#IndiaEUWater

The PANIWATER Project

Prof. Kevin McGuigan (RCSI)

PANI WATER पानी
LOTUS
PAVITRA GANGA
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PANIWATER Partners

18 partners from industrial and academic organizations from Europe and India are collaborating

BUCKS
ULSTER

IT-SLIGO
MU
RCSI

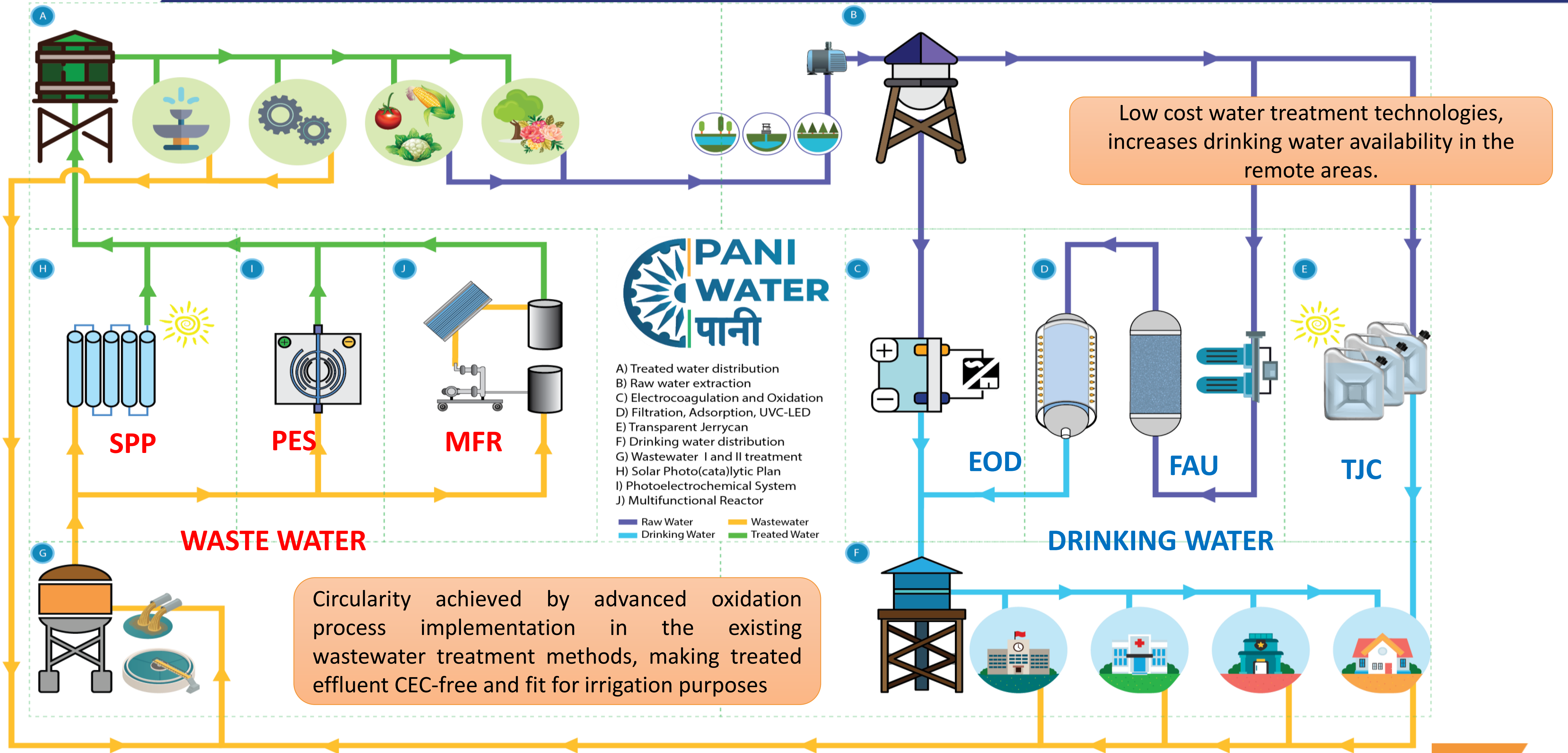
CIEMAT-PSA
URJC
USC

INNOVA
AQUASOIL
UNISAL

UCY

DEVALT
TARA
CSIR-NEERI
BITS PILANI
KWALITY
AUROVILLE

Summary of Technologies - PANIWATER: Six Water Treatment Technologies



Selected sites for Demonstration of technologies

Wastewater Treatment

Multistep system (FAU)

