

Indian Science Technology and Engineering facilities Map (I-STEM)

Invites application for

1. **Partial financial support for using R&D facilities in other institutions through the I-STEM web portal to Users from Academic Institutions and Start-ups (Format-1)**

Format for requesting support for accessing and using facilities through the I-STEM web portal.

(i) Details of the Personal Information

- a. Name of the Researcher/Faculty Member : **MEGHA MOHAN**
- b. Name of the Institution/Start-up : **NATIONAL INSTITUTE OF TECHNOLOGY CALICUT**
- c. Name of the Department : **DEPARTMENT OF CIVIL ENGINEERING**
- d. Degree registered for/Product being developed (for start-up) : **PhD**
- e. Mob. No. : **6282840497** Email ID: **megha_p180115ce@nitc.ac.in**

(ii) Project/Research topic Details:

- a. Project Title/Research Title: **DESALINATION USING NANOCOMPOSITE POLYMERIC MEMBRANE – EXPERIMENTAL AND MOLECULAR DYNAMIC SIMULATION STUDY**
- b. Sub area: **ENVIRONMENTAL ENGINEERING**
- c. Area Description:

In the future, the demand for fresh water will increase in tandem with the world's expanding populations. However, available freshwater supplies are in limited supply and poorly distributed. With climate change intensifying droughts and floods, desalination can provide a guaranteed source of potable water from seawater to ensure water supply sufficiently meets water demand. Together with water reuse, desalination provides a reliable solution for countries to augment their existing water supplies. Thin film nanocomposite membranes are more efficient than microporous membrane in desalination. In this work the efficiency of different nanocomposite membranes in desalination is evaluated. Also, for analyzing the physical movements of atoms and molecules Molecular simulation study (LAMMPS) is used.

d. Aims & Objective (in Bullets):

- To characterize the nanomaterials reduced graphene oxide, graphene oxide, and carbon nanotubes using SEM, EDAX and Raman spectroscopy.
- To fabricate thin-film nanocomposite polymeric membrane by incorporating the nanoparticles into the active polymeric layer and to characterize the fabricated membranes for their morphology, chemical nature, surface wettability, surface roughness and performance.
- To test the efficiency of these membranes for desalination by low pressure-driven experimental study.
- To conduct molecular simulation study to improve the efficiency of nanocomposite membranes in desalination

e. Duration (MM/YYYY): 1.5 years

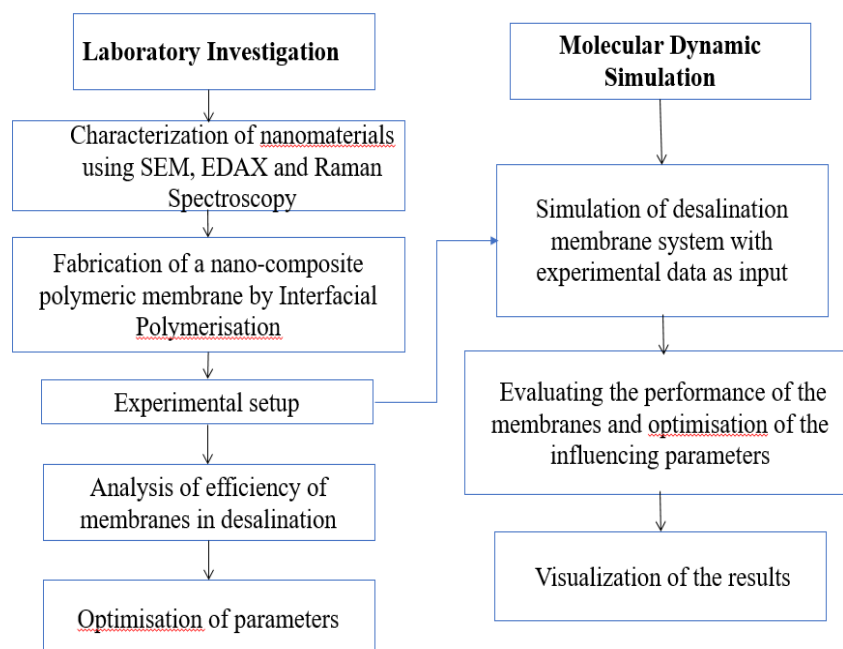
f. Project Summary (1000 words):

- Phase 1: Thin film nanocomposite membranes are fabricated and their efficiency in desalination will be evaluated.
 - a) Polysulphone membrane will be fabricated by phase inversion.
 - b) Nanocomposite membrane will be fabricated by interfacial polymerization. Graphene oxide, reduced graphene oxide and Carbon nanotubes are the nanomaterials.
 - c) These membranes will be used as nanofiltration membrane for desalination.
 - d) The parameters influencing the desalination process will be optimized.
- Phase 2 : Molecular simulation study will be conducted for the analysis of the mechanism of atoms and molecules in the desalination system.
 - a) The results from the experimental work will be given as the input for simulation.
 - b) Evaluating the performance of the membranes and optimisation of the influencing parameters
 - c) Visualization of the results

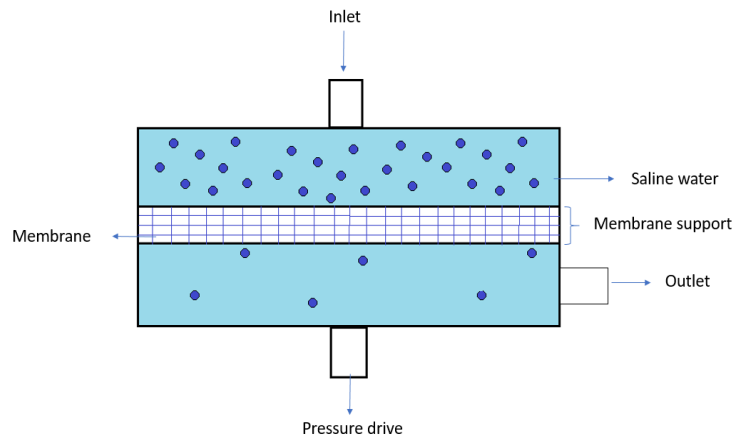
(Separate page may be attached to justify the requirements)

g. **Technical Details**

- a. TRL : T1 to T6 is satisfied
- b. Methodology



- c. Design & development
Nanofiltration setup is designed as per the below given diagram.



