



**NATIONAL CENTER FOR COMBUSTION RESEARCH
AND DEVELOPMENT (NCCRD)
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI – 600036, INDIA**

Ref. No. ICS/11-12/013/DSTX/TSUN

Date: 7 Mar. 2014

Due date: 28 Mar. 2014

Item name: GEL PERMEATION CHROMATOGRAPH

1. Quotations are invited in duplicate for the items shown overleaf (in Annexure I). The quotations duly sealed and superscribed on the envelope with reference no. and due date, should be addressed to the undersigned so as to reach on or before the due date mentioned above.
2. The quotations should be valid for sixty days from the due date and the period of delivery required should also be clearly indicated.
3. The total cost of the equipment in terms of CIP Chennai should be clearly mentioned.
4. Terms of warranty and guarantee should be explicitly mentioned.
5. Packing and delivery charges, customs and clearance duty should be clearly stated.
6. Goods shall not be supplied without an official supply order.
7. Local firms : Quotations should be for free delivery to this institute. If quotations for ex-godown delivery charges should be indicated separately.
8. Firms outside Chennai: Quotations should be for F.O.R. Chennai. If F.O.R. consignor station, freight charges by passenger train / lorry transport must be indicated. If ex-godown, packing, forwarding and freight charges must be indicated.
9. The rate of sales / general taxes and the percentage of such other taxes legally leviable and intended to be claimed should be distinctly shown along with the price quoted. Where this is not done, no claim for sales / general taxes will be admitted at any stage and on any ground whatsoever. The taxes leviable should take into consideration that we are entitled to have Concessional Sales Tax (CST) applicable to non-government educational institutions run with no profit motive for which a concession sales tax certificate will be issued at the time of final settlement of the bill.
10. Payment : Specify the mode of payment and if advanced payment has to be made. Every attempt will be made to make payment within 30 days from the date of receipt of bill / acceptance of goods, whichever is later.
11. IIT Madras is exempt from payment of excise duty and is eligible for concessional rate of customs duty. Necessary certificate will be issued on demand.
12. IIT Madras has the right to accept the whole or any part of the tender or portion of the quantity offered or reject it in full without assigning any reason.
13. In case of any queries/clarifications, please contact Dr. R. Vinu, Dept. of Chemical Engineering, IIT Madras, Chennai, Ph. +91-44-22574187, E-mail: vinu@iitm.ac.in.
14. The sealed quotation may be sent to

Prof. S. R. Chakravarthy

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Annexure I

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Specifications for GEL PERMEATION CHROMATOGRAPH

Scope: Gel permeation chromatograph (GPC) with Refractive index (RI) and UV detectors for the determination of molecular weight distribution of water soluble and organic soluble polymers, biomasses and lignin.

Principle: Separation of polymers according to molecular size as they pass through a column packed with particles of different sizes

Pump: double plunger reciprocating type, only isocratic mode, should be upgradeable to gradient mode at a later time

Delivery – constant pressure or constant flow rate, should be selectable

Flow rate range – 0.001 mL/min to 10 mL/min in 0.001 mL/min increments

Flow accuracy – $\pm 1\%$ of set value

Flow precision – $<0.1\%$ RSD

Max. operating pressure – 500 bar

Desired feature: inbuilt degasser

Injector: Six port Rheodyne 7725i or higher version, 20 μ L sample loop to be pre-fitted, 50 μ L loop to be separately provided, injector should be properly mounted

Column oven: Temperature controller should be PID, max. temperature – 80 $^{\circ}$ C, temperature accuracy - ± 0.1 $^{\circ}$ C

Detector:

(1) RI detector

- RI range – 1.00 to 1.75 RIU, pre-calibrated
- Measurement range – $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 4, 8, 16, 32, 64, 128, 256 and 512×10^{-6} RIU/full scale
- PID control of flow cell temperature should be possible
- Drift – $<8 \times 10^{-5}$ RIU/hr
- Linearity – 5×10^{-4} RIU



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(2) UV detector

- a. Wavelength range – 190 to 600 nm
- b. Wavelength accuracy – ± 1 nm
- c. Wavelength reproducibility – ± 0.1 nm

Columns: Column make should be PL Gel / Shodex / TSK Gel / Waters (size: 250 mm \times 4.6 mm \times 5 μ or equivalent)

Linearly calibrated columns are desirable, Suitable guard column should be provided

Column 1: For the analysis of lignin in biomasses

Column 2: PL Gel MIXED column or equivalent; For synthetic polymers like polystyrene, poly(methyl) methacrylates, etc.

Autosampler: Not required

Software: Data acquisition should start automatically after the sample is manually injected, capable of using two detectors simultaneously (desired feature), capable of integrating multiple peaks, custom set the baseline according to requirement, calibration and concentration determination, provide software CD with detailed documentation

GPC molecular weight determination software – should be quoted separately as an option

Computer: Not required (will be procured by IIT Madras)

Accessories: Provide atleast 7 polystyrene narrow standards from 1000 – 2000000 Da, solvent bottles, PEEK and SS tubings, fittings (nuts, ferrules), VALCO inline filter with frits, Syringe (25 μ L and 100 μ L)

Power: 230 V, 50/60 Hz, power socket – Indian type