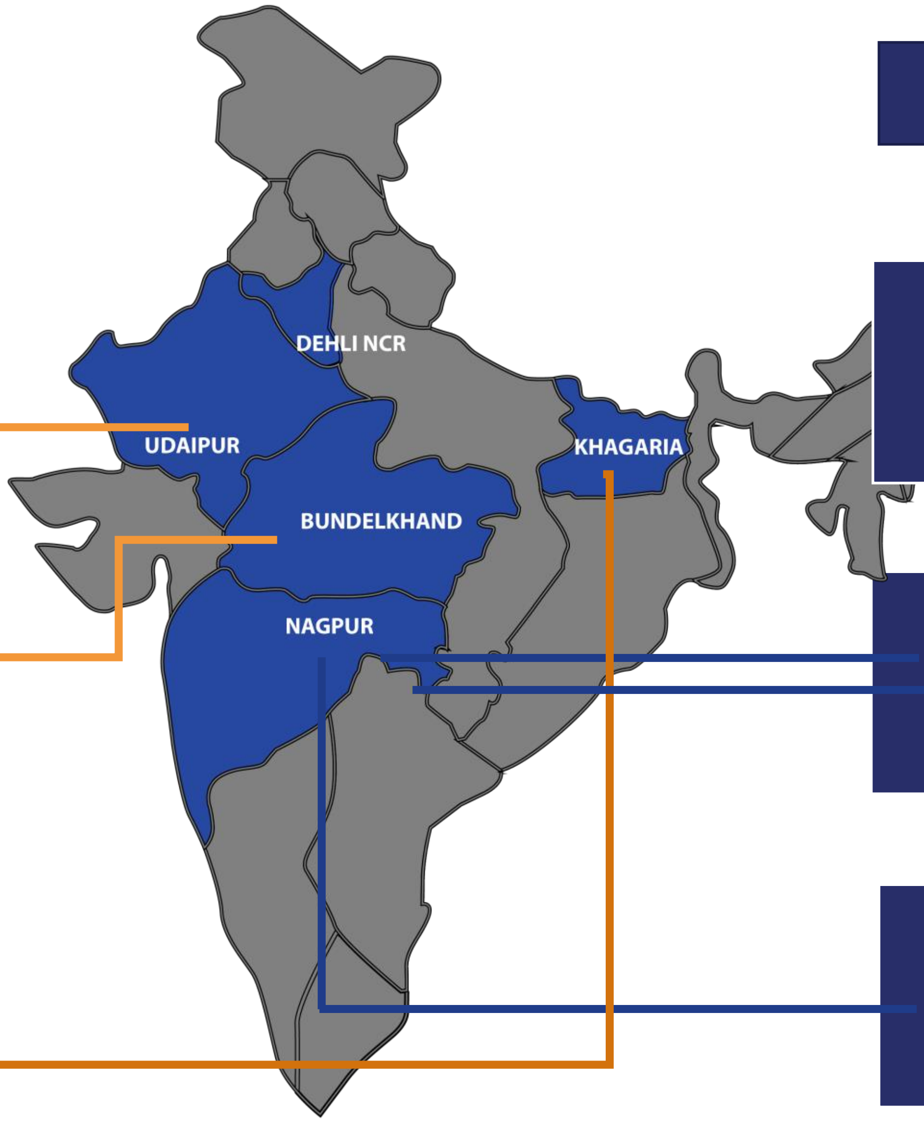
BITS PILANI; CSIR-NEERI; URJC; KPP; UCY; DEVALT NUIM

Transparent Jerrycan (TJC)

RCSI; CSIR-NEERI; URJC; CIEMAT; DEVALT

Electrocoagulation System (EOD)

AWS; CSIR-NEERI; DEVALT



Drinking Water Treatment

Photo-electrochemical system

UU UK; CIEMAT; URJC; CSIR-NEERI

Solar Photolytic plant

CSIR NEERI; ITS UCY; URJC; USC; CIEMAT; TARA

Multifunctional Reactor

CSIR NEERI; AQUASOIL; UNILE; TARA

Our Approach to Social Impact of PANI Water Technology Packages

We aim to:

Enhance understanding about the area (Socio-cultural fabric and governance status)

Engage with key stakeholders to understand training, capacity building needs and to design behavior change communication strategy for post project sustainability

Inform technology development process for more sustainable outcomes (to enhance end user acceptance and adaptation of technologies by target communities)

Develop **technologies and practices** that assist in promoting good water governance systems

Stakeholder engagement and Capacity Building is key to technology adoption and equitable benefit sharing by resource constrained communities

Water governance / Socio-economic Status

- Least access to tap water among socially underprivileged, lower income households thus making them more vulnerable.
- Recent initiatives of Jal-Jeevan Mission have started yielding good result in Madhya Pradesh. Within a short time-span, 25% households were reported to have tap water connections.

However quality concerns still warrant technological interventions both at household and community level

Women walk miles to fetch water

Farmers using treated wastewater already in practice due to water scarcity

Household Data from WashData (2017)

PANIWATER analyses how availability and accessibility of drinking water have changed across different geographical and socio-economic groups in India, particularly in **Delhi** and **Madhya Pradesh,** during the last two decades using secondary data from the last five successive rounds of the National Sample Survey (NSS) corresponding to drinking water.

