

PART 2

REQUIREMENT SPECIFICATIONS

1. SCOPE OF TENDER

The scope of this tender is for the Supply, Delivery, Installation, Commissioning, and maintenance of one unit of high performance liquid chromatograph mass spectrometer (the "Equipment") to the Department of biochemistry, National University of Singapore

The Equipment shall be delivered to: National University of Singapore, Centre for Life Sciences, 28 Medical Drive #03-03 Singapore 117456. The Contractor shall be fully responsible for all transport required (including costs and expenses thereof) for the delivery of the Equipment to the NUS' designated site.

2. TECHNICAL SPECIFICATIONS

The LC MS/MS Triple Quadrupole system shall include the following modules:

- Solvent Delivery System with Integrated Degasser
- Autosampler with cooler
- Multicolumn Thermostat
- Triple Quadrupole Mass Spectrometer System
- Software and Workstation
- Accessories

The triple quadrupole mass spectrometer and high performance liquid chromatography (HPLC) must be from single vendor to ensure seamless integration.

2.1 Solvent Delivery System with Integrated Degasser

- Instrument should be equipped with binary mixing solvent delivery system with Integrated Degasser binary mixing for high accuracy.
- Must support and function in the pH range of 1.0 – 12.5.
- Operating pressure range of the binary pump must be 1300 bar up to 2 mL/min and up to 800 bar with flow rate 5 mL/min.
- Flow precision: $\leq 0.07\%$ RSD or ≤ 0.02 min Standard Deviation (SD), whatever is greater.
- Flow accuracy: $\pm 1\%$ or 10uL/min whatever is greater.
- Must come with active seal wash, automatic purge valve.
- Gradient formation: up to 2 solvents.
- Composition precision: $<0.15\%$ RSD or 0.02 min SD, whatever is greater
- Composition accuracy: at least $\pm 0.35\%$
- The binary pump should come with lowest delay volumes down to 45 uL (10uL without mixer) for running ultrafast gradients.
- Comes with ultra clean tubing kit.
- Safety aids: Extensive diagnostics, leak detection, error detection via LED display and early maintenance feedback system

2.2 Autosampler with cooler

- The autosampler must come with flow through injection design with variable injection volume with 1300 bar.
- The injection linearity is 0.9999 in the range of 0.1 – 100 μ L.

- The auto sampler must have an injection volume range of 0.1 – 20 µL in 0.1 µl increments without any hardware changes
- Injection cycle time: < 10 seconds
- Providing cooling and heating in the range from 4 ° C - 40 °C, temperature settable 4 ° C - 40 °C in 1 °C increments.
- Able to accommodate shallow Micro Titer Plates; Deep well plates, 2 mL vial container.

2.3 Multicolumn Thermostat

- The temperature range is 4° C – 110 ° C.
- The temperature accuracy is $\pm 0.5^{\circ}$ C.
- The temperature precision is 0.05° C.
- Able to accommodate 4 X 30cm columns.
- Able to tighten the column without using any tools.
- Good Laboratory Practices (GLP) purposes: Early maintenance feedback (EMF) for continuous tracking of instrument usage with user-settable limits and feedback messages. Electronic records of maintenance and errors

2.4 Triple Quadrupole Mass Spectrometer System

- Minimum mass range: 10-3000 amu
- Scan speed of at least 17,000 Da/sec
- Nebulizer spray assembly orientated perpendicular to the axis of the ion source
- Should have an integrated divert valve to switch the LC flow to waste during void volume elution, gradient end-point and any other portion of analytical run
- Source elements and the desolvation capillary can be removed for cleaning without breaking vacuum.
- Built in calibrant delivery system with fully automated optimization of ion optics and mass axis calibration in positive and negative ion modes using a proprietary tune solution.
- Source elements including sampling capillary can be removed for cleaning without breaking vacuum.
- Mass stability: maximum ± 0.1 amu over 24 hrs; Mass resolution: minimum 0.7 Da with autotune
- Positive/Negative polarity switching must be less than 25 ms, in continuous mode during LC/MS and LC/MS/MS runs
- Fully automated optimization of ion optics and mass axis calibration

