

PROJECT PORTFOLIO (27 Projects) & WORK EXPERIENCE OF DR. NUPUR BAHADUR

NMC&G-TERI
CENTRE OF EXCELLENCE
ON WATER REUSE

Ministry of Jal Shakti, Government of India

Department of Water Resources, Water Development and Gangs Rejuvenation
Ministry of Jal Shakti, Govt. of India

KPMG

Effect of Upgradation of 12 STPs on the Water Quality of Sahibi River

By:
Dr. Nupur Bahadur
Subject Matter Expert (Sustainability & Circular Economy)
Team KPMG PMU, DJB

Final Report
Adequate & Sustainable Treatment of Bandhwari Landfill Leachate

Submitted to:
MCG & Haryana State Pollution Control Board (HSPCB)

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

Project Report

Options for Advanced Treatment and Resource Recovery for Decarbonization of Wastewater Utilities in the Bengaluru Metropolitan Area

Submitted to:
The World Bank Group
World Bank Contract No. 7200198

WORLD BANK GROUP
BWSSB

Final Project Report

Wastewater Inventorisation and Review of National Practice for reporting GHG emissions from wastewater

Submitted to:
TETRA TECH

TETRA TECH
THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

Study on Microplastics in River Yamuna and Groundwater in Delhi

Department of Environment
Government of NCT of Delhi

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

Final Report
Study on Yamuna Frothing in Delhi

Department of Environment
Government of NCT of Delhi

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

Final Project Report
Comprehensive Assessment 18 MLD ZLD Plant at Balotra

Submitted to:
Balotra Water Pollution Control and Research Foundation Trust

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

Project Report
Strategies to Manage Treated Water at Industrial Model Township (IMT) in Bawal, Haryana

Submitted to:
The Chairperson
Haryana Water Resources Authority
HSVP, Sector-6, Panchkula, Haryana 134109

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

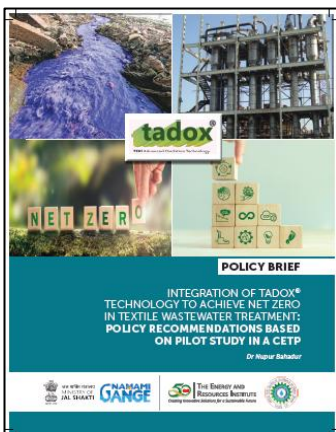
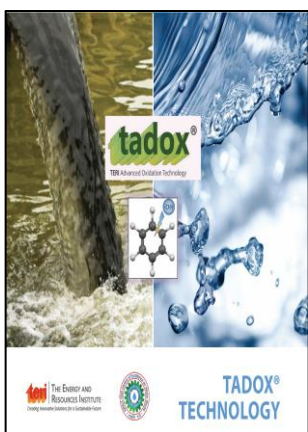
Report
Status of Used Water Management and Water Reuse Polices in India

Industrial Use | Agricultural Use | Urban Use

GNAMAMI GANGE
THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

Compendium on Best Practices of Treated Water Reuse in India

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THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future



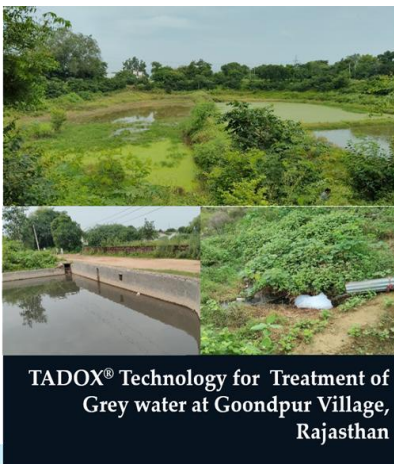
KPMG



Delhi Jal Board

Comparison of Sludge Treatment Technologies & Roadmap for Sludge Management at DJB STPs

By :
Dr. Nupur Bahadur, Subject Matter Expert (Sustainability & Circular Economy), KPMG PMU, DJB



TADOX® Technology for Treatment of Grey water at Goondpur Village, Rajasthan

Submitted to:
Diageo India








Online Training And Capacity Building (OTCB) Certificate Programme

DEVELOPING TREATED WASTEWATER REUSE FACILITIES

ONLINE



Image Courtesy: National Mission for Clean Ganga, Ministry of Jal Shakti, Govt. of India, Dwarapuri STP 140 MLD at Varanasi, Uttar Pradesh.

| | | | |
|--|---|---|--|
| <p>PROGRAMME DATES</p> <p>07 - 22nd MARCH 2021</p> <p>TIME</p> <p>2:00 PM - 5:30 PM</p> | <p>REGISTRATION DETAILS</p> <p>Instructions:</p> <ol style="list-style-type: none"> Payment acceptable through online link or demand draft only. Payment Gateway link and bank account details are given below. | <p>PROGRAMME FEES</p> <p>Categories & Participation Fees (INR)</p> <p>Government Officials and Working Professionals : 7500/-</p> <p>Number of functioning organization: 1000/-</p> <p>Academics and Teaching Community : 3500/-</p> <p>Researchers, Students and Retired professionals : 2000/-</p> <p>+ GST 18%</p> | <p>e-CERTIFICATE</p> <p>(i) Certificate of Participation for all who registers.</p> <p>(ii) Certificate of Merit for all those who have 90% attendance and 75% marks in the exam.</p> |
|--|---|---|--|

Target Audience

This course is designed to be useful and informative for policy and decision makers like Central and State Ministries involved with Water and Wastewater Departments, Pollution Control Boards, Mayors, standing and water works committees, Municipal Commissioners, Town Planners, Urban Local Bodies (ULBs), Jal Boards, Wastewater Treatment Companies, Wastewater Treatment Plant (WTPs), including Effluent Treatment (ETPs) and Sewage Treatment Plants (STPs) Associations, Operations & Maintenance and Service providers, Academicians, R&D Experts, Technology Developers and Providers etc. This course would also help mid-career professionals who are involved with the water and waste water reuse facility creation in government and private organizations to gain knowledge on new technologies, current practices, field experience, etc. The course would also be helpful for fresh graduates or students of the engineering, environment, water policy and planning disciplines.

Banking details: India PPP Capacity Building Trust, A/c No. 05881450000075, IFSC:HDFC0000588, Plot No B, Sector 4, R K Puram, Opposite Capital Court Building, New Delhi - 110022.

Registration link : <https://trainingprograms.icapttrust.in/ta/course/description/OTCB-Water-Reuse>

Bank Group Registration facilities available @discounted rate:


Last Date To Apply: 07-03-2021

Early Bird Incentive:
10% early bird discount on payment up to 1-3-2021


Partners







Government of the National Capital Territory of Delhi




DELHI STATE POLICY ON TREATED WATER REUSE

BY

THE GOVERNMENT OF NATIONAL CAPITAL TERRITORY OF DELHI (GNCTD)

2026

PHOTOCATALYTIC OXIDATION FOR SUSTAINABLE MANAGEMENT OF TEXTILE & DYEING INDUSTRY WASTEWATER



teri school of advanced studies

Draft Thesis Submission
By
Nipun Bhargava
Registration no. 1700532RSP

TERI School of Advanced Studies
Department of Regional Water Studies
Plot No. 10, Sankar Road, Vasant Kunj Institutional Area,
New Delhi, India, PIN - 110 070

[20th September 2024]

| S. No. | SUB-CATEGORY | CATEGORY / PROJECT TITLE | FUNDER |
|--------|--|---|--|
| | | 1. CONSULTANCY | |
| 1 | 1. Water Quality Monitoring & River Rejuvenation | Effect of Upgradation of 12 STPs of DJB and their effect on Water Quality of Sahibi River | DJB, Delhi Govt. |
| 2 | 2. Sustainability & Circular Economy | Options for Advanced Treatment and Resource Recovery for Decarbonization of Wastewater Utilities in the Bengaluru Metropolitan Area | The World Bank |
| 3 | 3. Review & Analysis | Wastewater Inventorization and Review of National Practice for reporting GHG Emissions from Domestic Wastewater in India | Tetra Tech and USEPA |
| 4 | 4. Pollution Abatement Plan | Water Quality Monitoring & Landfill Leachate Treatment & Management Plan | MCG & HSPCB |
| 5 | 5. Addressing Enviro-Legal & NGT Matters | Strategies to manage Treated Water at Industrial Model Township (IMT) in Bawal, Haryana | Haryana Water Resources Authority (HWRA), govt. of Haryana |
| 6 | 6. Preparing City Sanitation Plan | Development of City Sanitation Plan for six major cities of Kerala with focus on Liquid Waste Management | Department of Local Self Government, Kerala |
| | | 2. TECHNICAL ADVISORY | |
| 7 | 1. Treated Water Reuse Project Formulation | DJB Treated Water Reuse Plan with Tertiary Treatment & Reverse Osmosis (TTRO) Facility | DJB, Delhi Govt. |
| 8 | 2. Technology Assessment | Comparison of Sludge Treatment Technologies & Roadmap for Sludge Management at DJB STPs | DJB, Delhi Govt. |
| 9 | 3. Technology Innovation | Invention of TERI Advanced Oxidation Technology (TADOX) | WTI, DST, MoS&T, GoI |

| | | | |
|----|---|--|---|
| 10 | 4. Technology Development | Pilot trails and development of TADOX Technology for Industrial & Municipal Wastewater Treatment | Multi Client |
| 11 | 5. Technology Piloted in National Mission Project | TADOX Technology Piloted in National Mission Project in a CETP in Textile Cluster in Kanpur under Namami Gange Program | National Mission for Clean Ganaga (NMCG), MoJS, GoI |
| 12 | 6. Technology Commercialization | TADOX® Technology and Trademark License Agreement signed | Ion Exchange India Ltd. (IEI) Mumbai |
| 13 | 7. Technology Commercialization | TADOX® Technology and Trademark License Agreement signed | Dew Projects & Chemicals Pvt. Ltd. Noida |
| 14 | 8. Adequacy Assessment of CETP & ZLD Plant | Comprehensive Assessment of Balotra Textile Common Effluent Treatment Plant to achieve Zero Liquid Discharge (ZLD) | Balotra Water Pollution Control Treatment and RO Pvt. Ltd |
| 15 | 9. CSR Project | CSR Project from for Implementation of TADOX Technology Plant to treat grey water across ponds in Goondpur Village in Alwar Dist. of Rajasthan | DIAGIO, United Spirits Ltd. Bengaluru |

| | | | |
|----|--|---|---|
| | | 3. R&D ON ENVIRONMENTAL ISSUES | |
| 16 | 1. Research based Policy Interventions | Study of Froth in River Yamuna | Dept. of Environment, Delhi Govt. |
| 17 | 2. Research based Policy Interventions | Study of Microplastics in River Yamuna and Ground Water in Delhi | Dept. of Environment, Delhi Govt. |
| 18 | 3. R&D | Study of Physico-Chemical Properties of Metal & Metal Oxide Nanoparticles | DST-SERB Young Scientist, DST, MoS&T, GoI |

| | | | |
|----|---------------------------------|---|---|
| | | 4. ADVOCACY | |
| 19 | 1. National Status Review | Status of Used Water Management & Water Reuse Policies in all 28 States and 8 UTs of India | NMCG-TERI CoE on Water Reuse |
| 20 | 2. Water Reuse Policy Drafting | Water Reuse Policy for Delhi | DJB, Delhi Govt. |
| 21 | 3. Compendium | Compendium of best case studies of Treated Water Reuse in India | NMCG-TERI CoE on Water Reuse |
| 22 | 4. Policy Brief | Policy Brief on TADOX Technology Integration in Textile Clusters | NMCG-TERI CoE on Water Reuse |
| | | 5. KNOWLEDGE CREATION & CAPACITY BUILDING | |
| 23 | 1. Institution Building | NMCG-TERI CoE on Water Reuse at TERI | National Mission for Clean Ganaga (NMCG), MoJS, GoI |
| 24 | 2. Training & Capacity Building | Online Training & Capacity Building Certificate Program on Developing Treated Water Reuse Facilities | National Mission for Clean Ganaga (NMCG), MoJS, GoI |
| 25 | 3. Ph.D. Guidance | 26 Research Papers with 1670 Citations with average Impact Factor 9+ in Google Scholar and guided 3 Ph.D.s & 20 Dissertations, published 9 Newspaper & 9 magazine articles. | Multi Client |
| 26 | 4. Research Publications | | |
| 27 | 5. Media Articles | | |