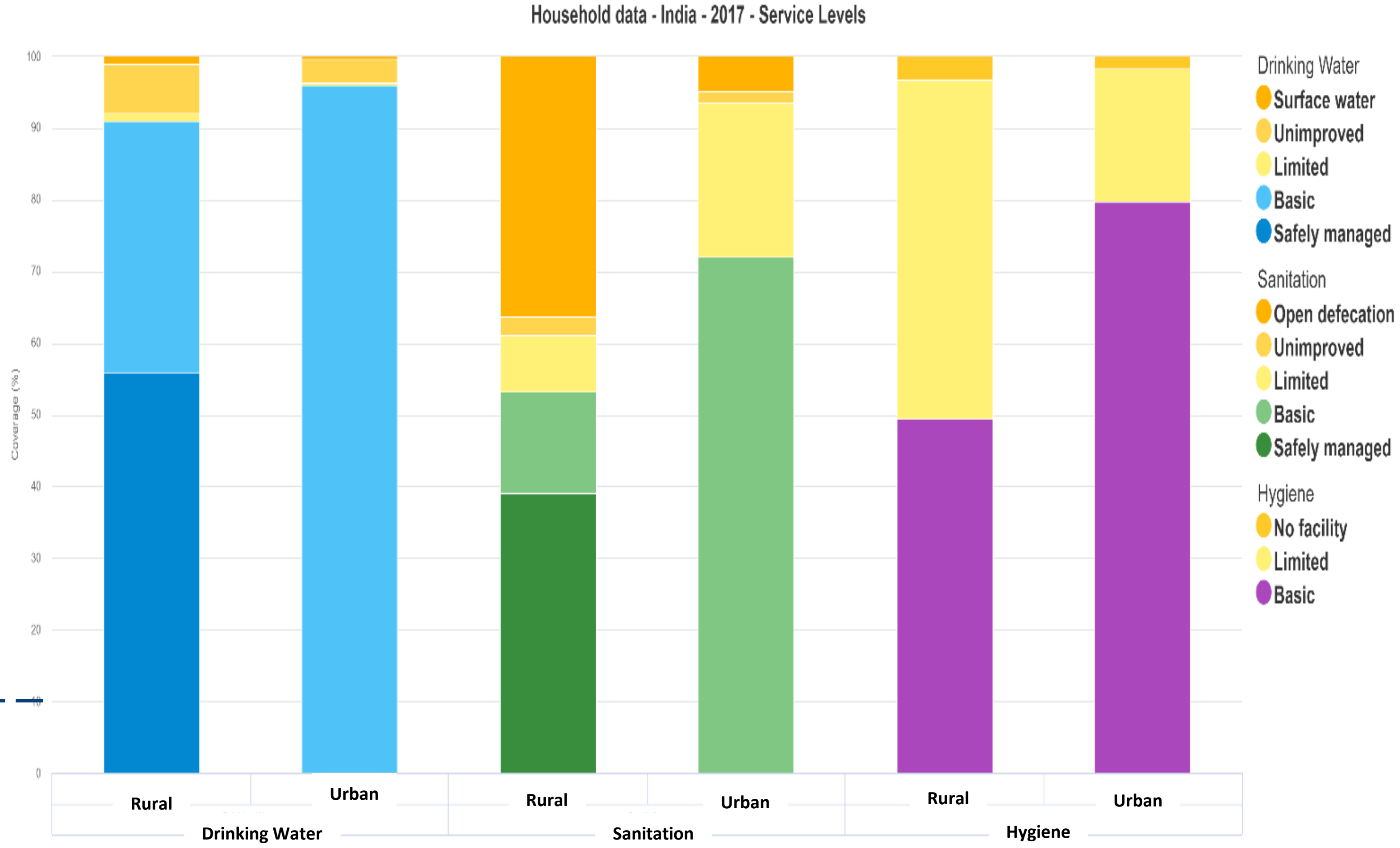


Figure 2. Global Household data for drinking water, sanitation and hygiene 2017 (Source: Wash Data @ https://washdata.org/data/household#!/dashboard/new accessed 24/7/2020@10.15).

Drinking water (Delhi and Madhya Pradesh in 2018)

Tap water access = 44%

Handpump / tubewell = 41%

Boiling, Filtering, Electric purifier = 35%

Wastewater (Delhi and Madhya Pradesh in 2018)

Drainage system = 72%

Any form of treatment = 12%

Reuse = 1%

- PANIWATER social science is focusing on Madhya Pradesh and Delhi.
- Water scarcity can be managed and governed towards sustainable and equitable use.
- Madhya Pradesh and Delhi, are less than half-way there as of 2019.