2.5 Electrospray Ionisation (ESI) Source

- Compatible with liquid flow rates of 1 µl/min to 2 ml/min without splitting
- The ESI source must be equipped with heater assembly for achieving efficient desolvation and increased efficiency of ionization
- Full gradient capability from 100% aqueous to 100% organic
- Sensitivity: for positive ESI, at least S/N 550,000:1 for 1pg reserpine on-column, transition m/z 609 to 195; for negative ESI, at least S/N 550,000:1 for 1pg chloramphenicol on- column, transition m/z 321 to 152.
- Optional Instrument sensitivity checkout achievable on installation with positive mode detection limit specification (IDL) >0.6 fg for 1fg of reserpine injected on column. (quantifying on the transition m/z 609 to 195)

2.6 Mass Analyzer

- Allows the following data acquisition modes: Q1/ Q3 MS scan, precursor scan, product ion scan, neutral loss/gain scan, multiple reaction monitoring (MRM) and selected ion monitoring (SIM), dynamic MRM or equivalent.
- Minimum dwell time of 0.5 ms
- LCMS start-up kit should be supplied as standard
- Comes with orthogonal (90 degree) curved collision cell reduce noise and footprint of the MS system.
- At least six orders of magnitude for linearity
- Detector operates in both positive and negative ion modes
- Has high energy conversion dynode and high-gain electron multiplier horn
- The high vacuum must be maintained by turbo-molecular pump. This pump should be backed by mechanical (rough) pump
- Should be delivered with enclosure to reduce the noise level of the mechanical pump
- 1 fg of reserpine injected on column, quantifying on the transition m/z 609 to 195 with Instrument detection limit (IDL) less than 0.75 fg for positive mode and 1 fg of chloramphenicol injected on column, quantifying on the transition m/z 321 to 152 with Instrument detection limit (IDL) less than 0.75 fg for negative mode.

2.7 Software and Workstation

Comes with standard workstation for acquisition and with additional 2 workstations. Total will be 3 workstations.

- The system must include a Windows®-based data acquisition and editing software package that incorporates a graphical user interface utilizing multi-pane windows for easy data acquisition and analysis
- Must be able to provide fully integrated control for both the ultra high-performance liquid chromatography (UHPLC) and the triple quadrupole mass spectrometer (MS/MS) system
- Has on-line help for instrument control programs as well as user manual in PDF file format
- The system must include a Windows®-based data acquisition and editing software package that incorporates a graphical user interface utilizing multi-pane windows for easy data acquisition and analysis
- It should cover digital instrument control, qualitative and quantitative processing, report creation, self-diagnosis and auto- tune.
- Auto tuning with sensitivity and resolution optimization for both positive ion and negative ion should be standard.
- Capable of tuning for electrospray (ESI) in positive and negative ion modes
- Software control of MS tuning parameters of all scan, SIM, MRM and linked, all tune files can be stored as part of a method. Positive and negative autotune modes, autotune can be customized
- The software should have Auto MRM optimization tool for fast & easy method development which includes determination of MRM transition and MS parameter optimization for each transition. All the information should be stored as a database for future use. Manual optimization using must be available as an option.
- MRM ion table can associate name to ion and internal standard

- Dynamic/Scheduled MRM function with automatic maximization of dwell time
- The self-diagnosis feature of the software should enable diagnosis of the mass spectrometer and all connected LC units.
- Method file should be capable to save all analysis parameters, data processing parameters and report format.
- Auto Start up and shutdown of the MS should be possible using a single key operation.
- Sample schedule wizard function should be standard

2.8 Installation

- The contractor shall provide all necessary test equipment, instruments and labor for the delivery, installation, testing and commissioning of the proposed system.
- Prior to system commissioning, the contractor shall be fully and solely responsible for every aspect of the successful implementation of the systems by the completion date as specified.
- Site survey must be conducted by the vendor and a site survey report must be produced by the vendor at no extra cost. In case where the site doesn't meet the required specification, recommendations about how to improve must be clearly suggested in the report by the vendor.

