



भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati

OFFICE OF THE DEAN OF
INDUSTRIAL INTERACTIONS AND
SPECIAL INITIATIVES

Mr. Labanu Kishore Konwar
Assistant Registrar

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NIQ Ref. No. IITG/IISI/24-25/T19

• To

• Date: 14.06.2024

All interested vendors

SUBJECT: NOTICE INVITING QUOTATION FOR SUPPLY & INSTALLATION OF PILOT MEMBRANE DISTILLATION FOR THE DEPARTMENT OF CHEMICAL ENGINEERING (PROJECT NO. XCLEISPDST00985XXSS104), IIT GUWAHATI.

Dear Sir/ Madam,

The Director, Indian Institute of Technology Guwahati, invites quotations for supply and installation of Pilot Plant Membrane Distillation as per details mentioned in the **CHECK- LIST** attached herewith. The quotation in **double bid [Details as per Check List]** is to be submitted in sealed envelopes to the undersigned on or **before 05/07/2024**.

Please note -

- Tender document is divided into two parts i.e. (1) Instruction to Bidders and (2) Terms & Conditions;
- There is no Tender fee and Tender document is to be downloaded from our website given below.
https://www.iitg.ac.in/iitg_tenders_all / NIQ for II&SI
- Duly filled, signed and sealed copy of 'Statement of Compliance to essential Terms & Conditions' and Technical Bid must be submitted along with the quotation.
- The bid documents are not transferable and the seal and signature of the authorized official of firms must appear on all the papers and envelopes submitted.

Kindly read both the Instructions and Terms properly and see that instructions and terms are fully understood and complied. No correspondence shall be entertained in case your quotation is rejected on ground of not complying with our instructions, terms and conditions. In case of doubt please contact us at 0361 258 2948 or the Principal Investigator at 0361 258 3527.

Thanking you.

Yours Sincerely,

सहायक कुलसचिव, औद्योगिक सहभागिता एवं विशेष पहल
Assistant Registrar, Industrial Interactions & Special Initiatives
भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati
गुवाहाटी, असम 781039
Guwahati, Assam 781039

INSTRUCTION TO BIDDERS

- A) Important Date and Time:
- (i) Last date & Time of receipt of Tender : **05/07/2024, (1700 HRS)**
 - (ii) Time of opening Tender : **09/07/2024**
 - (iii) Venue of Bid opening : **Department of Chemical Engineering, IIT Guwahati.**
- B) Quotations will have to be submitted in a **DOUBLE Bid** [Details as per CHECK - LIST]. The address of the firm submitting the quotation and the Officer to whom the quotation is addressed must appear distinctly on sealed covers. Further, on sealed cover, the following are to be written:

<p><u>QUOTATION FOR SUPPLY & INSTALLATION OF PILOT PLANT MEMBRANE DISTILLATION FOR THE DEPARTMENT OF CHEMICAL ENGINEERING (PROJECT NO. XCLEISPDST00985XXSS104), IIT GUWAHATI</u></p> <p>LAST DATE OF SUBMISSION: 05/07/2024</p> <p>NIQ Ref. No. IITG/IISI/24-25/T19</p> <p>To,</p> <p style="text-align: right;">The Assistant Registrar Industrial Interactions And Special Initiatives Indian Institute of Technology Guwahati Guwahati 781 039, Assam, India.</p> <p>From: M/s _____</p> <p>Phone No.: _____</p> <p>Email ID : _____</p>

- C) **Submission of Compliance Certificate:** Duly filled and signed Compliance Certificate (as per format at **ANNEXURE I**) must be enclosed.
- D) **Bid not transferable:** The bid documents are not transferable and the seal and signature of the authorized official of the firm's must appear on all the papers and envelopes submitted.

TERMS & CONDITIONS:

(Please note the term 'both foreign & indigenous' wherever mentioned means the term is applicable to both foreign & indigenous purchase)

01. **Rates:** Rates quoted for indigenous items should be on **FOR IIT Guwahati, on DOOR DELIVERY basis**, with break-ups as per details below (**For import items please refer 'Additional Terms for imported goods' below**).