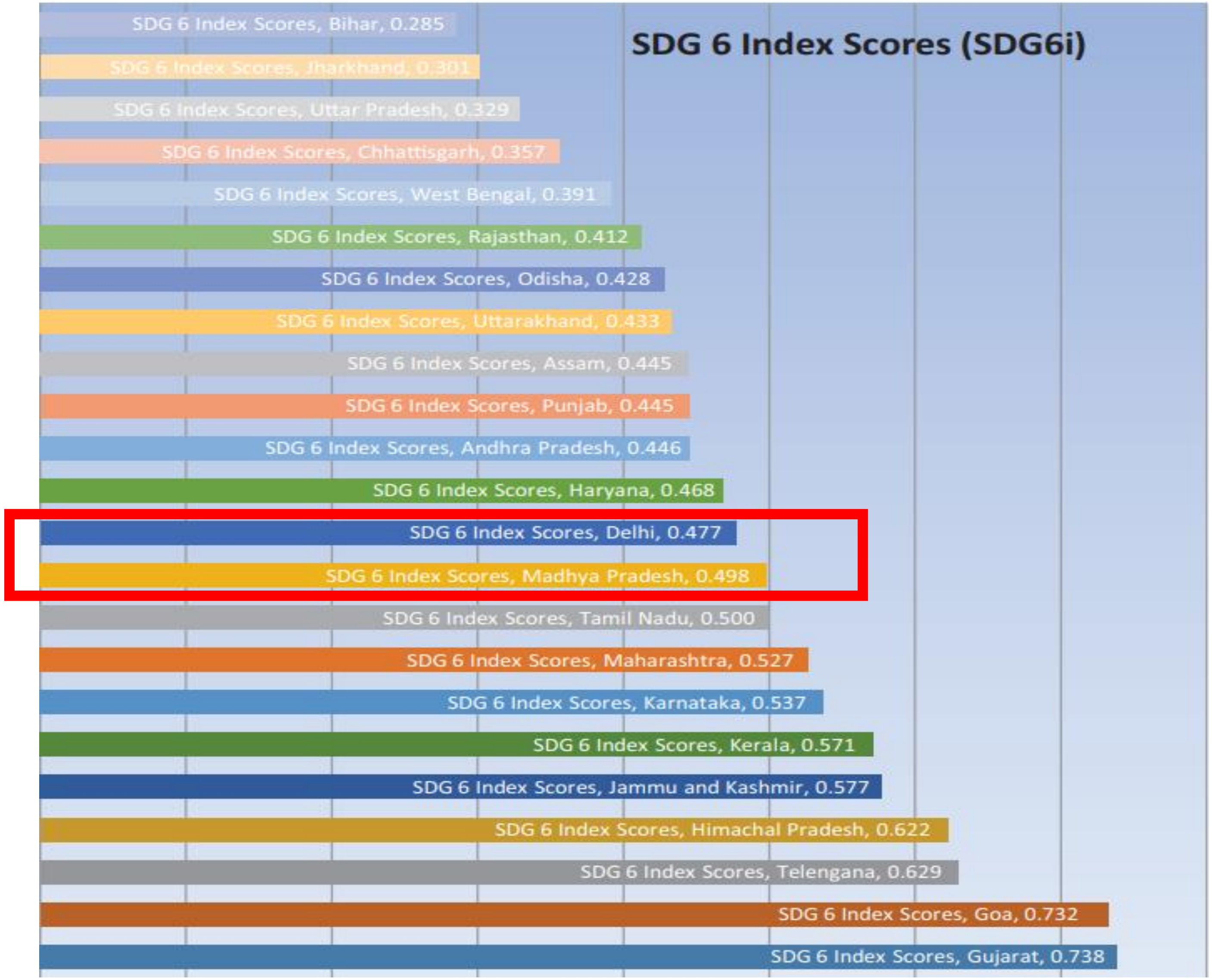
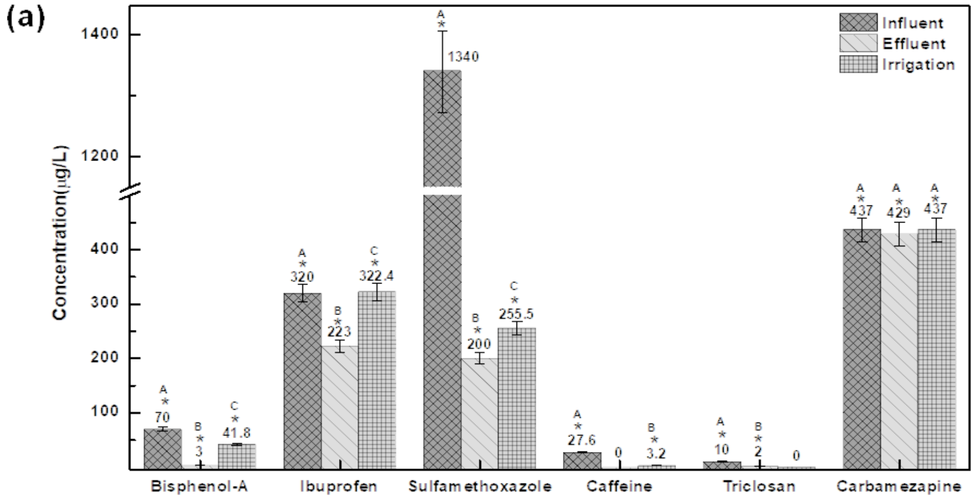
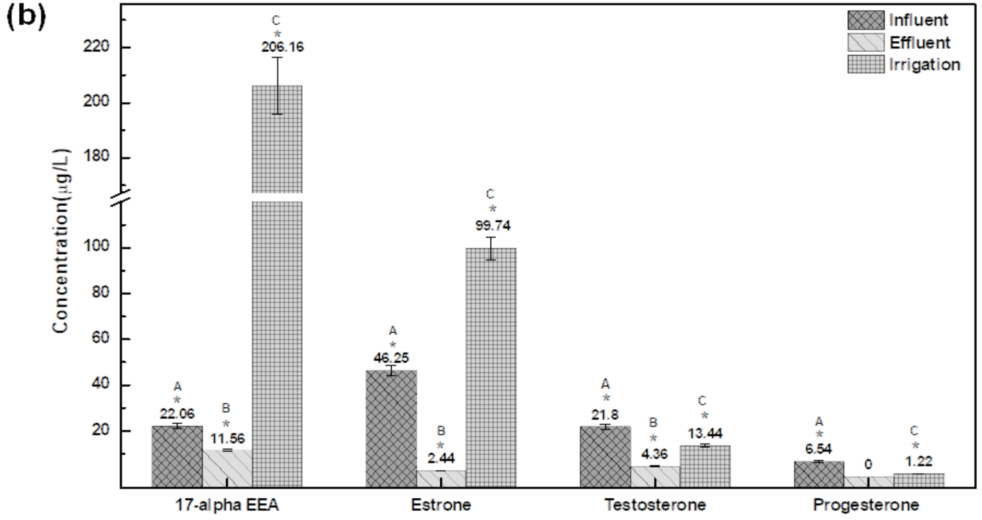


Fig 5: Indian Sub-National Level Composite SDG 6 Indian Scores out of 1 (Source: Bhowmick *et al*, 2020: 27).

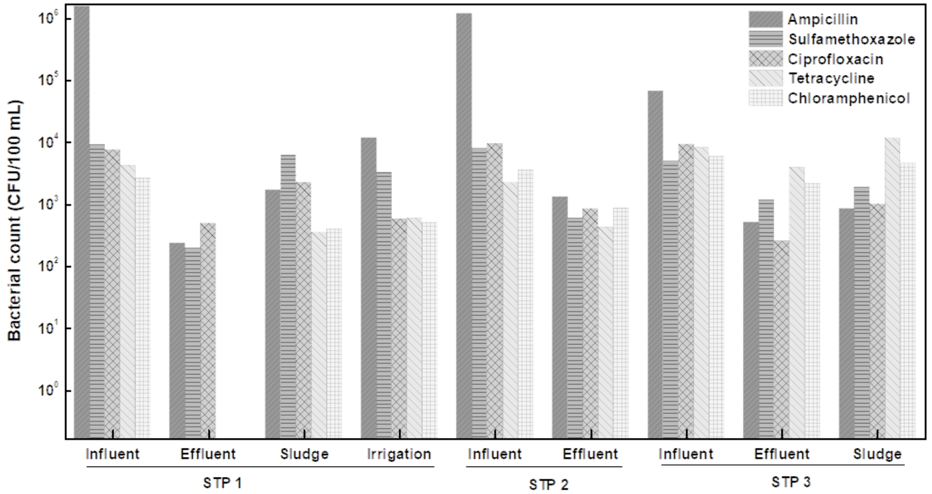
Contaminants of Emerging Concern in treated Sewage and Irrigation canal*

*J Hazmat 408, 2021 , 124877 " Profiling of Emerging Contaminants and Antibiotic Resistance in Sewage Treatment Plants: An Indian Perspective"