Category 1:
CONSULTANCY

Effect of Upgradation of 12 STPs on the Water Quality of Sahibi River

By:

Dr. Nupur Bahadur

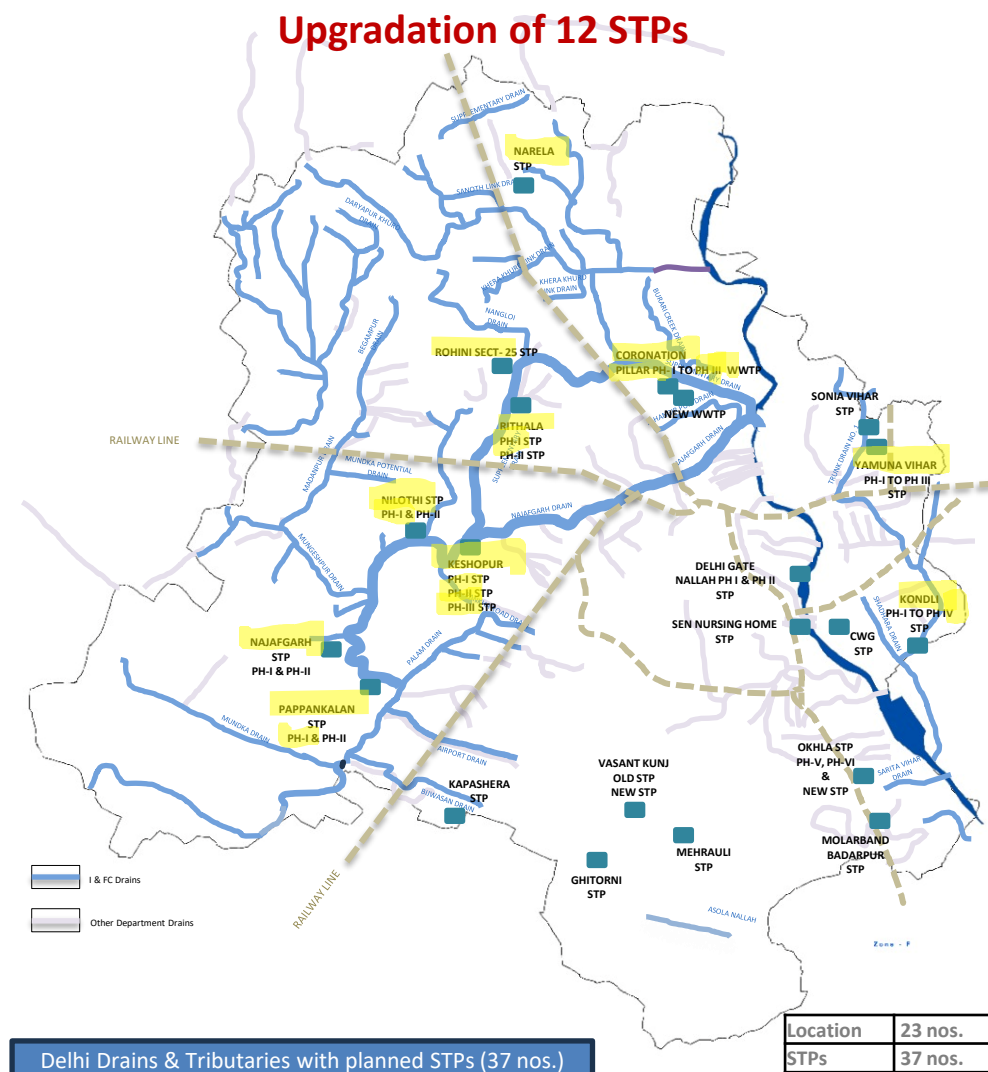
Subject Matter Expert (Sustainability & Circular Economy)

Team KPMG PMU, DJB



Conclusion

- 12 STPs: **Initial Capacity=275 MGD, Augmented Capacity=345 MGD** (Increase by 70 MGD); **Actual Treatment=335 MGD**
- All 12 STPs after upgradation were found compliant at the **Outlet** after Upgradation and meeting DPCC Discharge norms since Oct. 2025.
- Regarding **Sahibi River Water Quality**, as per **DTQC Nov 2025** data, Compliant COD value at almost all locations justifies improved treatment of chemical pollution.
- Sudden rise in **Dec 2025** for TSS, BOD and COD is explained by Director (DTQC): (i) at nearest points of Pappankalan-I (NR-9 & NR-10) there is intrusion of black sewage from Badshahpur, Dharampura and Palam Vihar drains and (ii) at nearest points of Keshopur-II & III (NR-12 & NR-13) there is intrusion from Mungeshpur drain and Madipur drain coming from Madipur Industrial area having majorly shoe factories.



2. Sustainability & Circular Economy

EXECUTIVE SUMMARY

Options for Advanced Treatment and Resource Recovery for Decarbonization of Wastewater Utilities in the Bengaluru Metropolitan Area

SUBMITTED TO
The World Bank Group
World Bank Contract no. 7206788



Project Completion Certificate

Name, Designation: Mr. Kristoffer Welsien, Senior Water Supply and Sanitation Specialist
Office Address of the Issuing Officer-The World Bank
Name of Contractor / Agency: The Energy and Resources Institute (TERI), Darbari Seth Block, Core 6C, India Habitat Centre, Lodhi Road, New Delhi - 110 003, India

| | | |
|----|---|---|
| 1 | Title of the Project | Options for Advanced Treatment and Resource Recovery for Decarbonization of Wastewater Utilities in the Bengaluru Metropolitan Area |
| 2 | Team Lead & PI | Dr. Nupur Bahadur |
| 3 | Work order | Contract 7206788 |
| 4 | Date of commencement of work | November 01, 2022 |
| 5 | Actual Date of completion | June 30, 2023 |
| 6 | Details of compensation levied for delay, if any | None |
| 7 | Value of Project | USD 64,558 |
| 8 | Brief Scope of Work | The primary objective of this project is to identify and assess large scale options for advanced treatment of wastewater and recovery and utilization of resources, such as biogas, bio solids and reusable water in the expanded BBMP area including the 110 villages, and to develop a regional strategy and plan for efficient and sustainable wastewater treatment and reuse. |
| 9 | (i) Work sub-contractor (ii) Amount shared with the vendor | (i) Infrastructure Development and Corporation (Karnataka) Limited (ii) INR Rs. 24 lakhs including taxes |
| 10 | Remarks on the executed work | Aspects from the report are being incorporated in nine new STPs in Bengaluru through projects worth 1,000 Crore |

Impact
Created

It is certified that the Project is successfully completed.

Mr. Kristoffer Welsien
Task Team Leader and Senior Water Supply and Sanitation Specialist
Date: June 4, 2025

OBJECTIVE:

The primary objective of this project was to identify and assess large scale options for advanced treatment of wastewater and recovery and utilization of resources, such as biogas, bio solids and reusable water in the expanded BBMP area including the 110 villages, and to develop a regional strategy and plan for efficient and sustainable wastewater treatment and reuse.

DELIVERABLES:

- (i) Team visited all 36 STPs of Bengaluru and suggested wastewater treatment technology based on capacity and point of reuse;
- (ii) Designed strategies for biogas generation, biosolid management, and reclaimed water reuse, integrating circular economy principles to support decarbonization of wastewater utilities.
- (iii) Provided various PPP models like HAM/BOOT/BOO etc.
- (iv) Developed a regional wastewater management roadmap and proposed that if BWSSB was earning INR 16 Crore/annum then how could it earn more than 480 Crore/annum with suggested interventions and become financially self-sustainable Utility.
- (v) To achieve this goal of financial sustainability, changes were suggested in Procurement Policy, State Water Policy and Water Reuse Policy.

IMPACT CREATED: As per the Project Completion Certificate received by the World Bank Group, **recommendations from the Project have been incorporated into nine new STP Projects in Bengaluru**



Final Project Report

Wastewater Inventorisation and Review of National Practice for reporting GHG emissions from wastewater

Submitted to
TETRA TECH



Tetra Tech & USEPA



2024 Global Methane Forum

Mobilizing Methane Action

18-21 March 2024, Geneva, Switzerland

The Importance of Data Collection and Monitoring, Reporting, and Verification (MRV) to Finance Projects in the Biogas Sector

Inventorization of GHG emissions from the Domestic Wastewater Sector in India

Dr Nupur Bahadur

Senior Fellow & Associate Director

NMCG-TERI CoE on Water Reuse

Circular Economy & Waste Management Division
The Energy and Resources Institute (TERI), INDIA

Vice Chairman

International Water Association - India



UNEP convened initiative

OBJECTIVE:

To study wastewater ecosystem in the country and inventorize the WTPs and review of national practices for GHG emissions reporting from the domestic wastewater sector.

DELIVERABLES:

- (i) Led nationwide inventorization of wastewater treatment plants (WTPs) to map infrastructure and operational status.
- (ii) Conducted comprehensive review of national practices for GHG emissions reporting from the domestic wastewater sector.
- (iii) Identified and summarized key emission sources including methane and nitrous oxide across treatment processes.
- (iv) Developed recommendations to improve GHG estimation methodologies, aligning with global best practices and IPCC guidelines.
- (v) Prepared a technical report and knowledge products for Tetra Tech and USEPA to support policy and reporting improvements.

IMPACT CREATED: Presented project findings at the Global Methane Forum Conference at the United Nations, Palais des Nations, Geneva (March 18–21, 2024).