	Particulars	Rate
I	Basic Price (Ex work)	
II	GST	
III	Transportation charge up to IITG premises	
IV	Transit Insurance covering All Risk up to 10 days after delivery	
V	Installation & Commissioning Charge, if any	
VI	Grand total on door delivery at IIT Guwahati	
VII	Annual Maintenance Contract rate (after expiry of warranty period)	

Note: Vague terms like "packing, forwarding, transportation etc. extra" without mentioning the specific amount will not be accepted. Such offers shall be treated as incomplete and rejected. Bidders shall indicate their rates in clear/visible figures as well as in words and shall not alter/overwrite/make cutting in the quotation. In case of a mismatch, the rates written in words will prevail.

02. **Validity of Quotation:** Quoted rates must be valid for **120 days** from the last date of submission of quotation.
03. **Warranty:** The pilot scale membrane distillation unit must be warranted for a minimum for a period of 12 months from the date of successful installation and commissioning. All corrective actions during warranty period shall be completed at no additional cost to IIT

Guwahati. The supplier is required to initiate corrective actions within 10 days to repair or replace the defective materials or components after intimation.

04. **Literature a must:** All the quotations must be supported by the printed technical leaflet/literature and the specifications mentioned in the quotation must be reflected/ supported by such printed technical leaflet/ literature. The model and specifications quoted should **invariably be highlighted** in the leaflet/literature for easy reference.
05. **After Sales Service:** In case of imported goods, vendors should clearly state the available nearest after sales service centre and detail address in India, without which their offers shall be liable for rejection.
06. **Dealership Certificate:** Dealers or Agents quoting on behalf of Manufacturer must enclosed valid dealership certificate.
07. **Quality Certificates:** Valid certificate to prove that the products are genuine and of International standard, as mentioned below, must be enclosed:
(a) Manufacturer's certificate.; (b) ISO/ISI certificate.
08. **Performance Bank Guarantee:** In case of quotations having quoted value Rupees five lacs (INR 5,00,000/-) and above, the successful bidder shall furnish an unconditional Performance Bank Guarantee (as per format at **ANNEXURE II**) valid till 60 days after the warranty period from a scheduled Bank of India for 3% of the Purchase Order value within 21 days of placement of order. Where the performance bank guarantee is obtained by a foreign bank, it shall be got confirmed by a Schedule Indian bank and shall be governed by Indian Laws and be subject to the jurisdiction of courts at Guwahati. In exceptional case or on the request of the Indenting Officer competent authority may allow starting of PBG Period from the date of installation, in which case submission of PBG valid till 60 days after the warranty period may be made within 21 days from the date of installation.

The Performance Bank Guarantee (PBG) guarantees that,

- (a) The Vendor guaranteed satisfactory operation of the Equipment & components against poor workmanship, bad quality of materials used, faulty designs and performance.
 - (b) The Vendor shall at his own cost rectify the defects/replace the items supplied, for defects identified during the period of guarantee.
 - (c) This guarantee shall be operative from the date of installation till 60 days after the warranty period.
09. **Delivery:**
- a) **Time Limit:** Maximum within 90 (Ninety days) days from the date of issue of purchase order.
 - b) **Safe Delivery:** All aspects of safe delivery shall be the exclusive responsibility of the vendor. At the destination site, the package will be opened only in the presence of IIT user/representative and vendor's representative. The intact condition of the package and the seal/indicators for not being tampered with shall form the basis for certifying the receipt in good condition.
 - c) **Insurance:** The supplier is to establish 'All Risk Transit Insurance' coverage till door delivery at IIT Guwahati.
 - d) **Part Delivery:** Part delivery is not allowed.
 - e) **Penalty Delay delivery:** The date of delivery should be strictly adhered to otherwise the Director, IITG reserves the right not to accept delivery in part or full.
10. **Genuine Pricing:** Vendor is to ensure that quoted price is not more than the price offered to any other customer in India to whom this particular item has been sold, particularly to IIT/Institutes and other Government Organization. Copy of the latest price list for the quoted item, applicable in India, must be enclosed with the offer.
11. **Conditional tenders not acceptable:** All the terms and conditions mentioned herein must be strictly adhered to by all the vendors. Conditional tenders shall not be accepted on any ground and shall be rejected straightway. Printed conditions mentioned in the tender bids submitted by vendors will not be binding on IITG.
12. **Goods and Service Tax (GST):**
- (a) Up-to-date Sales Tax clearance certificate, **GST Registration** number of the firm will have to accompany the quotation.
 - (b) GST Deduction at source as per Order/ notification of the Govt.
 - (c) GST No of IIT Guwahati is 18AAAJI0130P1Z8
 - (d) HSN/SAC No of the items must be clearly mentioned in the quotation along with GST No.
 - (e) **As per Notification No. 45/2007- Central Tax (Rate) dated 14.11.2017 and 47/2017-Integrated Tax (Rate) dated 14.11.2017, issued by Ministry of Finance, IIT Guwahati will avail 5% GST rate, on the items, as mentioned in the**