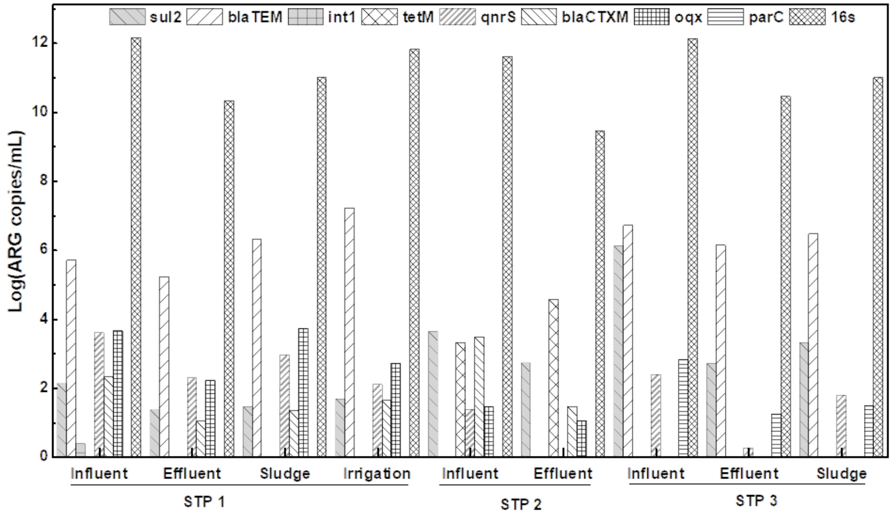




Detection of CECs at STP .



Antibiotic resistant bacteria count in STPs



Abundance profile of ARGs

Perspective View of Advanced treatment unit for Sewage Treatment Plant (Air Force)

Proposed tertiary advanced treatment technology

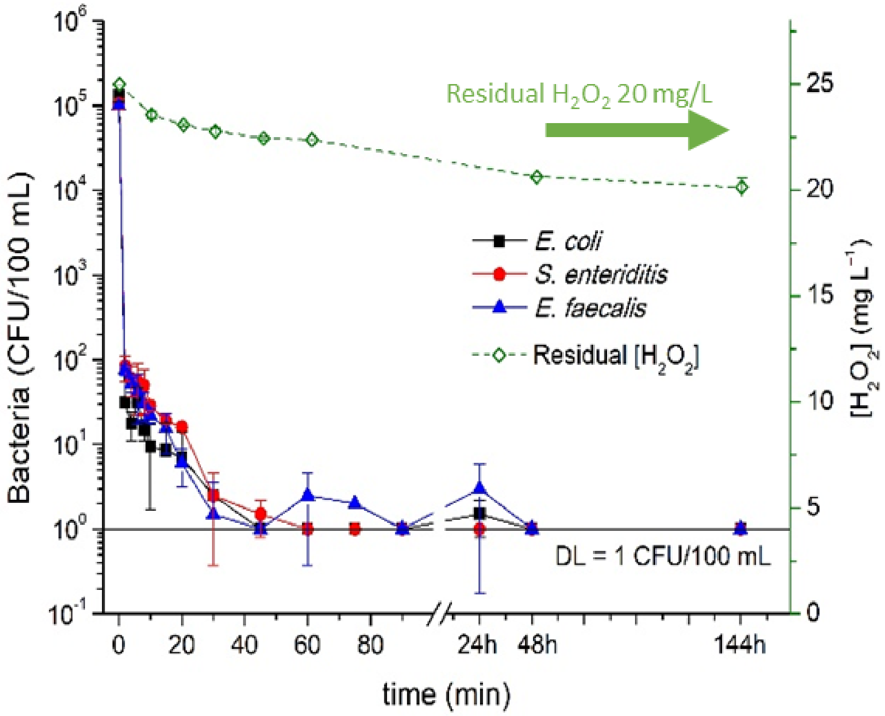
- ✓ **Dual step multifunctional reactor (MFR)**
- ✓ **Combination of optimized physicochemical treatment & AOP in a single step.**
- ✓ **Unique fluid dynamics and residence time allows complete mixing of effluent with oxidants**
- ✓ **Full utilization of oxidants**
- ✓ **Decentralized SWT – Easier to manage**

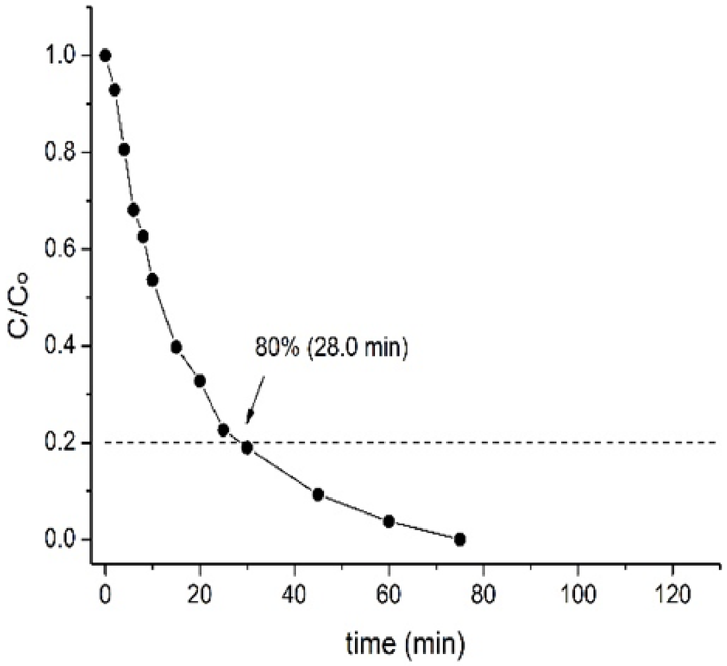
1. Shelter for tertiary & advanced treatment units	5. Control station
2. Outlet storage tank	6. Mixing unit
3. Inlet storage tank	7. Oxidant 1 storage
4. Radiation unit	9. Oxidant 2 generator

SPP: Technologies tested: UVC (H_2O_2/Persulfate); Solar photo-Fenton (combined with AC) ; Solar/H_2O_2/persulfate (NEERI)

Selected technology for the elimination of CECs and pathogens: UVC/ H_2O_2 *(PV for electricity supply)

*Environ. Sci.: Water Res. Technol., 2020, 6, 2553 "UVC-based advanced oxidation processes for simultaneous removal of microcontaminants and pathogens from simulated municipal wastewater at pilot plant scale"