4. Pollution Abatement



Final Report

Adequate & Sustainable Treatment of Bandhwari Landfill Leachate

Submitted to

MCG & Haryana State Pollution Control Board (HSPCB)

On-Site complete solution to treat Bandhwari Landfill Leachate



KEY RECOMMENDATIONS

- ✓ Direct leachate treatment using DTRO should be avoided as it is highly resource & energy intensive and does not provide sustainable solution to permeate and reject management.
- ✓ DTRO Permeate sent to Sewage Treatment Plant (STP) for further treatment will make STP dysfunctional and non-compliant.
- ✓ LTP should be operational all the time and its biological process needs to be improved.
- ✓ TADOX® is required to remove color & organics while DTRO is required to remove TDS, so therefore both TADOX® & DTRO should be integrated suitably as per requirement to provide adequate treatment.
- ✓ Based on preliminary study, the proposed On-Site Solution is integrated, adequate, resource & energy efficient, affordable and sustainable.

Background:

550 registered industries in IMT Bawal are equipped with 22.5 MLD (up to 30 MLD) CETP, which is functional to treat the pre-treated effluent generated from these industrial units. A 3rd party evaluation done earlier indicated that the treated water of the CETP meets the norms of inland discharge set by CPCB and HPCB, but due to lack of infrastructure for disposal of treated water approximately 132 acres of land in the surrounding areas has become waterlogged, creating both aesthetic and environmental challenges for the authorities and this called for NGT intervention.

Objectives:

- 1) To visit IMT Bawal area, collect water samples for testing & analysis and assess the quality of treated water from CETP and stagnant water around the CETP.
- 2) To carry out detailed evaluation of the process and operations of the CETP in order to assess quality of the discharged treated water whether meeting prescribed norms set by CPCB/HSPCB.
- 3) To assess water quality of the stagnant water, reuse potential of treated as well as stagnant water and how well the overall situation be managed for long term sustainability.
- 4) To develop action plan and provide necessary advice to add

Impact
Created

IMPACT CREATED:

Report helped Haryana Water Resource Authority (HWRA) to find sustainable solution to existing environmental problem and helped **solved NGT case** related to this matter.



Project Report

Strategies to Manage Treated Water at Industrial Model Township (IMT) in Bawal, Haryana

Submitted to:
The Chairperson
Haryana Water Resources Authority
HSVP, Sector-6, Panchkula, Haryana 134109

Category 2:
TECHNICAL
ADVISORY

DJB TREATED WATER REUSE PLAN
Tertiary Treatment & Reverse Osmosis (TTRO) Plant



1. Treated Water Reuse Plan for Delhi

- i. The initiative supports the broader objective of **limiting the use of piped potable water to essential domestic needs**, while progressively shifting commercial and industrial demand to treated reuse water. In addition, the project establishes a **replicable and scalable reuse model** that can be extended across Delhi, significantly reducing environmental discharge into the Yamuna River and positioning Delhi as a **national model for circular economy practices in urban water management**.
- ii. TTRO should therefore be viewed **not as a cost, but as a long-term investment** in water security, environmental sustainability, and economic growth. With timely implementation and continued guidance from Delhi Jal Board, the proposed TTRO projects can play a transformative role in improving water use efficiency, supporting industrial development, and advancing Delhi's vision for a resilient and sustainable urban water future, including implementation under a structured PPP framework where appropriate.



Delhi Jal Board

Comparison of Sludge Treatment Technologies & Roadmap for Sludge Management at DJB STPs

By:

- Dr. Nupur Bahadur, Subject Matter Expert (Sustainability & Circular Economy), KPMG PMU, DJB

Ministry of Science & Technology, Govt. of India Press Release on the successful outcome of DST Project for Technology development

TECHNOLOGICAL INNOVATION



Results published on DST Website

Ministry of Science & Technology

75 Azadi Ka Amrit Mahotsav <https://pib.gov.in/PressReleasePage.aspx?PRID=1748888>

New advanced oxidation technology can enhance waste water reuse at lower cost

Posted On: 25 AUG 2021 3:59PM by PIB Delhi

A new technology may soon enhance the reuse of waste water in an affordable and sustainable manner. The technology which uses UV-Photocatalysis can treat municipal sewage and highly polluting industrial wastewater streams and increase its reuse as a technological option in industrial as well as municipal wastewater treatments.

With ever-increasing water crisis, it becomes imperative for industries & utilities to reuse 'treated water'. However, the current treatment practices are inefficient because of high dependence on biological treatment processes which are highly energy intensive. This calls for development of sustainable technologies like Reverse Osmosis (RO), Membrane Evaporators (MEE). These systems are energy intensive and require high operating expenses. Researchers have felt the need to develop a sustainable technology which can treat municipal sewage and highly polluting industrial wastewater streams and increase its reuse as a technological option in industrial as well as municipal wastewater treatments.

The Energy and Resources Institute (ERI) has developed a sustainable technology which can treat municipal sewage and highly polluting industrial wastewater streams and increase its reuse as a technological option in industrial as well as municipal wastewater treatments. This technology can reduce the operating expense by 30-40% for municipal sewage treatment plants (STPs) and industrial wastewater treatment plants (IWTs).

भारत सरकार GOVERNMENT OF INDIA विज्ञान और प्रौद्योगिकी मंत्रालय MINISTRY OF SCIENCE AND TECHNOLOGY

<https://dst.gov.in/new-advanced-oxidation-technology-can-enhance-waste-water-reuse-lower-cost>

50 1971-2021 DEPARTMENT OF SCIENCE & TECHNOLOGY

स्वच्छ भारत एक कदम स्वच्छता की ओर

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Home >> New advanced oxidation technology can enhance waste water reuse at lower cost

New advanced oxidation technology can enhance waste water reuse at lower cost

Awards and Recognitions



Design & Manufacturing Technologies for 'Make in India'
7th Oct 2015
Ministry of Science & Technology, Govt. of India

ETE Water Award Technology Innovation
22nd Oct 2015
ETE Save the Environment Society for Research & Awareness, Kolkata

Asia Foundation Excellence Technology Development
23rd Oct 2015
Asia Foundation, New Delhi & Ministry of Jal Shakti, Govt. of India

RICT Water Award Innovation in Water Technology
23rd Nov 2022
Federation of Indian Chambers of Commerce & Industry Water Mission



IWA-Project Innovation Award 2024 SILVER
Category: Breakthrough in Research & Development
Selected from amongst 108 entries from 34 Countries,
13th Aug 2024, Toronto, Canada



Valuable Contributor Award
Category: Green Leadership
14th Oct 2024, GRIHA, New Delhi

The technology is commercialized and ready for field implementation through our Licensees Partners.

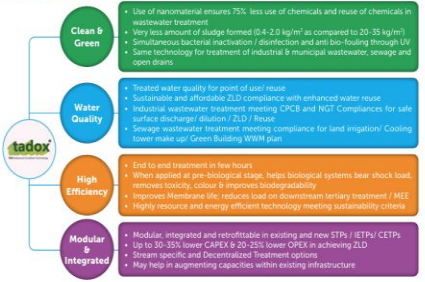


<https://ionexchangeglobal.com/>



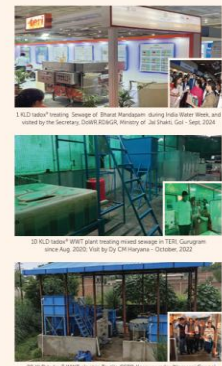
<https://www.dewindia.com/>

OVERALL BENEFITS



SAME TECHNOLOGY-WIDE APPLICATION AREA

| Implementation Sectors (Industrial) | Implementation Sectors (Surface Water) | Target Parameters | Application Area |
|--|--|--|--|
| <ul style="list-style-type: none"> Textile Serumy Chemical & Petrochemical Food & Beverage Pharmaceutical LA/ME Manufacturing | <ul style="list-style-type: none"> MEE & Low boiler Denamry Dye & Dye Pesticide Strength/Inhibitor Oil & Gas Phosphoric Acid Dyeing & Sugar Construction Housing Others | <ul style="list-style-type: none"> Color COD TSS TOC TP POPS Microplastics Pathogens | <ul style="list-style-type: none"> Decentralized Wastewater Treatment (DWT) Zoo Liquid Discharge (ZLD) Water Reuse Lake/Pond rejuvenation Water Charging Programmes Jal Jeevan Mission (Urban) AMUL Water Union (D/D) Swachh Bharat Mission |



FOR FURTHER DETAILS PLEASE CONTACT
Dr. Mani Narayan, Founder Director
NIRCC/ETP Centre of Excellence on Water Reuse (NIRCC/ER)
The Energy and Resources Institute (TERI), Lodhi Road, New Delhi-110003
Email: water@teriresources.in | Website: www.teriresources.in
Tel: +91-11-2646 1200 or +91-11-2646 1214 | Fax: +91-11-2646 1244 | Mob: +91-98-10-2465 1245

About tadox®

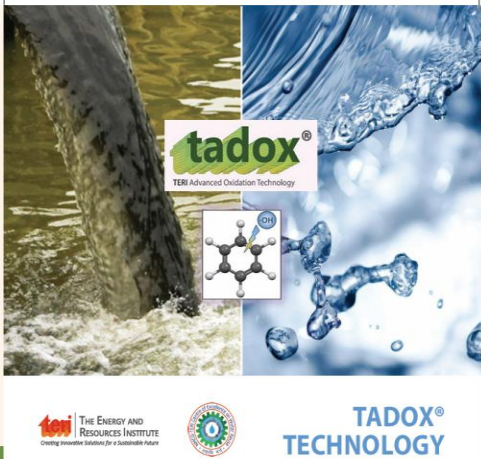
The Energy and Resources Institute (TERI) has developed a patented technology called TERI Advanced Oxidation Technology (tadox®) for adequate treatment of municipal sewage, open drains, landfill leachate and industrial wastewater. It involves UV-TiO₂ Photocatalysis where in-situ generation of hydroxyl radicals leads to oxidative degradation and mineralization of targeted pollutants and is highly effective in treatment of wastewater containing high color, COD, BOD, TOC, dissolved organics, microplastics, non-biodegradable and persistent organic pollutants (POP).



tadox® was developed through DST-WTI, Ministry of Science & Technology, Govt. of India and now piloted successfully in the Namam Ganga National Mission, Ministry of Jal Shakti, Govt. of India. This technology was demonstrated in a Textile Common Effluent Treatment Plant (CETP) in Roosa Industrial Area, Kanpur, making it a global 1st-of-its-kind initiative of demonstrating UV-Photocatalysis for wastewater treatment at 20 KL/d and this project bagged Silver Award in the IWA Project Innovation Awards 2024.