Notification.

13. **Late and delayed tender:** Late and delayed tender will not be considered. In case any unscheduled holiday occurs on the prescribed closing/opening date the next working day shall be the prescribed date of closing/opening.

14. Payment:

(a) 30% of the price will be paid in advance against equivalent bank guarantee from a scheduled bank provided by the supplier. The remaining 60% shall be released only after receipt and acceptance of materials in good condition and 10% after satisfactory installation and commissioning of the equipment.

OR

(b) 90% Payment against completion of factory acceptance tests and delivery and 10% payment after successful installation and/ or commissioning of the ordered goods at site.

15. PENALTY FOR DELAYED DELIVERY:

In case of supply order for the scientific equipments/ apparatus, the date of delivery should be strictly adhered to. In the event of delayed delivery, installation & commissioning i.e. after the expiry of the period as agreed by both the parties, the vendor shall be liable for a penalty deduction at a percentage of the value of the undelivered equipment subject to a maximum of 10% (ten percent) as detailed below:

@1% up to one week;

@2.5% up to two weeks;

@5% up to three weeks;

@10% for four weeks and above

For the purpose of this clause, part of the week is considered as a full week. In case of delayed delivery, the Director, IIT Guwahati reserves the right not to accept the subject consignment.

16. **Enquiry during the course of evaluation not allowed:** No enquiry shall be made by the bidder(s) during the course of evaluation of the tender till final decision is conveyed to the successful bidder(s). However, the Purchase Committee or its authorized representative (IIT Guwahati) can make any enquiry/seek clarification from the bidders. In such a situation, the agency shall extend full co-operation. The bidders may also be asked to arrange demonstration of the offered items, in a short period notice, as such the bidders have to be ready for the same.

17. The acceptance of the quotation will rest solely with the Director, IITG, who in the interest of the Institute is not bound to accept the lowest quotation and reserves the right to himself to reject or partially accept any or all the quotations received without assigning any reasons.

18. Force Majeure:

If the performance of the obligation of either party is rendered commercially impossible by any of the events hereafter mentioned that party shall be under no obligation to perform the agreement under order after giving notice of 15 days from the date of such an event in writing to the other party, and the events referred to are as follows:

I) any law, statute or ordinance, order action or regulations of the Government of India,

II) Any kind of natural disaster, and

III) Strikes acts of the Public enemy, war, insurrections, riots, lockouts, sabotage.

19. **Termination for default:** Default is said to have occurred

(a) If the equipment or any of its component is found having poor workmanship, faulty designs, poor performance and bad quality of materials used.

(b) If the supplier fails to deliver any or all of the services within the time period(s) specified in the purchase order or any extension thereof granted by IIT.

(c) If the supplier fails to perform any other obligation(s) under the contract.