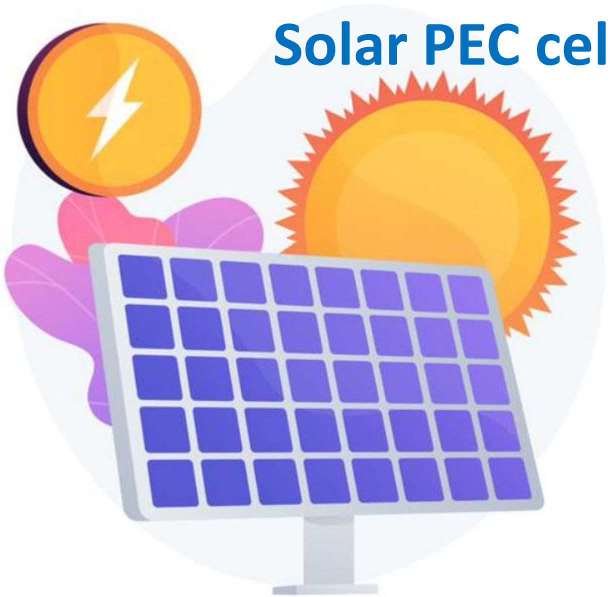


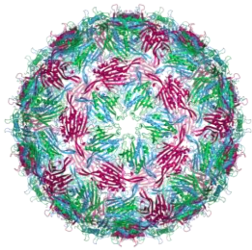
90 min of treatment to reach bacteria inactivation (D.L.) 80% of CEC removal in 28 min

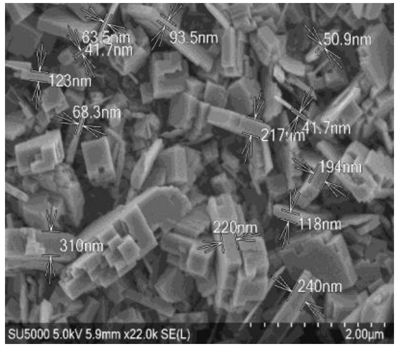
No regrowth

Photo-electro-catalysis (PEC) – high performance WO3 nanostructures for PEC degradation of CECs, Pathogens and MS2-phage in water