WhatsApp: +9198102465124
NIRCC @ tadox® website link



THE ENERGY AND RESOURCES INSTITUTE
Enabling tomorrow's leaders with a sustainable future

TADOX® TECHNOLOGY

ENERGY AGRICULTURE ENVIRONMENT HABITAT RESOURCE SECURITY CLIMATE HEALTH & NUTRITION

4. Industrial & Municipal Wastewater Treatment Technology Development

Industrial Wastewater Treatment

| (Uttar Pradesh & Uttarakhand) | Punjab, Haryana, Andhra Pradesh & Kerala | Maharashtra, Tamil Nadu & Gujarat |
|--|---|---|
| Textile CETP, Kanpur, 2023/24 <ul style="list-style-type: none"> pH: 6.5 Conductivity: 1280 microS • COD: 3840 mg/L • COD: 128 mg/L • BOD: 13 mg/L • BOD/COD ratio: 0.11 • Chlorides as Cl⁻: 348 mg/L • Nitrate as NO₃⁻: 228 mg/L • Total Nitrogen: 223 mg/L | Tannery ETP, Kanpur <ul style="list-style-type: none"> pH: 8.26 • COD: 1480 mg/L • COD: 128 mg/L • BOD: 13 mg/L • Measured Chromium (Cr⁶⁺): 2 mg/L | Textile ETP, Ludhiana <ul style="list-style-type: none"> pH: 9.5 • TSS: 4610 mg/L • TSS: 338 mg/L • COD: 229 mg/L • BOD: 14 mg/L • Color: 2718 Hazen |
| Slaughter House, Agra <ul style="list-style-type: none"> • COD: 45 mg/L • Colour: 16 | Pharmaceutical Industry, Rishikesh <ul style="list-style-type: none"> pH: 6.2 • COD: 1200 mg/L • COD: 128 mg/L • TSS: 488 mg/L • Total Ammonia Nitrogen: 0.1 mg/L • Residual Phosphorus: 5.5 mg/L | Chemical Manufacturing ETP, Noida <ul style="list-style-type: none"> pH: 5.4 • Conductivity: 3970 microS/cm • COD: 240 mg/L • TSS: 704 mg/L • BOD: 23 mg/L • Color: 237 mg/L |
| Chemical Manufacturing ETP, Roorkee <ul style="list-style-type: none"> pH: 8.18 • COD: 360 mg/L • COD: 128 mg/L • BOD: 18 mg/L • Measured Chromium (Cr⁶⁺): 0.1 mg/L • Total Nitrogen: 1.0 mg/L • Total Ammonia Nitrogen: 0.06 mg/L • Reactive Phosphorus: 0.1 mg/L | Oil & Gas Industry, Ahmedabad <ul style="list-style-type: none"> pH: 8.8 • COD: 234 mg/L • COD: 240 mg/L • TSS: 704 mg/L • BOD: 23 mg/L • Color: 16 | MEE Condensate, Bharuch <ul style="list-style-type: none"> pH: 8.8 • COD: 128 mg/L • COD: 128 mg/L • TSS: 704 mg/L • BOD: 23 mg/L • Color: 16 |
| Chemical Manufacturing ETP, Raigarh <ul style="list-style-type: none"> pH: 6.88 • Turbidity: 457 NTU • COD: 390 mg/L • COD: 137 mg/L • TSS: 12 mg/L • BOD: 0.35 mg/L • BOD/COD ratio: 0.12 | Electronic Manufacturing, Hapur <ul style="list-style-type: none"> pH: 8.0 • COD: 40 mg/L • COD: 24 mg/L • TSS: 15 mg/L • NO₃⁻: 14 mg/L • NO₂⁻: 2 mg/L • TN: 26 mg/L | Standalone STP, Gurugram <ul style="list-style-type: none"> pH: 8.0 • COD: 128 mg/L • COD: 128 mg/L • TSS: 24 mg/L • TSS: 83 mg/L • NO₃⁻: 16.6 mg/L • Color: 149 mg/100L |
| Chemical Manufacturing ETP, Raigarh <ul style="list-style-type: none"> pH: 8.88 • Turbidity: 457 NTU • COD: 390 mg/L • COD: 137 mg/L • TSS: 12 mg/L • BOD: 0.35 mg/L • BOD/COD ratio: 0.12 | Electronic Manufacturing, Hapur <ul style="list-style-type: none"> pH: 8.0 • COD: 40 mg/L • COD: 24 mg/L • TSS: 15 mg/L • NO₃⁻: 14 mg/L • NO₂⁻: 2 mg/L • TN: 26 mg/L | Gochi Drain, Faridabad <ul style="list-style-type: none"> pH: 8.0 • TSS: 280 mg/L • COD: 200 mg/L • COD: 128 mg/L • TSS: 24 mg/L • TSS: 83 mg/L • NO₃⁻: 16.6 mg/L • Color: 145.18 Hazen |

Municipal Wastewater, Sewage and Open Drain Treatment

| Current Conventional Treatment | Municipal STP, Delhi | tadox® Treatment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------------|--------------------|-----|------|------|------|-------|-----|-----|-------------|---|---|-----------|-----|------|-----------|-------|------|-----------|-------|------|------------------------|-----|---|------------------------|------|------|------------------------|-----|-----|------------------|--------|-------|----------------------|------|-------|--|-----------|---------------|----|-----|----|--------------------|--|------------|-------------|--------------------|----|-----|-----|-------|----|-----|-------------|---|---|-----------|------|------|-----------|------|-----|-----------|----|----|------------------------|------|------|------------------------|------|------|------------------------|-----|-----|------------------|----|----|----------------------|---|---|
| Delhi & Haryana <table border="1"> <tr><th>Parameters</th><th>STP</th><th>OTF</th></tr> <tr><td>Cell</td><td>72.2</td><td>72.2</td></tr> <tr><td>Color</td><td>204</td><td>184</td></tr> <tr><td>pH: CO2 Cl2</td><td>-</td><td>-</td></tr> <tr><td>TDS, mg/L</td><td>342</td><td>3680</td></tr> <tr><td>CO2, mg/L</td><td>35200</td><td>8800</td></tr> <tr><td>BOD, mg/L</td><td>10100</td><td>3500</td></tr> <tr><td>NO₂, mg/L</td><td>440</td><td>0</td></tr> <tr><td>NH₄, mg/L</td><td>0.13</td><td>0.18</td></tr> <tr><td>NH₃, mg/L</td><td>700</td><td>100</td></tr> <tr><td>E.Coli MPN/100ml</td><td>150000</td><td>6/100</td></tr> <tr><td>Total Coli MPN/100ml</td><td>8500</td><td>2/100</td></tr> </table> | Parameters | STP | OTF | Cell | 72.2 | 72.2 | Color | 204 | 184 | pH: CO2 Cl2 | - | - | TDS, mg/L | 342 | 3680 | CO2, mg/L | 35200 | 8800 | BOD, mg/L | 10100 | 3500 | NO ₂ , mg/L | 440 | 0 | NH ₄ , mg/L | 0.13 | 0.18 | NH ₃ , mg/L | 700 | 100 | E.Coli MPN/100ml | 150000 | 6/100 | Total Coli MPN/100ml | 8500 | 2/100 | <table border="1"> <tr><th>STP Inlet</th><th>Direct tadox®</th></tr> <tr><td>5h</td><td>24h</td></tr> <tr><td>3h</td><td>tadox® @ Polishing</td></tr> </table> | STP Inlet | Direct tadox® | 5h | 24h | 3h | tadox® @ Polishing | <table border="1"> <tr><th>Parameters</th><th>Current STP</th><th>SDCCP or Polishing</th></tr> <tr><td>pH</td><td>8.0</td><td>8.8</td></tr> <tr><td>Color</td><td>14</td><td>< 1</td></tr> <tr><td>pH: CO2 Cl2</td><td>-</td><td>-</td></tr> <tr><td>TDS, mg/L</td><td>91.3</td><td>1280</td></tr> <tr><td>CO2, mg/L</td><td>2150</td><td>240</td></tr> <tr><td>BOD, mg/L</td><td>42</td><td>42</td></tr> <tr><td>NO₂, mg/L</td><td>0.08</td><td>0.03</td></tr> <tr><td>NH₄, mg/L</td><td>0.75</td><td>0.12</td></tr> <tr><td>NH₃, mg/L</td><td>340</td><td>230</td></tr> <tr><td>E.Coli MPN/100ml</td><td>ND</td><td>ND</td></tr> <tr><td>Total Coli MPN/100ml</td><td>2</td><td>2</td></tr> </table> | Parameters | Current STP | SDCCP or Polishing | pH | 8.0 | 8.8 | Color | 14 | < 1 | pH: CO2 Cl2 | - | - | TDS, mg/L | 91.3 | 1280 | CO2, mg/L | 2150 | 240 | BOD, mg/L | 42 | 42 | NO ₂ , mg/L | 0.08 | 0.03 | NH ₄ , mg/L | 0.75 | 0.12 | NH ₃ , mg/L | 340 | 230 | E.Coli MPN/100ml | ND | ND | Total Coli MPN/100ml | 2 | 2 |
| Parameters | STP | OTF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cell | 72.2 | 72.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Color | 204 | 184 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| pH: CO2 Cl2 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TDS, mg/L | 342 | 3680 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CO2, mg/L | 35200 | 8800 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BOD, mg/L | 10100 | 3500 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NO ₂ , mg/L | 440 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NH ₄ , mg/L | 0.13 | 0.18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NH ₃ , mg/L | 700 | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E.Coli MPN/100ml | 150000 | 6/100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Coli MPN/100ml | 8500 | 2/100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STP Inlet | Direct tadox® | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5h | 24h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3h | tadox® @ Polishing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Parameters | Current STP | SDCCP or Polishing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| pH | 8.0 | 8.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Color | 14 | < 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| pH: CO2 Cl2 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TDS, mg/L | 91.3 | 1280 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CO2, mg/L | 2150 | 240 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BOD, mg/L | 42 | 42 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NO ₂ , mg/L | 0.08 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NH ₄ , mg/L | 0.75 | 0.12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NH ₃ , mg/L | 340 | 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E.Coli MPN/100ml | ND | ND | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Coli MPN/100ml | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Mixed Sewage Treatment

GRIPA Council
The Energy and Resources Institute®

"TERI Advanced Oxidation Technology"
(Under Punjab STP (Grey & Black Water))

The water bodies in the area of the project were highly polluted. The water quality has been improved.

GRIPA Council has been the project licensee. The project has been successfully completed and the water quality has been improved.

The water for the licensee was released on 14th January, 2024.

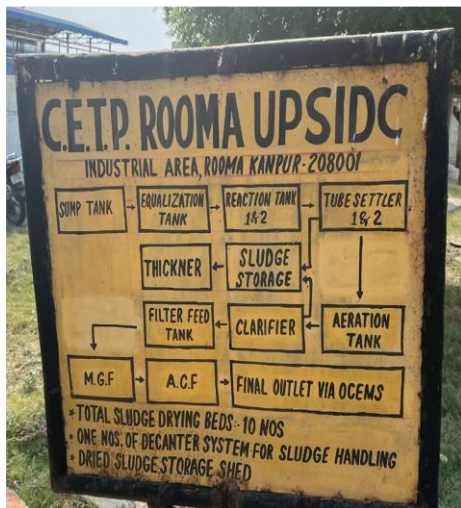
| Sl. No. | Parameter | Value | Limit |
|---------|----------------------------|-------|-----------|
| 1 | pH | 7.8 | 6.5 - 8.5 |
| 2 | TSS (mg/L) | 70 | 628 |
| 3 | TSS (mg/L) | 394 | < 400 |
| 4 | Residual Chlorine (mg/L) | 596 | 1200 |
| 5 | Turbidity (mg/L) | 436 | 4 |
| 6 | BOD (mg/L) | 45 | 62 |
| 7 | CO2 (mg/L) | 380 | < 400 |
| 8 | Chlorides (mg/L) | 3319 | 1619 |
| 9 | Turbidity (mg/L) | 3436 | 4500 |
| 10 | BOD (mg/L) | 446 | 276 |
| 11 | NH ₃ (mg/L) | 35.2 | 6 |
| 12 | NO ₂ (mg/L) | 0.14 | < 0.1 |
| 13 | NO ₃ (mg/L) | 15.64 | 45 |
| 14 | Color (mg/L) | 11 | 100 |
| 15 | Total Coliform (MPN/100ml) | 5/100 | < 1000 |

TERI Advanced Oxidation Technology
The project has been successfully completed and the water quality has been improved.