(d) Under the above circumstances IIT may terminate the contract / purchase order in whole or in part and forfeit the PBG as applicable. In addition to above, IIT may at its discretion also take the following actions: IIT may procure, upon such terms and in such manner, as it deems appropriate, goods similar to the undelivered items/products and the defaulting supplier shall be liable to compensate IIT for any extra expenditure involved towards goods and services obtained.

20. **Applicable Law:**

- (a) The contract shall be governed by the laws and procedures established by Govt. of India and subject to exclusive jurisdiction of Competent Court and Forum in Guwahati or India only.
- (b) Any dispute arising out of this purchase shall be referred to the Director IIT Guwahati, and if either of the parties hereto is dissatisfied with the decision, the dispute shall be referred to the decision of an Arbitrator, who should be acceptable to both the parties, to be appointed by the Director of the Institute. The decision of such Arbitrator shall be final and binding on both the parties.

ADDITIONAL TERMS FOR IMPORTED GOODS

Following terms besides the fore mentioned terms will be applicable in case of foreign purchases:

21. **Rates:** Prices quoted must be for destination including freight and insurance charges inclusive of **delivery up to the door of department/centre IIT Guwahati premises**, as per details below.

(a)	Particulars	Rate
I	Basic Price (Ex work)	
II	FCA/FOB dispatch port,	
III	Total CIP/CIF Kolkata	
IV	CIP IIT Guwahati Price (Freight and Insurance charge from Kolkata to IIT Guwahati)	
V	Grand total on door delivery at IIT Guwahati	
(b)		
VI	Installation & commissioning charge if any	
VII	Custom duty (Approximate)	
VIII	Agency Commission if any	
IX	Annual Maintenance Contract rate (after expiry of warranty period)	

Note:

- (i) *Vague terms like "packing, forwarding, transportation etc. extra" without mentioning the specific amount will not be accepted. Such offers shall be treated as incomplete and rejected. Bidders shall indicate their rates in clear/visible figures as well as in words and shall not alter/overwrite/make cutting in the quotation. In case of a mismatch, the rates written in words will prevail.*
- (ii) *Rate of Foreign Exchange shall be the rate prevailing on the date of quotation opening.*

22. **After Sales Service:** In case of imported stores, foreign manufacturing firms should indicate facilities available for after sales service in India without which their offers are liable to be ignored.

23. **Delivery:**

- (a) Delivery of goods at IIT Guwahati, will have to be maximum within 95(ninety-five) days from the date of issue of the Purchase Order.
- (b) **Delivery at IIT Guwahati only.**
- (c) While transshipment will be allowed, part shipment will not be allowed.

24. **Payment:**

- (a) **Above INR 5 Lacs:** By an irrevocable letter of Credit at CIF/CIP Kolkata value negotiable through any overseas branch of State Bank of India/ AXIS Bank with unrestricted provision.
- (b) **Below INR 5 Lacs by FDD/Wire Transfer as given below:**
- (i) **Advance payment Against Bank Guarantee:** 90% of the price will be paid in advance **against equivalent bank guarantee** from a scheduled bank provided by the supplier/Indian Agent. The remaining 10% shall be released only after receipt and acceptance of materials in good condition or after satisfactory installation and commissioning of the equipment.
- or**
- (ii) **Payment Against Proof of Despatch:** 90% of the price will be paid against receipt of proof of dispatch such as AWB, Invoice, Packing List, Insurance certificate, etc. The remaining 10% shall be released only after receipt and acceptance of materials in good condition or after satisfactory installation and commissioning of the equipment.

or

(iii) **100% Payment Basis:** On request by the supplier/s 100% payment by FDD will be made. In this case on receipt of your Order Acknowledgement an FDD will be established for total ordered value, thereupon, a Xerox copy of the FDD will be sent to you which will enable you to send the materials. On satisfactory receipt and acceptance of the materials or satisfactory installation and commission of the equipment the Original FDD will be sent to you.

Note: Please note FDD/LoC will not be opened unless and until Letter of Acknowledgement in original is received at IIT Guwahati, directly from the principal (Even in case of firms having subsidiary office in India). The Indian agents are therefore advised to submit quotation after consultation with their respective principals).