Solar PEC cell - WO3 photoanode

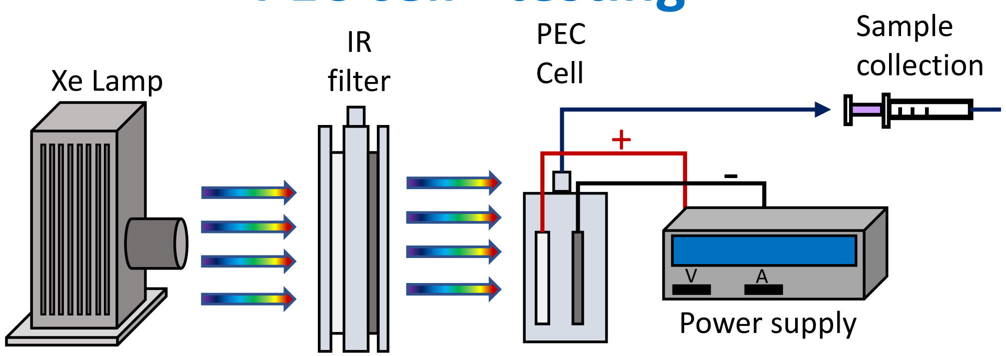




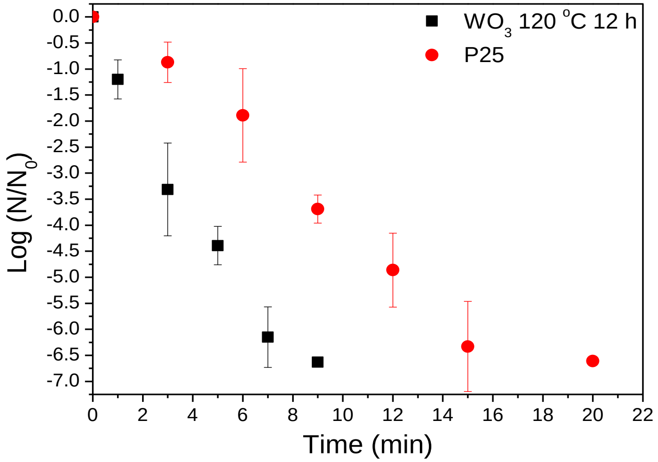


WO_3 nanostructures

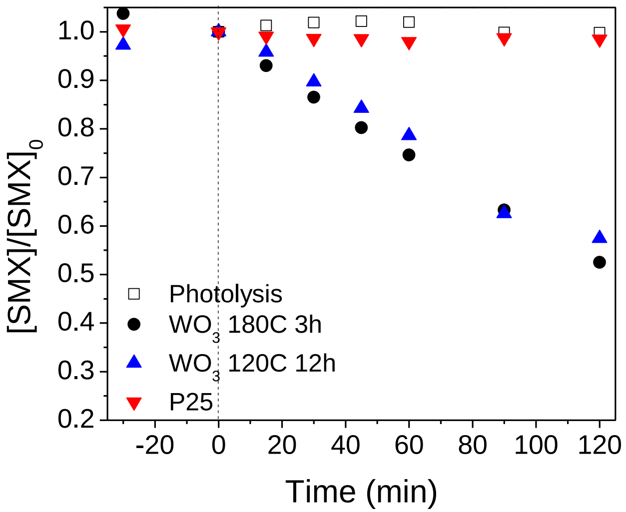
PEC cell - testing



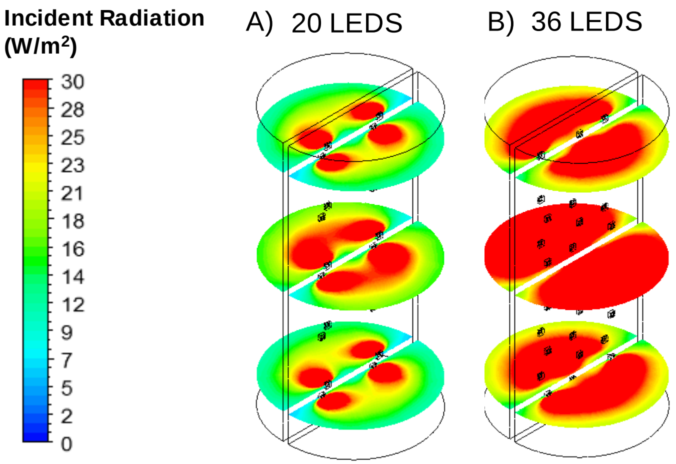
MS2 removal



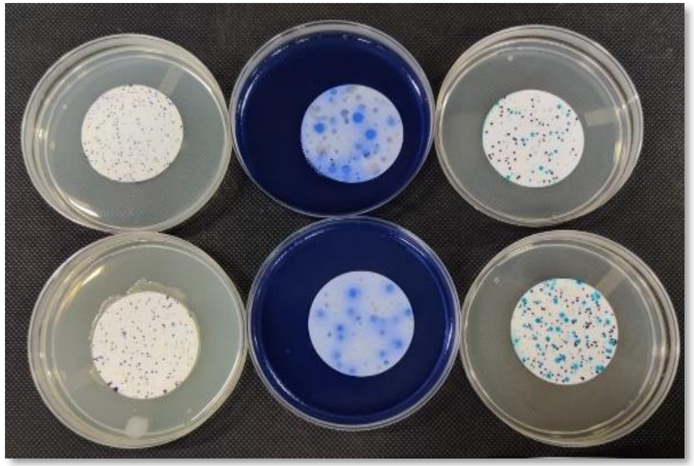
Sulfo-methaxazole degradation

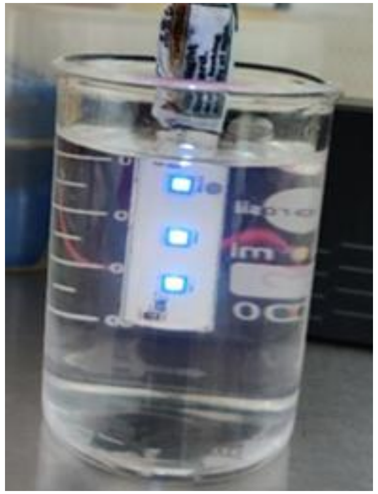


Filtration Adsorption UV

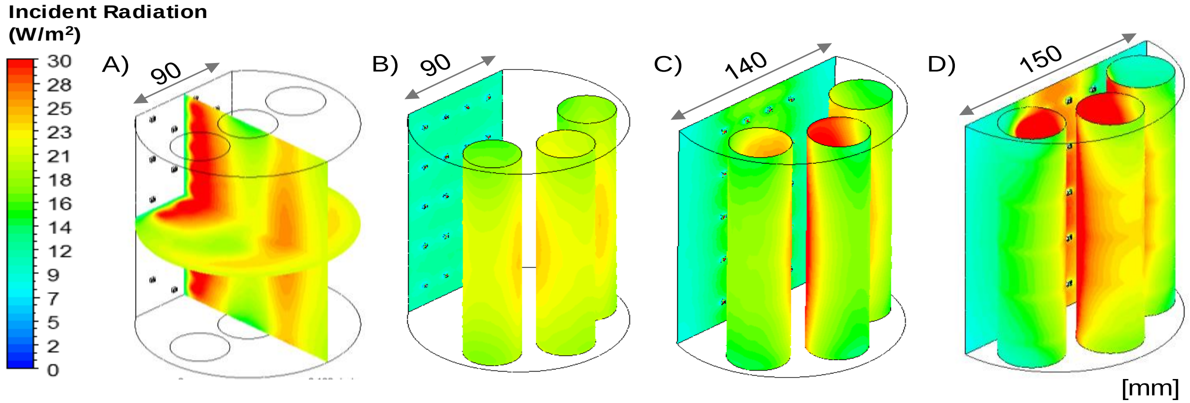


Incident radiation with internal LED





Disinfection with LED Strips Immersed in 100 mL water, with *E. coli* and *B. subtilis*