*Wastewater quality parameters analyzed at a National Accreditation Board for Testing and Calibration Laboratory (NABL) Delhi as per ISO/IEC 17025:2015.



5. Technology Piloted in National Mission Project




Raw Effluent Tadox Treated

1. For ETPs Tadox[®] treated water could be used for various in-house applications.
2. In a CETP, Tadox[®] treated water will go to existing Biological Treatment.

| Parameters | Unit | CSIR – Indian Institute of Toxicology Research Lab, Lucknow | | |
|---------------------|-------|---|---------------------|----------|
| | | Raw water | TADOX Treated water | % Change |
| Colour | Hazen | 1249.00 | 22.33 | 98 |
| pH Value | - | 8.66 | 7.79 | - |
| TSS | mg/l | 270.0 | 6.0 | 98 |
| Ammoniacal Nitrogen | mg/l | 3.81 | <0.11 | 97 |
| Oil and Grease | mg/l | 31.2 | 2.4 | 92 |
| COD | mg/l | 990.0 | 54.4 | 94.5 |
| BOD | mg/l | 312.50 | 11.00 | 96.5 |
| Odor | - | Objection-able | Un-Objectionable | |

Achievements

1. COD \leq 50 mg/l, BOD \leq 10 mg/l and Color \leq 10 Hz
2. 85-90% Water Reuse
3. 50% CAPEX & 40% OPEX Reduction
4. GHG emission reductions up to 32%.
5. With Solar integration, Net Zero Target is achievable.
6. 1st of its kind demonstration in the World of Advanced Oxidation Photocatalytic (AOP) treatment in a Textile CETP.
7. 75% Less use of chemicals.
8. Sludge reduction from 30 to 0.5 Kg/m³
9. Non-toxic sludge
10. Evidence based Policy recommendations.



tadox
Water & Wastewater Technology

NET ZERO

POLICY BRIEF

INTEGRATION OF TADOX® TECHNOLOGY TO ACHIEVE NET ZERO IN TEXTILE WASTEWATER TREATMENT: POLICY RECOMMENDATIONS BASED ON PILOT STUDY IN A CETP

Dr Nupur Bahadur

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
JAL SHAKTI

NAMAMI GANGE

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

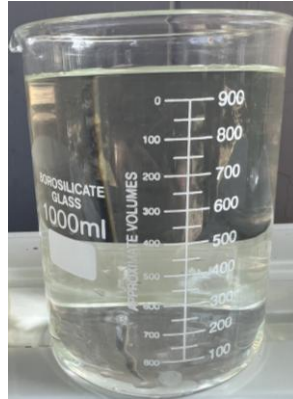
TADOX® treating Mixed Sewage of TERI Gurugram Campus



**Direct
End to End
Treatment
in 5 h**



**No Stream
Segregation**



GRIHA Council

This is to certify that the product of

“The Energy and Resources Institute”

TADOX® (TERI Advanced Oxidation Technology)

(under typology: STP (Grey and Black Water))

has been included in the GRIHA Product Catalogue under the following categories:

GRIHA V.2019 criterion: 14;

&

GRIHA V.2015 criterion: 14

The product can be used in GRIHA registered projects to meet the GRIHA norms, respectively. This is valid only for the product which has been mentioned above.

The certificate for the above-mentioned product is valid from

19th January, 2024 – 18th January, 2026

Sanjay Seth
Vice President & Chief Executive Officer

Note:
1. Before selecting the above specified products, it is recommended to revalidate that the project is meeting the GRIHA's mandatory compliances.
2. This evaluation has been done based on the documentation – in the form of 3rd party test results and/or declarations – submitted by the manufacturer to GRIHA Council.
3. The enlisted product(s) only qualify for the criterion mentioned in the certificate.
GRIHA Council is a joint initiative of Ministry of New and Renewable Energy, Government of India and The Energy and Resources Institute (TERI) to implement GRIHA (Green Rating for Integrated Habitat Assessment), India's National Rating System for Sustainable Habitats.
www.grihaindia.org

| S.No. | Parameters | Raw Water | Treated water | GRIHA* | GRIHA** | Matching criteria |
|-------|--|--------------------|---------------|---------|------------|-------------------|
| 1 | pH | 7.8 | 8.1 | 6.5-9.0 | 6.0-8.5 | ✓ |
| 2 | TDS (mg/L) | 757 | 628 | | 2100 (max) | ✓ |
| 3 | TSS (mg/L) | 184 | 6.0 | <20 | | ✓ |
| 4 | Electrical conductivity (micromhos/cm) | 1541 | 1255 | | 2250 (max) | ✓ |
| 5 | Turbidity (NTU) | 10.3 | 4 | - | - | |
| 6 | BOD (mg/L) | 45 | 6.20 | <10 | - | ✓ |
| 7 | COD (mg/L) | 160 | 40 | <50 | - | ✓ |
| 8 | Chlorides (mg/L) | 103.97 | 99.97 | - | 600 (max) | ✓ |
| 9 | Sulphates (mg/L) | 54.88 | 43.92 | - | 1000 (max) | ✓ |
| 10 | Sodium Absorption Ratio | 4.41 | 2.76 | | 26 (max) | ✓ |
| 11 | NH ₄ -N (mg/L) | 21.2 | 0.8 | <5 | - | ✓ |
| 12 | N-total (mg/L) | 123.4 | 8.4 | <10 | - | ✓ |
| 13 | Boron (mg/L) | 1.1 | 0.99 | - | 2 (max) | ✓ |
| 14 | Fecal Coliform (MPN/100 mL) | 3x 10 ⁶ | <10 | <100 | - | ✓ |

*GRIHA standards for Sewage Treatment Plant (STP)

** CPCB standard for Irrigation Water in GRIHA Manual v 2019

TADOX® technology treated LIVE, Sewage of Bharat Mandapam during India Water Week 2024



Ms. Debashree Mukherjee
Secretary, Department of Water Resources (DoWR,RD&GR),
Ministry of Jal Shakti, GoI



Ms. Vini Mahajan
Secretary, Department of Drinking Water and Sanitation (DDWS),
Ministry of Jal Shakti, GoI



Reimagining the future of water

The IWA Project Innovation Awards 2024



IWA
Project Innovation
Award 2024

SILVER

Breakthrough in
Research & Development

(Amongst 108 entries from 34 Countries)



(Awarded on 13th Aug 2024 in Toronto, Canada)

6. TADOX® Technology Commercialization

1. TADOX® Technology & Trademark License Agreement signed with Ion Exchange India Ltd on 21st Feb. 2024



7. TADOX® Technology Commercialization

2. TADOX® Technology & Trademark License Agreement with M/S Dew Projects and Chemicals Pvt. Ltd., Noida on 14th March 2023



8. Adequacy Assessment of CETP & ZLD Plant



Final Project Report

Comprehensive Assessment 18 MLD ZLD Plant at Balotra

Submitted to
Balotra Water Pollution Control and Research Foundation Trust

OBJECTIVE:

To perform adequacy assessment of the CETP along with the status check of ZLD Plant.

DELIVERABLES:

- (i) Conducted technical adequacy assessment of CETP and ZLD systems, reviewing design, capacity, and operational efficiency.
- (ii) Performed gap analysis to identify discrepancies between procurement specifications and actual implementation affecting performance.
- (iii) Recommended process optimization measures for RO recovery, reject management, and energy efficiency to achieve ZLD compliance.
- (iv) Coordinated with SPV management, technology vendors, and regulators, delivering a detailed technical report and proposed sustainability strategy including resource recovery and water reuse.

IMPACT CREATED: Report helped the SPV to find **difference in the procurement document vs real implementation** impacting performance and take corrective actions.

Impact
Created

9. CSR Project



TADOX® Technology for Treatment of Grey water at Goondpur Village, Rajasthan

Submitted to:
Diageo India

DIAGEO
India



teri THE ENERGY AND
RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

TADOX® Technology for Pond Rejuvenation in Goodpur Village in Alwar



Inlet



Outlet



| | |
|------------------------|-------------------------------------|
| Site: Alwar, Rajasthan | Sample Collection Date: 15/01/2026 |
| | Sample Received in Lab: 16/01/2026 |
| | Analysis Date: 16 to 22/01/2026 |
| | Sampled By: Mr. Shubham Yadav |
| | Sample: Three Water Sample Received |

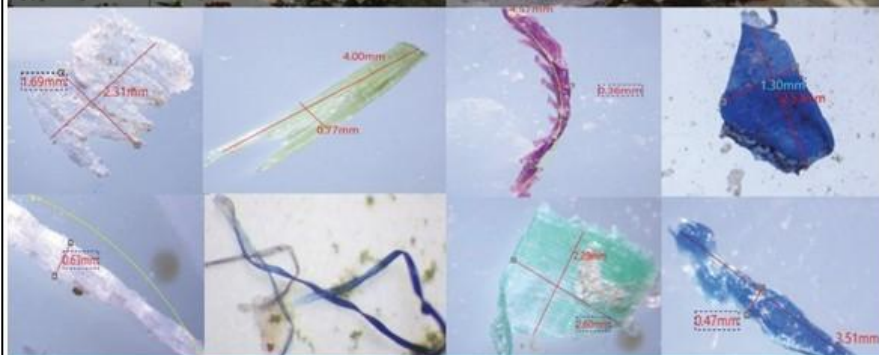
| S. No. | Parameters | Units | STP Inlet | STP Outlet |
|--------|--------------|-------|-----------|------------|
| 1. | pH | - | 7.47 | 7.15 |
| 2. | TDS | mg/L | 864 | 955 |
| 3. | Conductivity | μS/cm | 1330 | 1471 |
| 4. | Turbidity | NTU | 14.81 | 0.18 |
| 5. | TSS | mg/L | 17 | 2.0 |
| 6. | COD | mg/L | 88 | 25 |
| 7. | BOD | mg/L | 26 | 7 |

Category 3:

R&D

ON ENVIRONMENTAL ISSUES

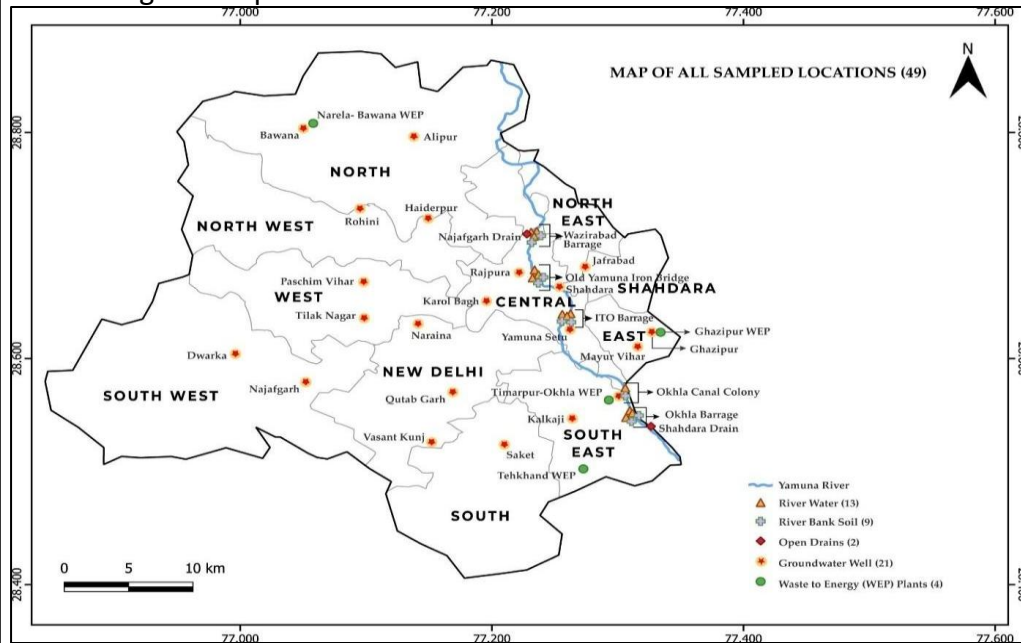
1. Research based Policy Interventions



Study on Microplastics in River Yamuna and Groundwater in Delhi

Objectives:

- (1) To assess the water quality of the River Yamuna and groundwater in Delhi with a special focus on the presence of microplastics (MPs).
- (2) To identify potential sources of MP contamination across Delhi's districts and along the River Yamuna.
- (3) To understand leaching impacts of MPs along banks of the river.
- (4) To map major hotspots in both river and groundwater systems.
- (5) To propose a time-bound action plan with enforceable strategies to mitigate MP pollution.



2. Research based Policy Interventions

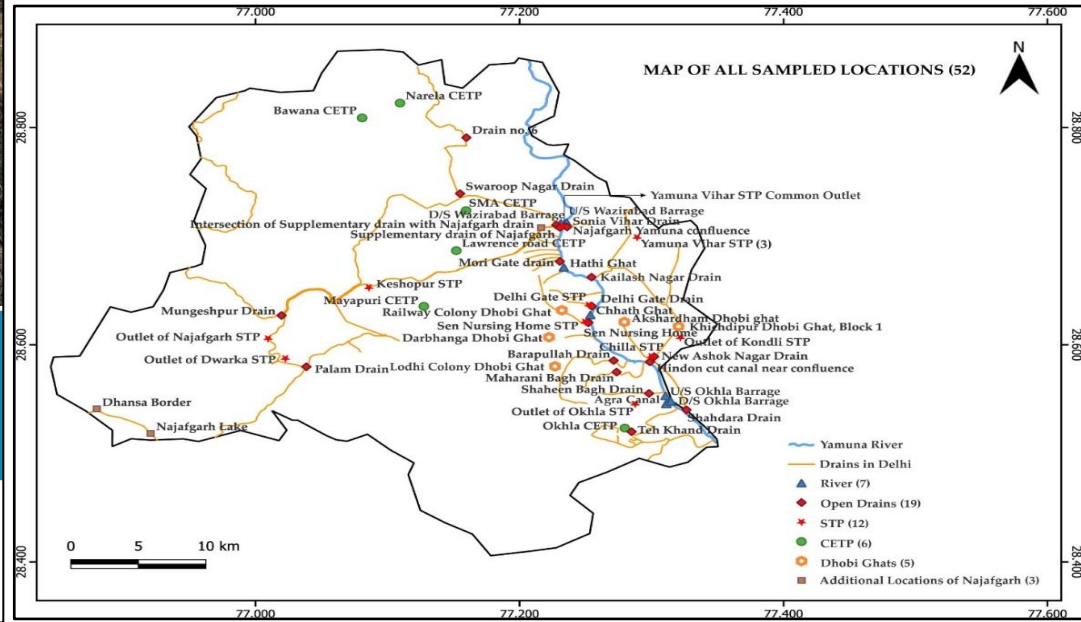


Final Report

Study on Yamuna Frothing in Delhi

Objectives:

- (1) To find reasons behind the frothing in River Yamuna and correlate it with the outflow of different drains.
- (2) To identify sources of frothing in Najafgarh and Supplementary drains.
- (3) To identify major drains accounting for maximum pollution load responsible for froth and finding out parameters exceeding the standard/permissible limits.
- (4) To identify area sources such as colonies, industrial areas, etc., contributing to the pollution load responsible for frothing in Yamuna.
- (5) To develop short-term, medium-term and long-term action plan including clear enforcement strategies for minimizing frothing/foaming in the river Yamuna.



Department of Environment
Government of NCT of Delhi



teri THE ENERGY AND
RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

Yamuna Froth: Blame It On Detergents And Dirty Water

Study Offers Several Suggestions To Curb Pollution In River

Kushagra Dixit
@timesofindia.com

New Delhi: Acting on the Delhi govt's recommendation, The Energy and Resources Institute (Teri) has prepared a comprehensive strategic plan to tackle frothing in the Yamuna, identifying major pollution sources and department-specific measures to address the issue.

The study, commissioned to develop a roadmap for the river's rejuvenation, notes that froth forms when poor water quality, high levels of surfactants from detergents and turbulence combine—particularly when barrage gates at Okhla are opened, which stirs up sludge and causes foaming.

Shared with Delhi govt and a copy of which is with TOI, the study calls for a coordinated approach across departments, starting with strengthening a centralised mechanism like the State Mission for Clean Yamuna (SMCY) to ensure inter-agency coordination.

It recommends that the Department of Environment revisit the 1994 Yamuna water-sharing agreement to ensure minimum environmental flow and present Teri's findings in the upcoming winter session of the Delhi Assembly as part of a broader public awareness campaign.

For pollution monitoring, the Delhi Pollution Control Committee (DPCC) has been advised to expand water testing to include ammonia and phosphate—key contributors to detergent-induced froth—beyond the existing parameters. The report also calls for regular inspections of Dhobi Ghats, installation of micro sewage treatment

TERI'S FINDINGS AND RECOMMENDATIONS



CAUSE: Froth forms due to a mix of detergent surfactants, pollution load and high turbulence near barrages

Environment Dept:

Strengthen Clean Yamuna Mission; ensure minimum environmental flow

DPCC & BIS: Monitor ammonia and phosphate; promote eco-friendly zeolite & enzyme against phosphate & sulphate based detergents

Irrigation and flood control:

Install aerators and webcams

at barrages; clear water hyacinth; conduct regular desilting

DIB: Upgrade STPs with tech like bio-nutrient removal and advanced oxidation photocatalyst; enforce compliance; adopt IoT monitoring

MCD: Monitor drains online;

tap illegal outfalls; curb untreated sewage

DSIIDC: Audit CETPs; act against illegal dyeing units; enforce zero liquid discharge

DDA: Install decentralised STPs in JJ clusters using compact oxidation tech



plants (STPs) at laundry cluster, and stricter enforcement of eco-friendly detergent standards. DPCC is urged to collaborate with the Bureau of Indian Standards to promote zeolite- and enzyme-based detergents over phosphate-heavy alternatives.

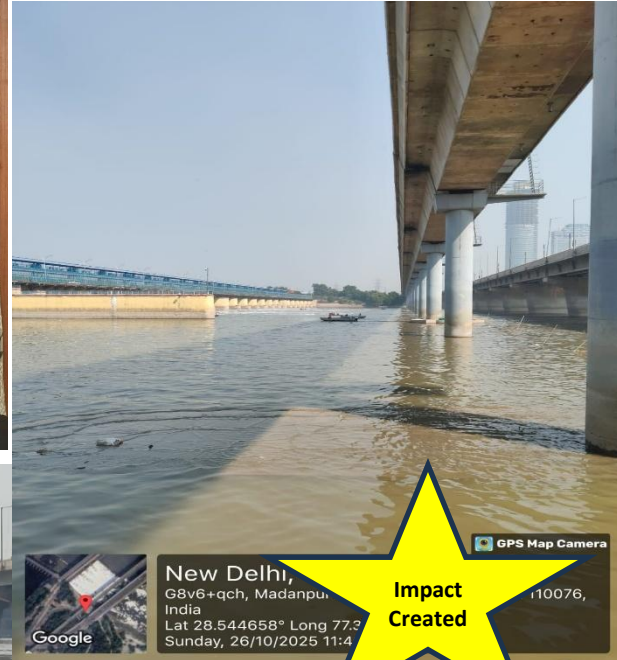
The Irrigation and Flood Control Department (IFCD) has been tasked with installing aerators in low-flow areas, particularly upstream of Okhla barrage, to maintain dissolved oxygen levels and reduce froth. The study also proposes webcams at barrage gates for real-time monitoring and regular removal of water hyacinth, which contributes to foam formation. Delhi Jal Board (DJB) has been advised to expand STP ca-

capacity improve compliance—12 STPs were found non-compliant—and adopt advanced treatment technologies such as Biological Nutrient Removal and Advanced Oxidation Processes.

Other directives include online water quality monitoring at drains, flow meter installation, and curbing illegal discharges by the Municipal Corporation of Delhi; strict performance checks and new CETPs by the Delhi State Industrial and Infrastructure Development Corporation; and decentralised or micro-STPs for unauthorised colonies and JJ clusters by Delhi Development Authority. "The study was commissioned by the Delhi govt, and after a year of research, we

have developed concrete recommendations," said Nupur Bahadur, director of Teri's NMCG Centre of Excellence on Water Reuse. "If each department acts promptly and in coordination, frothing can be controlled, pollution in the Yamuna reduced, and the river's rejuvenation achieved within a set timeframe."

Echoing Teri's findings, environment minister Manjinder Singh Sirsa said the study highlights critical gaps that need to be addressed. "The recommendations made by the study are very helpful and pave the way for cleaning the river," he said. "We will use the results and suggestions, and plug the gaps highlighted to ensure effective action," he added.



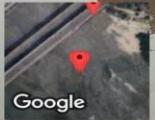
It was Froth Free Yamuna & Froth Free Chatt Festival in 2025!!