2.9 Warranty

Manufacturer's warranty on system must be a minimum of 12 months. Warranty must only commence upon completion of full installation and commissioning. Warranty must cover all consumable and non-consumable parts and labor with complete support.

2.10 Safety Features

The instrument should have undergone testing under the Consumer Protection Safety Requirements and bear the Safety Mark for use in Singapore

3. OTHER REQUIREMENTS

3.1 Utilities Requirement

Utilities requirement for the system should be specified in detail in the tender submission. The tenderer is required to be accurate and specific in specifying all the equipment consumption and emission ratings (for example, electrical input current rating, water supply, compressed air supply, exhaust ratings, etc., where applicable).

3.2 Safety Requirements

At all times in its performance of the works described above, the Contractor shall comply with all safety rules and regulations stipulated by the relevant authorities as well as and in accordance with industry best practices. At all times in its performance of the works described above, the Contractor shall possess and maintain (and shall ensure all its employees or contractors performing the works shall possess) all relevant certificates and permits required under law for its performance of the works described in above, including any certificates or legal documents required by NUS. Tenderers are to submit all relevant certificates and permits required under law as part of tender submission, and during the period of

the Contract, shall provide copies of such certificates at NUS' request from time to time.

3.3 Factory Acceptance Test (FAT)

- a) The Tenderer should provide as part of its tender submission the factory acceptance test protocol as recommended by the manufacturer so as to demonstrate full compliance to the Specifications. NUS reserves the right to amend the protocol as it deems necessary. The Tenderer agrees to perform the acceptance test as agreed, to the satisfaction of NUS.
- b) Factory Test Acceptance Test Criteria. The factory acceptance test shall include, but not limited to:
 - i. all the parameters routinely tested by the manufacturer
For example: Sensitivity, Positive ESI, the measured signal-to-noise ratio [RMS] obtained from the chromatogram monitoring the transition m/z 609 to m/z 195 on injection of 1 pg of Reserpine should be more than or equal to 1,500,000:1, based on a 1- μ L injection of a 1 pg/ μ L Reserpine solution in 70:30 Acetonitrile/Water (no additives), at a flow rate of 400 μ L/min in MRM mode.
 - Sensitivity, negative ESI, the measured signal-to-noise ratio [RMS] obtained from the chromatogram monitoring the transition m/z 321 to m/z 152 on injection of 1 pg of Chloramphenicol should be more than or equal to 1,500,000:1, based on a 1- μ L injection of a 1 pg/ μ L Chloramphenicol solution in 70:30 Acetonitrile/Water (no additives), at a flow rate of 400 μ L/min in MRM mode.

3.4 Delivery (applicable if supplier's incoterms is not DDP)

DAP (Delivered At Place; Incoterms 2010) to National University of Singapore. The Contractor shall be fully responsible for all transport required for the delivery of the Goods to NUS designated site. The Contractor shall also arrange for all insurance required including coverage for loss of or damage to the Goods during conveyance or transportation to NUS designated site, at no additional cost and expense to NUS.

3.5 Price

- a) Pricing shall include freight and insurance to the delivery location.
- b) All software to enable the proper functioning and use of the system to meet the requirements of NUS will be supplied together with the equipment. The license fees for all software shall be included within the Contract price. Contractor and/or its software licensor shall grant and NUS shall have the perpetual right and licence to use the software and such right and license shall be transferable upon the transfer or sale of the system.

3.6 Export and Import licenses (if applicable)

Export / Import licenses if required, should be clearly indicated.