26. **Customs Duty:** The Institute is generally **exempted** from payment of Customs Duty vide GOI Notification No.51/96-Customs, dated 23.07.96, with Regn. No. TU/V/RG-CDE (351)/2006, dated 14.09.2006. [CUSTOMS DUTY EXEMPTION CERTIFICATE WILL BE MADE AVAILABLE BY THE INSTITUTE IN REGARD TO QUOTES IN FOREIGN CURRENCY ONLY [**NOT AGAINST QUOTES MADE BY A FIRM IN INDIAN CURRENCY, UNLESS THE CONCERNED FIRM IS A FOREIGN HOLDING COMPANY WITH 'FDI' CERTIFICATE ISSUED BY THE MINISTRY OF FINANCE, GOVT. OF INDIA**].

27. **Agency Commission:** The percentage of ex-works value to be paid to Indian agent in equivalent Indian currency as agency commission as applicable will have to be clearly stated in the quotation.

28. **After Sales Service:** For equipment to be imported the quotation will have to clearly state the available nearest after sales service centre and contact no. in India.

29. **Country of Origin:** While Country of Origin Certificate will not be insisted, the same however will have to be stated in the Original Invoice for payment through LoC.

30. **LoC Amendment:** LoC/FDD amendment charges due to mistake on the part of the supplier, if any, will have to be borne by the supplier.

31. **Materials Rejection:** IIT Guwahati reserves the right to reject any materials, components, or equipment supplied that do not meet the specified quality standards or technical specifications outlined in the NIQ document and as per final PO. Except any modification in PO has agreed due to manufacturing difficulties with IIT Guwahati after PO issuances. Rejected materials must be replaced by the supplier at no additional cost to IIT Guwahati, including all associated shipping and handling expenses.

32. **Subletting of Work:** If the supplier intends to subcontract the manufacturing of any sub-components of the items specified in this Notice Inviting Quotation (NIQ) for the Supply and Installation of Batch Pyrolysis Reactor and Continuous Pyrolysis Reactor, then IIT Guwahati reserves the right to obtain information on the subcontracting party, including their details and reputation.

33. **Intellectual Property Rights Notice:** The work outlined in this Notice Inviting Quotation (NIQ) for the Supply and Installation of Batch Pyrolysis Reactor and Continuous Pyrolysis Reactor encompasses intellectual property rights that are owned by IIT Guwahati. Accordingly, suppliers are required to enter into a Non-Disclosure Agreement (NDA) to access the comprehensive design of the system described in this project. Furthermore, suppliers must verify that all sub-components utilized in the construction of these bench/lab scale reactors, as detailed in the NIQ, do not violate any intellectual property rights held by third parties.

34. **Training and Documentation:** Suppliers must provide comprehensive training to s personnel on the operation, maintenance, and safety procedures of the supplied reactors. Additionally, detailed documentation, including user manuals, installation guides, and maintenance protocols for complete system, must be provided in both digital and printed formats.

35. **Pre-qualification Criteria:**

Previous Performance: Specify that bidders must have successfully executed projects involving the supply and installation of equipment similar in complexity and technology to reputable public or government institutions. It should be noted that bidders must demonstrate a track record of supplying equipment to esteemed institutions such as IITs, NITs, CSIR labs, or other recognized government research organizations.

Years of Operation: The vendors should have been engaged for a minimum of 5 years in the manufacturing and supply of the similar type of reactor, indirectly verifying their financial stability and industry experience.

Technical and Service Capabilities: Vendors should have technical expertise in equipment manufacturing and servicing,

encompassing in-house engineering proficiency, post-sales support, and the availability of spare parts.

Turnover Requirement: 2 crore INR minimum annual turnover for past three years

*If required, the bidder will be asked to provide online technical presentations while opening technical bids.

