 µg/mL Hg (100 ml), Nebulizer (3 Nos),	No change
	Shield Torch (plasma lock technology or shield plate or any equivalent technology appropriate to respective vendor (2 Nos),	Shield Torch (plasma lock technology or shield plate or any equivalent technology appropriate to respective vendor (2 Nos) **up to the warranty period, if material is required.**
	Extraction Vessel (2 Nos)	***Omitted***
	Ion Lenses or equivalent accessory (3 Nos)	Ion Lenses or equivalent accessory (3 Nos), **up to the warranty period, if material is required.**
	Individual standard for Iron (1000µg/mL, 100mL), Calcium (1000µg/mL, 100mL), Magnesium (1000µg/mL, 100mL), Sodium (1000µg/mL, 100mL), Potassium (1000µg/mL, 100mL), Titanium (1000µg/mL, 100mL), Copper (10µg/mL, 2pckt HNO3, 100mL), Manganese (10µg/mL, 2pckt HNO3, 100mL), Arsenic (10µg/mL, 2pckt HNO3, 100mL),	Individual standard for Iron (***100µg/mL***, 100mL), Calcium (***100µg/mL***, 100mL), Magnesium (***100µg/mL***, 100mL), Sodium (***100µg/mL***, 100mL), Potassium (***100µg/mL***, 100mL), Titanium (***100µg/mL***, 100mL), Copper (10µg/mL, 2pckt HNO3, 100mL), Manganese (10µg/mL, 2pckt HNO3, 100mL), Arsenic (10µg/mL, 2pckt HNO3, 100mL), Cadmium (10µg/mL, 2pckt HNO3, 100mL),

	Cadmium (10µg/mL, 2pckt HNO3, 100mL), Chromium (10µg/mL, 2pckt HNO3, 100mL), Lead (10µg/mL, 2pckt HNO3, 100mL), Zinc (10µg/mL, 2pckt HNO3, 100mL), Mercury(10µg/mL, 5pckt HNO3, 100mL), Beryllium (10µg/mL, 2pckt HNO3, 100mL), Boron (10µg/mL, H_2O, 100mL) and Selenium (10µg/mL, 2pckt HNO3, 100mL)	Chromium (10µg/mL, 2pckt HNO3, 100mL), Lead (10µg/mL, 2pckt HNO3, 100mL), Zinc (10µg/mL, 2pckt HNO3, 100mL), Mercury(10µg/mL, 5pckt HNO3, 100mL), Beryllium (10µg/mL, 2pckt HNO3, 100mL), Boron (10µg/mL, H_2O, 100mL) and Selenium (10µg/mL, 2pckt HNO3, 100mL)
3.	All required accessories to analyze and run ICP-MS for single cell analysis should be quoted	No change
4.	Vendor should quote as per specifications. NIPER will provide only empty room with electrical connections. Vendors will have to make arrangements for all the suitable furniture with chair and other accessories for the successful operation of the equipment.	No change
5.	Free of cost at site minimum 2 weeks training for operating instrument at the time of installation.	No change
	There will be two trainings, installation training and after few months advanced application training. Apart from these two, there will be application training every six months (till warranty period) on a mutually convenient date.	***There will be 15 days' trainings after installation till the warranty period for advanced application as per NIPERG requirement at mutually convenient date. Single visit will be minimum of two days. This should be quoted as an optional item.***
6.	Warranty: Three Years from date of installation including UPS, microdigestion system, equipment, fume hood (exhaust hood) & Gas panels. Pre-Installation Requirement for operation of the ICP-MS must be clearly mentioned in the Offer. NIPER-G will provide blank room with electrical connections.	Warranty: Three Years from date of installation including UPS ***with battery***, micro digestion system, equipment, fume hood (exhaust hood) & Gas panels. Pre-Installation Requirement for operation of the ICP-MS must be clearly mentioned in the Offer. NIPER-G will provide blank room with electrical connections. Price details for additional five years of AMC after completion of three years of warranty and five years of AMC to be quoted.

7.	The system software should meet the 21 CFR part 11 compliance. Further it should enable for audit trails, electronic signatures and other GLP requirements. The required IQ, OQ, ***PQ*** needed should be generated during installation and operation by your service personnel with no cost from our side.	The system software should meet the 21 CFR part 11 compliance. Further it should enable for audit trails, electronic signatures and other GLP requirements. The required IQ, OQ needed should be generated during installation and operation by your service personnel with no cost from our side.
8.	Cost of accessories should be quoted item-wise separately.	No change
9.	Chiller (if required) with 5 L extra of coolant.	No change
10.	Certified reference materials (CRMs) for heavy metals in food (5 different matrices), pharmaceuticals (at least in two different matrices) and biological matrices (3 different matrices) as per the availability should be provided.	Certified reference materials (CRMs) for heavy metals in food (5 different matrices), pharmaceuticals (at least in two different matrices) and biological matrices (3 different matrices) as per the availability should be provided ***with mutual discussion about matrix type with NIPER-Guwahati authority/Indenter.***
11.	NIST traceable multi element standards-minimum 500 ml (2 Nos)	***Omitted***
12.	Solvent will be arranged by supplier for the smooth demonstration and qualification of the system.	No change
13.	**Manpower:** Manpower for 3 year PhD Pharmacy/Analytical Chemistry/Chemistry or M.Sc. (Analytical chemistry/chemistry) With 4 years' experience Prior experience in ICPMS/AAS handling preferable. Salary: Rs. 50,000/-consolidated per month.	**Manpower:** Manpower for 3 year PhD Pharmacy/Analytical Chemistry/Chemistry or M.Sc. (Analytical chemistry/chemistry) With 4 years' experience Prior experience in ICPMS/AAS handling preferable. Salary: Rs. 50,000/-consolidated per month **with 5% increment every year**