The Tenderer shall provide any export/import licenses to NUS as may be required. The Tenderer shall make its own arrangements regarding import and export licenses,

custom and import duties and all related matters from their manufacturing/production origination to the NUS designated site.

3.7 Site Preparation

The Tenderer shall provide in its tender submission the information with regard to the dimensions and weights of the various component parts of the system as well as any specific site or environmental requirements. Within one month of the award of tender, the Contractor shall supply to NUS such information and assistance as may be necessary to enable NUS to conduct site preparation for the installation of the system.

3.8 Installation, Commissioning and Training

a) Installation

Equipment should be installed without disruption to normal operations. The Contractor shall warrant that upon its delivery and installation, each item of the system shall be in good working order and will conform to the Requirement Specifications and the Contractor's official published specifications. The Contractor shall provide all tools and equipment necessary for the installation of the system at no additional charge.

b) Commissioning

Equipment commissioning should be carried out for full functionality of hardware, software and process.

c) Training

Training should be carried out after the commissioning of the equipment for at least 4 personnel. The training should cover software and hardware operation, as well as the standard maintenance requirements.

3.9 Site Acceptance Test (SAT)

a) The Site Acceptance Test is to be inspected by 1 personnel from NUS.

b) The Tenderer should provide as part of its tender submission the Site Acceptance Test protocol as recommended by the manufacturer so as to demonstrate full compliance to Specifications. NUS reserves the right to amend the protocol as it deems necessary. The Tenderer agrees to perform the acceptance test as agreed, to the satisfaction of NUS.

c) Site Acceptance Test Criteria. The site acceptance test shall include, but not limited to:

- i. Please refer to the FAT in section 3.3

3.10 Documentation

a) Three (3) sets of operation and maintenance service manuals in English should be provided.

b) One (1) set of Factory Acceptance Test report in English (softcopy) shall be submitted within 60 working days upon satisfactory completion of factory acceptance test.

- c) One (1) set of Site Acceptance Test report in English (hardcopy and softcopy) shall be submitted within 7 working days upon satisfactory completion of site acceptance test.

3.11 Support and Maintenance

- a) The Tenderer should provide on-time support for system maintenance, software and hardware troubleshooting. "On-time support" refers to response/help within 24 hours after NUS calls or email; or, if actual physical support at NUS's site is required, it is attendance within 3 business days if system fails to be back into operation with remote support.
- b) Tenderers shall ensure availability of critical spare parts and consumables for at least 5 years. A list of recommended preventive maintenance guidelines shall be provided as part of the tender documentation. Back up equipment support for testing must be available at the supplier's facility during equipment breakdown.

3.12 Warranty

The system should have a minimum 12 months on-site comprehensive warranty. The warranty shall include unlimited service calls, all cost of repairs, including but not limited to spare parts, consumables, labour, transport and accommodation. The warranty period shall commence upon satisfactory completion of the Site Acceptance Tests.

3.13 Track Record

Tenderers shall provide track records and references of past projects for similar system installations in the past 3 years.

For clarifications on technical specifications listed herein, tenderers may contact:

Name : Dr Sartaj Ahmad Mir
Email : bchsam@nus.edu.sg

EVALUATION CRITERIA

The following criteria will be used in the evaluation of this tender.

1. Critical Criteria:

Tenderers must satisfy the following critical criteria before their tender proposal will be further evaluated:

- a) Tenderers shall not be debarred from participating in NUS tenders or after the closing date of the tender

2. Other Criteria:

Tenders shall be evaluated based on a Price versus Quality matrix of 40% (Price) to 60% (Quality).

Tender Evaluation Criteria		
Price	Cost Competitiveness	40%
Quality	Level of Compliance with Requirement Specifications	40%
	Level of Compliance with Other Requirements	15%
	Possess a valid registration certificate with the appropriate Government Registration Authority (EPU/LAB/30, S5 or higher), or equivalent	3%
	Track record for past 3 years	2%
	Total	100%