The following documents should be submitted by the bidders to fulfill the pre-qualification criteria:

- A list of projects involving the supply and installation of equipment similar in complexity and technology to the reactor, along with purchase order copies, completion/handover certificates, detailed case studies or reference projects showcasing client feedback or performance certifications.
- A certificate of incorporation or registration of the vendor, indicating the date and place of establishment and the nature of business.
- Audited financial statements for the past three years, showing the annual turnover, profit and loss, and balance sheet.
- A technical brochure or catalogue of similar equipment supplied previously, detailing its specifications, features, and benefits.
- A declaration of warranty and after-sales support, specifying the terms and conditions, duration, and scope of coverage.



Asstt. Registrar (II&SI)

**Encl.: CHECK LIST
Encl.: ANNEXURE**

CHECK – LIST

FOR THE DEPARTMENT OF CHEMICAL ENGINEERING (PROJECT NO. xCLEISPxDST00985xxSS104):

<u>S.N.</u>	<u>Item Name & NIQ Ref. No.</u>	<u>Bid Type</u>
<u>01</u>	<i>Item: Pilot Plant Membrane Distillation Qty: 01 Details: As per description in Annexure III</i>	<u>DOUBLE Bid</u>

ANNEXURE -I

COMPLIANCE CERTIFICATE

(A certificate of compliance to NIQ term to be enclosed in the Technical bid)

SI. No.	NIQ Terms and Conditions	Yes/No
01	Rate quoted as per instruction	
02	AMC rate after warranty provided	
03	Validity of quoted rate for 120 days agreed	
04	PBG term agreed	
05	Payment term agreed	
06	Delivery terms agreed	
07	Warranty period agreed	
08	Literature: Printed Literature provided	
09	Dealership / distributorship certificate (in case of dealers/agents) provided	
10	Sales Service :address of after Sales Service centre in India provided	
11	Manufacturer certificate provided	
12	ISO/ ISI certification provided	
13	Applicable law terms agreed	
14	Pre-qualification Criteria	
.	Previous Performance	
.	Years of Operation	
.	Technical and Service Capabilities	
.	Turnover Requirement	

Sign. :.....

Vendor : M/s.....

Official seal of the vendor

ANNEXURE - II

PERFORMANCE BANK GUARANTEE

To:

Registrar,
Indian Institute of Technology,
Guwahati- 781 039

WHEREAS (Name of Supplier) hereinafter called "the Supplier" has undertaken, in pursuance of Contract No:, dated: 20... to supply (Description of Goods and Services) hereinafter called "the order".

AND WHEREAS it has been stipulated by you in the said order that the Supplier shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with the Supplier's performance obligations in accordance with the order.

AND WHEREAS we have agreed to give the Supplier a Guarantee:

THEREFORE, WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Supplier, up to a total of (Amount of the Guarantee in Words and Figures) and we undertake to pay you, upon your first written demand declaring the Supplier to be in default under the order and without cavil or argument, any sum or sums within the limit of (Amount of Guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the day of 20.....

Signature and Seal of Guarantors

.....
.....
.....

Date.....20....

Address:.....

.....
.....

All correspondence with reference to this guarantee shall be made at the following address:

Registrar,
Indian Institute of Technology,
Guwahati- 781 039, Assam.

Attention: Asst. Registrar (II&SI)

ANNEXURE – III

1. Details of the process equipment to be supplied

Leaching

S.No	Name of the Unit	No
1	Leaching unit	1
2	Ceramic membrane system	1
3	Membrane distillation unit	1
4	Crystallizer unit	1
5	Sensor and Data Acquisition unit	Refer detailed spec for individual nos.

2. Leach unit

Process objective: To selectively extract the targeted metal ions like Molybdenum and Nickel from the pitch dissolved in organic solvent. An aqueous solvent will strip the metal ion selectively in a sieve tray column from heavy fraction pitch dissolved in organic solvent

Type of Stripping unit: among any one Sieve tray column/Pulsed column/mixer settler units /centrifugal extractor.