New Delhi, India
8Bv6+qch, Madanpur
Lat 28.544658° Long 77.3
Sunday, 26/10/2025 11:4

Impact Created

GPS Map Camera



Noida, Uttar Pradesh, India
Kalindi Kunj Brg, Noida, Uttar Pradesh 201313, India
Lat 28.546671° Long 77.316147°
Sunday, 26/10/2025 01:09 PM GMT +05:30

GPS Map Camera



National Television @ Prime-Time Show by Mr. Rajdeep Sardesai at INDIA TODAY on 28th Nov 2025



Environment Minister Manjinder Singh Sirsa (File Photo/ANI)
Delhi Environment Minister Manjinder Singh Sirsa reviews TERI study on microplastics and frothing in Yamuna River
ANI | Updated: Dec 02, 2025 22:44 IST
New Delhi [India], December 2 (ANI): The Environment Department convened a high-level meeting on Tuesday, under the leadership of Delhi Chief Minister Rekha Gupta. The meeting was chaired by Environment Minister Manjinder Singh Sirsa to review TERI's comprehensive study on microplastics and frothing in the Yamuna river, according to an official release.

THE TIMES OF INDIA
City: Delhi Mumbai Bengaluru Hyderabad Kolkata
Yamuna pollution: TERI study suggests better monitoring, upgraded treatment plants
TNN / Dec 02, 2025, 23:33 IST

The Indian EXPRESS December 3, 2025 05:41 AM IST
JOURNALISM OF COURAGE
TERI flags high surfactant levels, ammonia and microplastics in the Yamuna
Identify hotspots, prepare time-bound implementation plans: Environment minister

Yamuna covered in pink froth, raising concerns over pollution

Paras Singh

paras@hindustantimes.com

NEW DELHI: The Kalindi Kunj to Okhla barrage section of Yamuna in southeast Delhi is covered with iceberg-like pink coloured floating froth, which, experts say, indicates fusion of untreated dyes and waste from neighbouring illegal industries.

Yamuna froth, a common sight indicating very high pollution levels as the river leaves Delhi, turned pink over the last three days, raising alarm about the river's chemical pollution load.

Yamuna activist Pankaj Kumar from the NGO Earthwarrior said that pink froth blanketing the Yamuna downstream of Okhla barrage is a glaring sign of untreated industrial waste and toxic effluents being dumped into it. "This isn't snow—it's chemical foam laced with dyes, phosphates, surfactants, and other pollutants from industries and untreated sewage. It harms aquatic life, poses health risks, and shows how decades of unchecked dumping continues to choke the river," he said.

Kumar added that what was once mostly foam bubbles now has turned bubblegum pink from industrial waste. "It's dangerous pollution that's been poisoning Delhi's lifeline for years. Billions spent on 'clean Yamuna' plans, yet here we are in 2026."

Officials explained that the froth is caused by soap-like surfactant molecules in polluted water. When water falls from a



Yamuna froth has turned pink over the last three day.

ARVIND YADAV/HT PHOTO

height at the Okhla barrage, the churning action raises the frothing. Lower temperatures make these bubbles more stable, intensifying the visible foam.

Sources of surfactants include detergents from untreated domestic sewage, industrial pollutants, wastewater from dhobi ghats, and organic material released by decomposing water hyacinth trapped near barrage.

Activists and experts urged the government to probe the pink froth and sources of dyes. Bhim Singh Rawat, a Yamuna activist, and member of the South Asia Network on Dams, Rivers and People said though there's no conclusive study for the situation

so far, untreated effluents from dye, textile or colouring industrial units could be a reason behind pink tints. "In Yamuna, it's probably due to untreated effluents from dyeing or colouring industrial units operating illegally. In the Delhi stretch of Yamuna, similar froth incidents were reported in March 2023 and 2016 downstream of Wazirabad barrage."

Rawat said similar phenomenon was seen in the Upper Odai river water in Tamil Nadu in January 2023. It was found that the pink froth in the river was due to untreated waste from seafood processing units.

Last year, The Energy and Resources Institute (TERI) study

commissioned by Delhi government to identify reasons and sources behind high froth formation, also flagged poor working of the city's STPs and common effluent treatment plants. It flagged hotspots at Akshardham, Khichdipur, and the Railway Colony dhobi ghats – which were found, discharging white, turbid and untreated wastewater directly into Yamuna via Ganesh Nagar drain, Shahdara drain, and 12A drain, respectively.

A DJB spokesperson did not respond. However, a DJB official said DPCC may be able to ascertain the reason behind pink froth. "Some dye or iron rich pollutant can cause it," the official said

Minister Shri. Parvesh Verma Visit ed Kalindi Kunj Barrage on 17th March 2026





सत्यमेव जयते
Department of Science and Technology
Ministry of Science and Technology
Government of India



Development of sludge free, clean, green and cost-effective technology at bench scale for treatment of Textile & Dyeing Industry Effluent

3. R & D

Dr. Nupur Bahadur

TADOX® Technology Centre for Water Reuse,
Water Resources Division, The Energy and Resources Institute (TERI), TERI



THE ENERGY AND
RESOURCES INSTITUTE

Creating Innovative Solutions For A Sustainable Future

(Project delivered in 3 years during 2017-2020)

OBJECTIVES

- To develop a bench scale photocatalytic reactor (PCR) specifically targeting such organic dyes which are in dissolved state, highly toxic, recalcitrant/non-biodegradable in nature and constitution, present in the effluent of textile & dyeing Industry.
- PCR design, operation and efficiency will be periodically checked by comparing pre and post treated wastewater quality parameters like odour, colour, pH, BOD, COD, TSS, TDS, TOC, alkalinity, heavy metals, sulphates, phosphates, oil & grease etc.
- To synthesize different types of Nanomaterials for treating textile effluent; detailed characterization and optimizing experimental parameters, dosing, kinetics/ adsorption, recovery, regeneration and reuse of nanomaterials; eco-toxicological effect, overall efficiency and techno-economic feasibility of overall treatment trail.

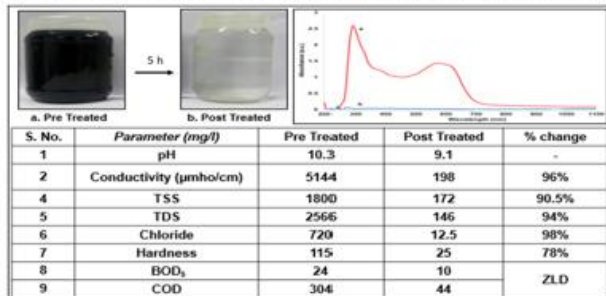
FACILITY CREATION & EQUIPMENT PROCURED



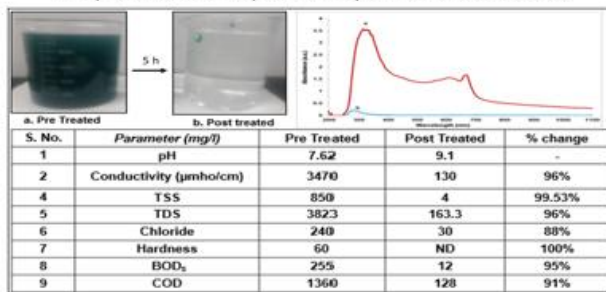
KEY RESULTS

Textile Wastewater Treatment

ETP, Textile Unit, Industrial Area, Sonipat, Haryana

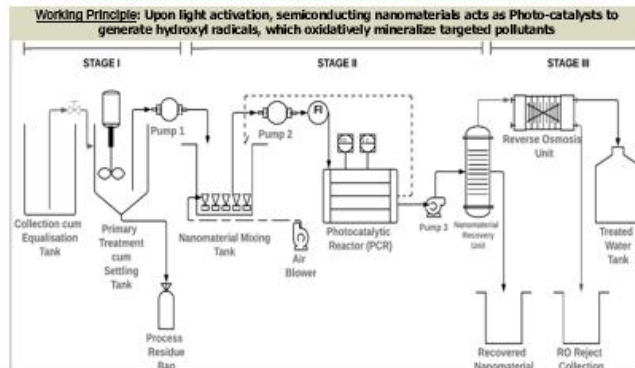


ETP, Textile Unit, Guntur, Andhra Pradesh



CETP, Textile Cluster of 11 Units, Kanpur, UP

TECHNOLOGY DEVELOPED: USPs



TADOX

- Application Areas:** End-to-end treatment of highly polluting Industrial and Municipal Wastewater; Point source pollution abatement of streams having high color, COD, BOD, POPs; In-situ generation of highly oxidizing hydroxyl radicals leads to adequate treatment.
- Clean & Green:** Limited use of chemicals; novel approach of treatment; Negligible and non-toxic sludge; no secondary Pollution; Advanced oxidation and disinfection leading to adequate treatment.
- Water Quality:** Help achieve Zero Liquid Discharge (ZLD) and enhance water reuse efficiency; Meet CPCB, Govt. of India discharge norms; Provide industrial process water quality.
- Efficiency:** Treatment within few hours; completely automated and advanced system; High resource and energy efficiency; Reduces load on tertiary treatment; Low CAPEX & OPEX by 30-40%; sustainable approach.
- Small Footprint:** Modular, integrated and retrofittable at various stages of treatment in current CETPS, STPs; Decentralized Treatment option in Green Buildings, townships, commercial spaces etc.; Compliance with criterion 14 of GRIHA v.2019 Manual.

Category 4:
ADVOCACY

1. Review of Water Reuse Policy at National Level

Status of Used Water Management and Water Reuse Polices in India

Report

Industrial Use

Agricultural Use

Urban Use



**GNAMAMI
GANGE**



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2. Drafting of Water Reuse Policy for Delhi



Government of the National
Capital Territory of Delhi



DELHI STATE POLICY ON TREATED WATER REUSE

BY

THE GOVERNMENT OF NATIONAL CAPITAL
TERRITORY OF DELHI (GNCTD)

2026

3. Compendium

Compendium on Best Practices of Treated Water Reuse in India



NAMAMI GANGE



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4. Policy Brief

tadox
TEXTILE WASTEWATER TREATMENT TECHNOLOGY

NET ZERO

POLICY BRIEF

INTEGRATION OF TADOX® TECHNOLOGY TO ACHIEVE NET ZERO IN TEXTILE WASTEWATER TREATMENT: POLICY RECOMMENDATIONS BASED ON PILOT STUDY IN A CETP

Dr. Nupur Bahadur

श्री मंत्रि विभाग
MINISTRY OF JAL SHAKTI

NAMAMI GANGE

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Creating Innovative Solutions for a Sustainable Future

Category 5:
KNOWLEDGE CREATION
&
CAPACITY BUILDING

1. Team Building & Institution Strengthening

VISION



जल शक्ति मंत्रालय
MINISTRY OF
JAL SHAKTI



NAMAMI
GANGETRI

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NMCG-TERI CENTRE OF EXCELLENCE ON WATER REUSE



Funded by

National Mission for Clean Ganga (NMCG)

Department of Water Resources River Development and Ganga Rejuvenation
Ministry of Jal Shakti, Govt. of India



National Mission for Clean Ganga

Developing integrated technological solutions to achieve "Nirmal Dhara" (Unpolluted Flow) objective through point source pollution abatement strategies.