Evaluation of incident radiation in UV-C reactors with 20 external LEDs

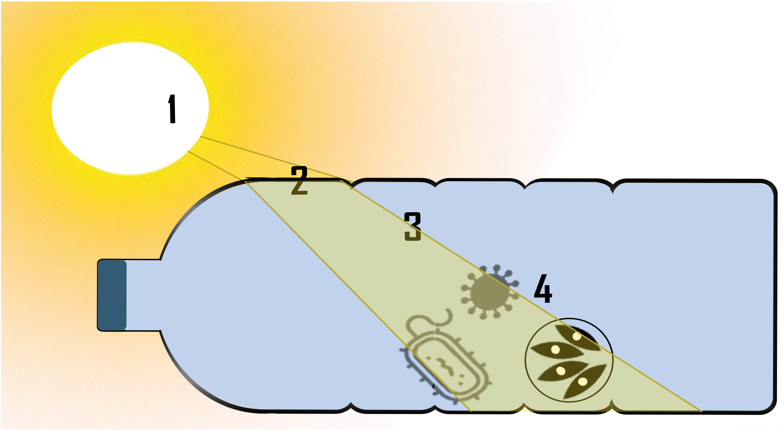
Electrocoagulation & Oxidation Device

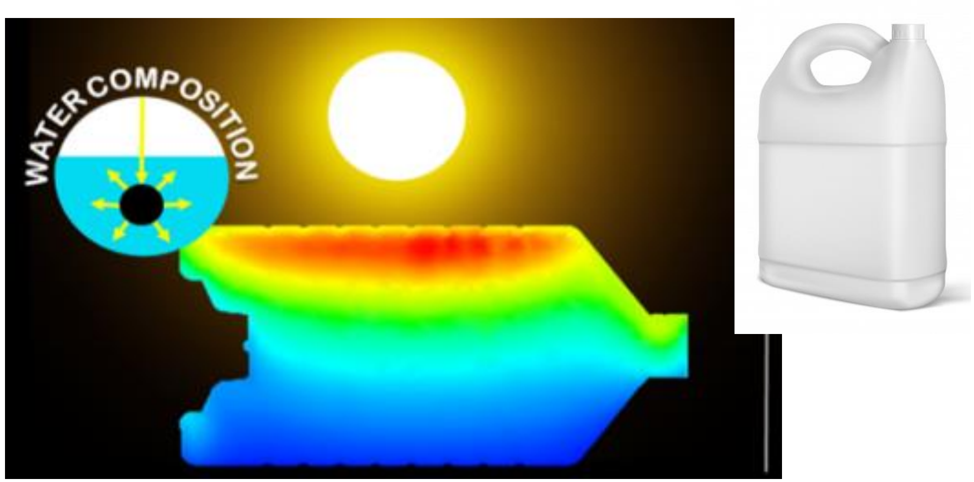
Front view photograph of the prototype

Summary of the results of the removal of the contaminants

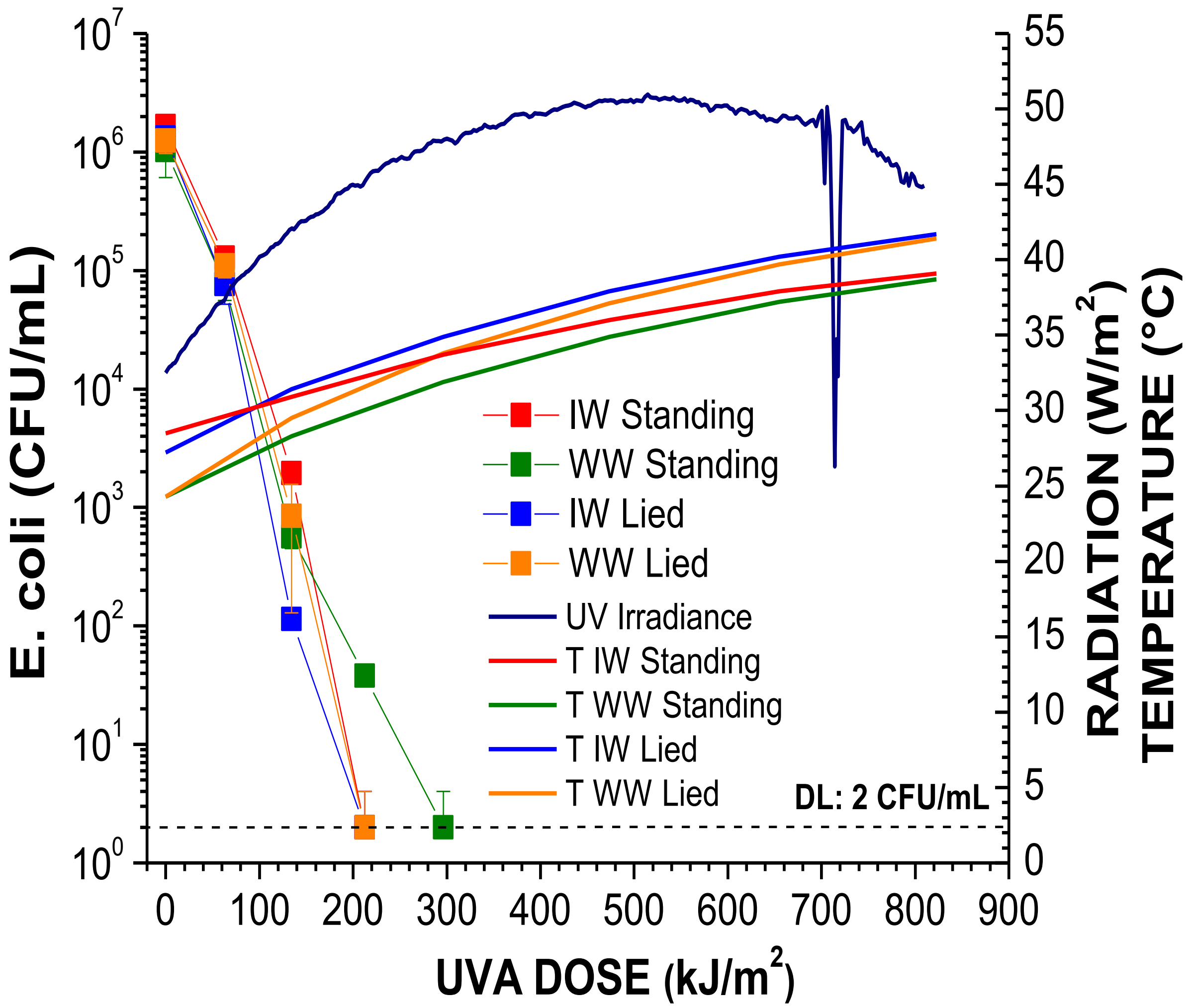
Parameters	Before	After	Removal rate
Turbidity, NTU	450	4.6	98.9%
Fluoride, ppm	5.0	0.6	87.5
Iron, ppm	5.0	< 0.1	99.9
Arsenic, ppb	400	6.5	98.37
E.coli, N/100 ml	1 400 000	154	99.99
Aluminium, ppm	< 0.02	< 0.02	-

Drinking Water Technology – Transparent Jerrycan (TJC) for Solar Disinfection





10 L Polypropylene TJC Prototype Manufactured in India to our design & undergoing pathogen inactivation studies under real sunlight conditions



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सत्यमेव जयते

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PANI WATER पानी

Photo-irradiation and adsorption-based novel innovations for water treatment. **paniwater.eu**

PANIWATER: Grant Agreement No. 820718

LOTUS

Co-creation of a versatile multiparameter real-time sensor for water quality, based on nanotechnologies. **lotus-india.eu**

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