Capacity unit: 100 LPH organic solvent flow (for example, toluene dissolved in pitch) and 100 LPH solvent flow rate

Aqueous Leach solvent: example solvents are Nitric acid / H₂SO₄, HCl, Ammonium hydroxide, Toluene

Compatibility with a Leach solvent: High-temperature stability, easy cleaning, metal complex stability

Temperature control: Temperature control system to prevent overheating and cooling the unit

3. Ceramic membrane unit (only for spent acid recovery)

Process Objective: To remove the suspended solids from the feed

Feed Flow rate: 500-1000 LPH

Operating temperature range: 40-80°C

Membrane type: Microfiltration

Operating pressure: less than 2 bar

Feed Specification: Spent acid from metal industry

TDS: 80000 ppm

SS: 100g/l Max

Turbidity: 0 to 1000 NTU

pH: 0-14

Membrane specification:Membrane Material: Al₂O₃

Pore Size: 1500 nm

Flux with pure water: 1200 LMH

Flux with actual feed:

Active area: 0.3m²

Channel Quantity and Length: 23 and 1178mm

UltrafiltrationMembrane Material: TiO₂

Pore Size: 4 nm

Flux with pure water: 1000 LMH

Flux with actual feed:

Active area: 0.178m²

Channel Quantity and Length: 9 and 1178mm

4. Membrane distillation unit**Objective:** To develop a system for recovering pure solvent and concentrating the solute

Feed Flow rate: 400-1000 LPH

Operating feed pressure :0 -1.5 bar

Operating temperature range: 60-80°C

Feed Specification: heavy fraction dissolved in organic solvent after removing suspended solids

TDS: 200-500 ppm

SS: <10 ppm Turbidity:

pH: 0-14

Permeate flow rate = 10 l/hr

List of units under Membrane distillation

S. No.	Name	No
1	MD membrane module	As per the membrane area required for 10LPH for feed and operating condition
2	Pumps	3
3	Condenser/Heat Exchanger	2
4	Tank	3
5	Heat pump	1
6	Pipe, Valve, fitting	As per detailed design and SOP
7	Vaccum pump	1

4.1 MD Membrane specification:

Material: PTFE

Pore size: 0.04-2µm

Porosity: 75%

Flux with pure water: 10 LPH

Flux actual feed:

4.2 All Pump specification

4.2.1 Hot water pump

Nominal flow: 500-2000 l/h

Pressure: 7 bar

MOC: SS

Temperature range: 25-80°C

Pump Type: Centrifugal

Motor rating: 2 HP

4.2.2 Vacuum Pump

Make: Crompton motor

Maximum Operating pressure: 50mmHg absolute

Operation type: Water Circulation cooling

MOC: SS

VFD: yes

Motor rating: 1 HP

4.2.3 Chiller pump

Motor rating: 2 HP

Temperature range: 10-25°C

Operating pressure: 2-5 bar

Vapor compressor specification

Input temperature: 80°C

Outlet temperature: 100°C

Input Power Supply: 16KW

4.3 Heat pump specification

Compressor

Electric Input range: 5-7 KW

Condenser fan motor-1

Electric Input range: 1.5-2.25 KW

Condenser fan motor-2

Electric Input range: 1.5-2.25 KW

Heat exchanger – 2Nos

Shell and Tube Heat exchanger-1

Mode of operation: Counter current

Inlet temperature: 65°C

Outlet temperature: 45°C

Shell and Tube Heat exchanger-2
 Mode of operation: Counter current
 Inlet temperature: steam at 100°C
 Outlet temperature: 40°C

Expansion Valve: Adiabatic and can handle as system required capacity

4.4 Tanks

4.4.1 Heavy fraction in Organic phase storage tank

Capacity – 1 KL MOC – HDPE

4.4.2 Pure solvent storage tank

Capacity – 1.5 KL MOC – SS

4.4.3 Reject solvent storage tank

Capacity – 1.5 KL MOC – SS

4.5 Vacuum pump cooling water pump

Capacity – 1.5 KL MOC – SS

4.6 Other components to be covered

Sensor, electrical and Automation system- Refer below Table

5. Crystallizer plant

Objective:

To facilitate the crystallization of concentrated seawater and the subsequent recovery of crystal salt from the liquid phase, known as mother liquor.

