

What did I do recently?



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Deepak Parekh Institute Chair Professor – connect with the donor, September 9, 2020

Nanotechnology research in clean water

New adsorbents

Nanoparticles, nanotubes, graphene, polymers, 2D materials

New sensors Colorimetry, fluorescence, FRET, DNA, assembly, biosensors

New catalysts Emerging toxins, heterojunctions

Novel phenomena

Graphenic analogues, nanopores, aquaporins

New devices

CDI, atmospheric water capture, novel membranes









EDITED BY

Nanoparticles

• 10 µm

Diverse materials



T. Pradeep et. al. Acc. Chem. Res. 2018; 2019.







Nanomaterials can solve local problems





ACS Sustainable Chemistry & Engineering Editorial, December 2016

Completed 3 years maintenance (stipulated: 2 years)

for 330 bamboo unit project in Nadia, WB

Minimum uptime: 91%, Maximum: 98% Only 4/330 have reported arsenic above 10 ppb Benefiting over 100,000 children and villagers

3471-25022

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A glimpse into the installed units

Changing the dynamics in the field







- Existing unit for iron and arsenic removal 20 m³/h
- Uses activated alumina and iron oxide (old generation of adsorbents)
- Existing unit for iron and arsenic removal 18 m³/h
- Uses iron oxyhydroxide (new generation of adsorbents)
- Input arsenic concentration: 168 ppb
- Output arsenic concentration: 2 ppb

Regions where our technologies have been implemented

Water quality affected habitations of India

* Data Shown here is as per laboratory testing results entry done on regular basis hence may change

30100

Collected on 29.05.2018

Arsenic, Fluoride, Iron, Salinity, Nitrate affected

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OUR REACH

Data collected from http://indiawater.gov.in

Now in Punjab





Calculation for the Tariff to be collected for treated water (Revision if Required)

Sr.No	Design population	1,071	Plant capacity/70 LPCD
	Item/Description	Cost / Quantity	Remarks
1	Cost of Replacement of Iron removal media	56400	After minimum two years if Iron concentration is more than 5 ppm. But iron concentration is more than 5 ppm at only two to three places. Therefore media may work for 3 years also.
2	Cost of Replacement of Arsenic removal media	978660	After minimum two years if Arsenic concentration is more than 100 ppb. But arsenic concentration is more than 100 ppb at only two to three places. Therefore media may work for 3 years also.
3	Cost of replacement of Activated Carbon	28560	
4	Total cost of Replacement of media	1063620	After minimum two years.
5	Total cost of Replacement of media for one year	531810	
6	Plant capacity	75000	ltr per day
7	Design population	1,071	Plant capacity/70 LPCD
8	Cost per litr of water	2.1 Paise per Itr	
9	Cost of replacement of media	1.36	Rs. per head per day =Media replacement cost per year/365/Design population per head per month for 70 LPCD water 11
		40.80	per nead per monun for 70 LPCD water

Seeing how the new adsorbents are changing the dynamics at the ground level (type 1 of our efforts)

Name of the scheme: Mahilan Wala (TW9144), District: Amritsar Population: 2610, Daily demand@70 LPCD: 188 kLD, OHSR Capacity:

Specifications of the unit

1	Name of state	:	Punjab
2	Area covered	:	Arsenic affected schemes of districts Amritsar, Gurdaspur,
			Hoshiarpur, Tarn Taran and Ropar
3	Name of project	:	Providing, fixing, commissioning of Nanomaterial based
			arsenic and iron removal plants to be retrofitted at water
			supply schemes to provide potable water @ 70 lpcd in
			Arsenic affected water supply schemes of Punjab
4	Number of Schemes and villages	:	70 schemes covering 102 villages
	covered		
5	No. of ARP units	:	83 units
6	Population covered under the project	:	136261
	as per year of the project 2016		
7	Cumulative Daily purified water supply	:	10 MLD
8	Type of water scarcity	:	Arsenic, Arsenic + Iron
10	Proposed treatment process	:	Nano Material based arsenic removal (technology
			developed by IIT Madras)
11	Estimated cost of project	:	Rs. 22.00 crore
12	Agency executing the project	:	Water Supply & Sanitation Department, Punjab.
13	Duration of supply of water	:	6 hr/day
	Daily Pumping hours	:	6 hr/day

Plan for immediate future



India Mark II hand water pump – most common water pump used globally

InnoNano Research's in-line arsenic removal filtration system In-line arsenic sensor and remote data management – indicates when filtration systems require maintenance. IMPROVED FILTER SUSTAINABILITY

SUSTAINABLE SOURCE OF ARSENIC FREE SAFE DRINKING WATER



Anshup, Udhaya Sakar, Amrita, Kamalesh, Vidhya 14

Smart water purifiers and big data



Ankit Nagar and Thalappil Pradeep. ACS Nano (perspective), 2020.



Evolution of materials to products



Ankit Nagar and Thalappil Pradeep. ACS Nano, 2020.

Water innovation - open to all

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Where there is clean water, there is hope.









Recent recognitions (after 2015): J. C. Bose National Fellowship, 2015-; Lifetime Achievement Research Award of IIT Madras, 2015; The World Academy of Sciences (TWAS) Prize in Chemistry, 2018; Padma Shri, 2020; Nikkei Asia Prize, 2020; Silver medal, Chemical Research Society of India, 2020

Editorial Boards: Scientific Reports (Nature Group), 2015-; International Journal of Water and Wastewater Treatment, 2015-; Chemistry of Materials, 2018-; ACS Nano, 2018-; Nanoscale Advances, 2019-; Analytical Chemistry, 2020-; Chemical Communications, 2020-

Fellowships: Elected Fellow of the Indian National Science Academy, 2016-; Elected Fellow of The National Academy of Sciences, 2015-; Elected Fellow of the American Association for the Advancement of Science (AAAS), 2018-; Elected Fellow of The World Academy of Sciences (TWAS), 2019-

Publications: 481 articles in journals, 7 published books, 13 chapters in books (about 25+ publications each year) Total citations >27,500, h -index 79, h5-index 60 (Google Scholar); citations >19,600, h-index 66 (Scopus) 120 patents or patent applications in all including Indian, PCT and US patents, including 50 issued Indian, PCT and US patents (about 6-8 patents each year)

23 patents licenced, earned Rs. 4.5 crores of royalty for the institute and over Rs. 500 cores for the nation

Incubation: InnoNano Research Private Limited; Safewater Nano Pte. Limited; InnoDI Water Technologies Private Limited; VayuJal Technologies Private Limited; Aqueasy Innovations Private Limited; Hydromaterials Private Limited (four in the past five years)

These technologies have delivered clean water to 10 million people

Conceptualised and built state of the art centres, Thematic Unit of Excellence and International Centre for Clean Water

Training: Trained over 250 students at various levels to conduct research, including 50 completed and 30 ongoing PhDs, 120 MSc/MTech theses, 40 postdocs and several visiting students from India and abroad (5 PhDs each year)

Others: Completed over 25 research projects worth Rs. 50 crores, established facilities benefiting science in the region (3 projects each year) Delivered over 500 invited/plenary and keynote lectures (30-40 presentations each year) Member of various committes of universities and governments

Publicity: Research featured in CNN, Scientific American, The Guardian, New Scientist, C&E News, Indian newspapers, especially The Hindu (three news items per year on research outcomes)