Nanofiltration setup design

d. Facilities and Instrumentation required

- Sonicator
- Magnetic stirrer
- FESEM
- HRTEM
- EDAX
- RAMAN SPECTROSCOPY
- CONTACT ANGLE MEASUREMENT
- ATR-FTIR
- XRD
- ZETA POTENTIAL
- AFM
- TGA
- BET

e. Consumables (Scientific materials)

- Piperazine
- m-phenylenediamine
- Trimesoyl chloride
- Tannic acid
- Iron(III) chloride hexahydrate
- Sodium dodecylbenzene sulfonate
- n-Hexane
- Polysulfone
- 1-Methyl-2-pyrrolidinone
- Graphene oxide
- Reduced graphene oxide
- Carbon nanotubes
- Sodium Chloride

h. **Expected output and outcome**

- The fabricated membranes are expected to show higher efficiency in desalination with less energy consumption.
- Through molecular dynamic simulation the mechanism occurring between the atoms and molecules will be analysed at a molecular level.

i. **Industry/Institute Collaboration** NIL **If, yes**

- (i) Name of the Collaborating Industry/Institute
- (ii) Collaboration Details
- (iii) Additional Details if any

j. **Funding required from I-STEM (with justification:**

Details of Requirements & Mode of the Engagement: (Attach the quotation for the consumables)

- (i) Short term Engagement: 6 months
- a. Usage of testing/characterization facilities across the country (Characterization Mode)
- i. Testing Charges

SI No	Characterization mode	Institution	Charge/ sample	No.of samples	Total
1	HR-TEM	STIC – Cusat Campus	2065	12	24780
2	FESEM	CSIF	Combined with EDAX	12	-
3	Raman Spectroscopy	NIT Calicut	-	12	-
4	EDAX	CSIF	1890 (For SEM-EDAX)	12	22680
5	Zeta potential	NIT Calicut	-	12	-
6	FTIR	STIC - Cusat Campus	295	12	3540
7	AFM	NIT Calicut	-	12	-
8	XRD	NIT Calicut	-	12	-
9	TGA	CSIF	1470	12	17640
10	BET	CSIF	3200	12	38400
11	Contact angle measurement	NIT Calicut	-	12	-
					Rs.1,07,040/-

Sample details

SI No	Sample details	Sample No
1	Polysulphone membrane	PSF 1
2	PSF with Graphene oxide	PSF GO 1
3	PSF with reduced Graphene oxide	PSF rGO 1
4	PSF with Carbon nanotube	PSF CNT 1
5	PSF after desalination	PSF 2
6	PSF with Graphene oxide after desalination	PSF GO 2

7	PSF with reduced Graphene oxide after desalination	PSF rGO 2
8	PSF with Carbon nanotube after desalination	PSF CNT 2
9	PSF after regeneration	PSF 3
10	PSF with Graphene oxide after regeneration	PSF GO 3
11	PSF with reduced Graphene oxide after regeneration	PSF rGO 3
12	PSF with Carbon nanotube after regeneration	PSF CNT 3

- ii. Consumable charges - NIL
- iii. Travel Cost (Boarding and Lodging, if any) – Rs. 5000/-
- b. Usage of fabrication and testing facilities across the country (Fabrication Mode) – Not required
 - i. Fabrication and testing Charges
 - ii. Consumable charges (if any)
 - iii. Travel Cost (Boarding and Lodging, if any)
- (ii) Medium term Engagement:
 - a. Execution of project in any one of the Host Institution (Project Mode)
 - a. Fabrication and or testing Charges
 - b. Consumable charges (if any)
 - c. Travel Cost (Boarding and Lodging, if any)
 - b. Execution of project in Multi Host Institutions (Project Mode)
 - a. Fabrication and or testing Charges
 - b. Consumable charges (if any)
 - c. Travel Cost (Boarding and Lodging, if any)

(Round-trip to the Host Institution by 2nd class (Non-AC) railway via the nearest route)

Details of User's Bank Account:

(Please send a copy of the cancelled cheque/copy of the passbook carrying all the information needed)

Beneficiary Name (User's name): MEGHA MOHAN

PAN: CRAPM8762N

Bank Account No. : 20108784234

Name of the Branch: SBI MANACHIRA

IFSC Code: SBIN0000861


Megha Mohan

Research Scholar

Dept of Civil Engineering

NIT Calicut


Dr. Pramada S.K (Research Guide)

Assistant Professor

Dept of Civil Engineering

NIT Calicut

Note: Proposed proposal must be executed within stipulated duration (max. 6 month) to avoid fund availability issues. Travel form will be provided by the I-STEM office. The users will submit the technical report, original invoice (duly signed by the Head of the Institution) raised by the Host Institution through I-STEM portal only along with a copy of the travel forms and original tickets through post to the Nodal Officer, I-STEM, Indian Institute of Science, Bangalore. A scan copy of all the documents may be sent in advance.