i.	Feed Flow Rate: The solution containing the solute to be crystallized is introduced into the crystallizer at a flow rate ranging from 20 to 40 L/h.
ii.	Feed Characteristics: Parameters such as the initial concentration of the solute (ranging from 340 to 370 g/L) and the particle size (ranging from 1 µm to 1 mm) are crucial for the feed solution.
iii.	Volume of Crystallizer: The crystallizer vessel has a volume ranging from 10 to 20 L to accommodate the feed solution. The desired production capacity is between 15 and 40 g/h, with a residence time of 15 to 30 minutes for the solution in the crystallizer.
iv.	Cooling Capacity: A cooling system with a 200 to 300 W capacity is employed to remove heat from the crystallizer, facilitating the crystallization process.
v.	Agitator: A motor with a power rating of 0.5 to 1.5 hp operates the agitator, ensuring uniform mixing within the crystallizer. The agitator also promotes nucleation and crystal growth.
vi.	Centrifuge or Filtration System: A centrifuge or filtration system separates the solid crystals from the mother liquor after crystallisation. The centrifuge has a maximum speed of 10,000 rpm and a maximum capacity of 600 ml.

6. Sensor, data acquisition process automation of all the units

Instrumentation number	Type	Location	Pressure head	Temperature range	Input (Vdc)	Output (mA)
FM1	Electromagnetic	Feed hot water pump	7-8 bar	25-80oC	12-24	4-20
FM2	Electromagnetic	Upstream of MD membrane	0.5-2bar	25-80oC	12-24	4-20
FM3	Electromagnetic	Downstream of MD membrane	0.1-1.5 bar	25-70oC	12-24	4-20
FM4	Electromagnetic	Chiller Pump	0.5-3bar	10-25oC	12-24	4-20
FM5	Electromagnetic	Ceramic membrane upstream	2-10 bar	20-80oC		

Instrumentation number	Type	Location	Pressure head	Temperature range	Input (Vdc)	Output
pH1	Glass electrode	Sieve tray	1-3 bar	25-80oC	12-24	
pH2	Glass electrode	Sieve tray	1-3 bar	25-80oC	12-24	
pH3	Glass electrode	Sieve tray	1-3 bar	25-70oC	12-24	

Instrumentation number	Location	Pressure range	Fitting	Dia Size (inch)	MOC
PG1	Upstream of MD membrane	0-7 bar	Valve with siphon	4	SS
PG2	Downstream of MD membrane	0-2 bar	Valve with siphon	4	SS
PG3	Upstream of Chiller	0-1.5 bar	Valve with siphon	4	SS
PG4	Downstream of heat exchanger 1	0-3 bar	Valve with siphon	4	SS
PG4	Downstream of heat exchanger 2	0-3 bar	Valve with siphon	4	SS
PG5	Vacuum pump downstream	0-700 mmHg	Valve with siphon	4	SS
PG6	Shell side of MD membrane	0-700 mmHg	Valve with siphon	4	SS

Instrumentation number	Location	Temperature range(oC)	Fitting	Input (Vdc)	Output (mA)
TT1	Upstream of MD membrane	25-80	Thermowell with sensor	12-24	4-20
TT2	Downstream of MD membrane	25-80	Thermowell with sensor	12-24	4-20

TT3	Reject stream of MD membrane	25-75	Thermowell with sensor	12-24	4-20
TT4	Upstream of heat exchanger 1	15-85	Thermowell with sensor	12-24	4-20
TT5	Downstream of heat exchanger 1	15-85	Thermowell with sensor	12-24	4-20
TT6	Upstream of heat exchanger 2	15-85	Thermowell with sensor	12-24	4-20
TT7	Downstream of heat exchanger 2	15-85	Thermowell with sensor	12-24	4-20
TT8	Upstream of crystallization unit	5-40	Thermowell with sensor	12-24	4-20
TT9	Downstream of crystallization unit	15-65	Thermowell with sensor	12-24	4-20

Control panel: SCADA