Swachh Bharat Mission-Urban 2.0

To work on water reuse policies with States. Organize training and capacity building programs for ULBs on solid and liquid waste management.



Atal Mission For Rejuvenation And Urban Transformation

To contribute in Technology Sub-Mission to encourage newer technology options to augment capacities and enhance recycle/ reuse of treated water.



Smart City Missions

Encourage decentralized wastewater treatment and reuse using micro-STPs across Construction and Housing sectors.



Water Vision @ 2047

Industries to be encouraged to adopt integrated, sustainable and affordable technological solutions to achieve Zero Liquid Discharge (ZLD).



ARTH Ganga

To encourage Circular Economy through reuse of sludge and wastewater for irrigation, industries and work with ULBs to explore revenue generation.



Self Reliant India

To encourage 'Make In India' technologies for achieving Water Security and UN SDG 6.

This was 1st of its kind CoE in the Country on Water Reuse established by Ministry of Jal Shakti, Govt. of India under the Namami Gange Mission and Dr. Nupur conceptualized, established and successfully ran this CoE as its Founder & Director.

Activities performed: Overall coordination, supervision and review of the project activities.

- Conceptualized and operationalized the CoE framework, including governance structure, technical roadmap and stakeholder engagement plan.
- Secured multi-year funding and institutional partnerships to ensure sustainability and scalability.
- Developed national guidelines and best practices for water reuse in alignment with SDG 6 and India's water security goals.
- Engaged with government agencies, industry bodies, and international organizations to influence policy and regulatory frameworks.
- Directed research programs on water reuse technologies, policy frameworks, and circular economy models.
- Supervised pilot projects and technology demonstrations for municipal and industrial wastewater reuse.
- Established KPIs and performance metrics to evaluate the Centre's impact on water reuse adoption and policy integration.
- Delivered annual progress reports and strategic recommendations to NMCG and MoJS, GoI.

2. Training & Capacity Building






Online Training And Capacity Building (OTCB) Certificate Programme

DEVELOPING TREATED WASTEWATER REUSE FACILITIES

ONLINE



Image Courtesy: National Mission for Clean Ganga, Ministry of Jal Shakti, Govt. of India. Dinapur STP 140 MLD at Varanasi, Uttar Pradesh.

| | | | |
|---|---|--|---|
|  <p>PROGRAMME DATES 8TH – 22ND MARCH 2021 TIMING : 2:00 PM - 5:30 PM</p> |  <p>REGISTRATION DETAILS Instructions: 1. Payment acceptable through online link or demand draft only 2. Payment Gateway Link and Bank account details are given below</p> |  <p>PROGRAMME FEES Categories & Participation Fees (INR) Government Official and Working Professionals : 7500/- Members of partnering organisation: 5000/- Academia and Teaching fraternity : 3500/- Researchers, Students and Retired professionals : 2000/- + GST 18%</p> |  <p>e-CERTIFICATE (i) 'Certificate of Participation' for all who registers (ii) 'Certificate of Merit' for all those who have 90% attendance and 75% marks in online exam</p> |
|---|---|--|---|

Target Audience
This course is designed to be useful and informative for policy and decision makers like Central and State Ministries involved with Water and Wastewater Departments, Pollution Control Boards, Mayors, standing and water works committees, Municipal Commissioners, Town Planners, Urban Local Bodies (ULBs), Jal Boards, Wastewater Treatment Companies, Wastewater Treatment Plant (WTPs) including Effluent Treatment (ETPs) and Sewage Treatment Plants (STPs) Associations, Operations & Maintenance and Service providers, Academicians, R&D Experts, Technology Developers and Providers etc., This course would also help mid-career professionals who are involved with the water and waste water reuse facility creation in government and private organizations to gain knowledge on new technologies, current practices, field experience, etc. The course would also be helpful for fresh graduates or students of the engineering, environment, water policy and planning disciplines.


Banking details: India PPP Capacity Building Trust, A/c No. 05881450000075, IFSC-HDFC0000588, Plot No 8, Sector 4, R,K Puram, Opposite Capital Court Building, New Delhi - 110022.

Registration link : <https://trainingprograms.icaptrust.in/s/store/courses/description/OTCB-Water-Reuse>
Bulk/Group Registration facilities available @discounted rate.

Last Date To Apply: 07-03-2021
Early Bird Incentive:
10% early bird discount on payment up to 1-3-2021

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NMCG-TERI Centre of Excellence on Water Reuse

PROCEEDINGS

1st Annual Meet and International Conference on Advancing Circular Economy and Water Reuse

27th July 2023 | Silver Oak Hall, India Habitat Centre, Lodhi Road, New Delhi

Event Sponsored and Supported by

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|  <p>NJS ENGINEERS INDIA PVT. LTD.</p> |   |   | | | |
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3. Guided 3 Ph.D. and more than 20 Dissertations

4. Research Papers

I.F. 1.6, Year:2023

PHOTOCATALYTIC OXIDATION FOR SUSTAINABLE MANAGEMENT OF TEXTILE & DYEING INDUSTRY WASTEWATER



Draft Thesis Submission

By

Nipun Bhargava

Registration no. 1700532RSP

TERI School of Advanced Studies

Department of Regional Water Studies

Plot No. 10, Sankar Road, Vasant Kunj Institutional Area,

New Delhi, India, PIN - 110 070

[20th September 2024]

Water Practice & Technology



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Water Practice & Technology Vol 00 No 0, 1 doi: 10.2166/wpt.2023.087

TERI advanced oxidation technology (TADOX®) for treatment and rejuvenation of open drains and surface water bodies: making habitats sustainable

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NB, 0000-0001-7124-860X

ABSTRACT

Water Practice & Technology

I.F. 1.6



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Water Practice & Technology Vol 17 No 8, 1692 doi: 10.2166/wpt.2022.065

TERI Advanced Oxidation Technology (TADOX®) to treat industrial wastewater with integration at pre- and post-biological stage: case studies from India

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J. Inst. Eng. India Ser. A
<https://doi.org/10.1007/s40030-023-00738-5>



ORIGINAL CONTRIBUTION

Breakthrough in Treatment of Sewage Using TADOX®, By-Passing Biological Treatment with removal of Micropollutants to enable high end Water Reuse

Nupur Bahadur^{1,2} · Nipun Bhargava^{1,2} ·
Shyamal Kumar Sarkar¹ · Vibha Dhawan²

Received: 18 September 2022 / Accepted: 2 May 2023
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I.F. 0.3, Year:2023

5. Media Articles

Bleeding Rivers

TADOX® Removing Colour at Point Source

As the demand for freshwater continues to surge and its availability diminishes, the need for effective wastewater treatment and reuse becomes increasingly urgent. Authored by **Dr Nupur Bahadur, Dr Metal Sarkar, and Dr Nimisha Singh**, the article talks about a cutting-edge technology—TADOX®—indigenously developed by TERI and its efficacy in wastewater treatment.

India's textile and dyeing sector stands as a vital pillar of the nation's economy, contributing 4% to the GDP, representing 12% of the nation's export earnings, and offering employment to around 45 million individuals. However, this industry is characterized by its extensive water usage, leading to substantial wastewater generation. This wastewater is laden with harmful chemicals, dyes, and pollutants and poses a severe threat to water bodies, soil quality, and aquatic ecosystems. The discharge of inadequately treated

textile and dyeing units' wastewater has adversely impacted water bodies across the country, notably in revered rivers such as the Ganga and Yamuna. The consequences of this environmental challenge extend to many local rivers like the Hindon River, the Coom River in Chennai, the coloured Bandi River in Rajasthan, and the severely polluted Sabarmati River in Gujarat, among others. This distressing and alarming situation underlines the urgent need to address the highly coloured and polluting wastewater, adversely affecting the

freshwater resources. As the demand for freshwater continues to surge and its availability diminishes, the need for effective wastewater treatment and reuse becomes increasingly urgent. The current scenario of wastewater treatment in India faces multifaceted challenges, ranging from the excessive use of chemicals, toxic sludge generation, and improper treatment methods to the unsustainable discharge of inadequately treated water into natural water bodies. The prevalent reliance on biological treatment systems exacerbates the problem, involving large land footprint and vulnerability to shock loads, especially in the context of industrial effluent treatment. The inadequately treated coloured water, when fed into tertiary systems such as RO/MEE/MVR, leads to membrane fouling and biofouling, creating additional problems that escalate capital and operational expenditures. Furthermore, the treatment methods currently employed fall short of meeting the stringent quality requirements for water reuse imposed by national missions like Namami Gange, SBM 2.0, and AMRUT 2.0.

Addressing the intricate challenges of the quality of surface water necessitates collaborative efforts across all levels. TERI, a renowned and multi-dimensional organization, is actively engaged in addressing wastewater treatment and water reuse issues. TERI's researchers have developed a cutting-edge technology known as TERI Advanced



Leachate treatment plan for the Bandhwari Landfill

About 2100 metric tonnes per day (MTD) of waste from the adjoining populated cities of Gurugram and Faridabad, is added to an existing 35,00,000 tonnes of untreated legacy waste. This results into generation of 350 kilo litres per day (KLD) of leachate.

Written by **Caes**

December 22, 2023 10:56:51

Follow Us



The former practice of discharging leachate in open to nearby village and covered forest areas poses severe environment, health and occupational hazard, including potential groundwater contamination together with an unbearable stink to the surrounding area leading to air pollution. [Image: pixabay]

Reuse treated wastewater

Innovative policies could provide the lifeline Bengaluru needs for a sustainable future.

HUPUR BAHADUR

Bengaluru, once known as the 'City of Lakes,' is now grappling with a severe water crisis. Rapid urbanisation, coupled with climate change and the depletion of natural water sources, has pushed the city to the brink of severe water scarcity. With its burgeoning population and expanding geographical boundaries, finding long-term and sustainable solutions to meet the ever-increasing water demand has become imperative.

Genesis of the Water Crisis

We have to understand the geographical location of Bengaluru, which is a challenge in efficient water management. Bengaluru is situated at a height of 920 m above sea level in a valley between the Western and Eastern Ghats, down south of India, and relies on freshwater transported from four major reservoirs like Krishnaraja Sagar (KRS), Kabini, Harangi, and Hemavathi, covering over 100 km. Although the supply from these reservoirs is an assured source, the supply to an elevated location is highly resource and energy intensive, which adds to the operational, maintenance, and financial woes of the Bangalore Water Supply and Sewage Board (BWSSB).

Further, the addition of 110 villages to the BBMP area in 2008 has seen extensive growth in construction activities, road expansion, and infrastructure development, leading to disruption of natural water systems. Mahadevapura, R.R.Nagar, Roomanahalli, and Dasarahalli are among the most affected areas lying on the periphery of the core Bengaluru area.

The Current Water Scenario

To understand the severity of Bengaluru's water crisis, let's look at the numbers. The city's daily water demand stands at a massive 2,100 million litres per day (MLD). However, the supply from the Cauvery basin is 1,450 MLD, leaving a deficit of around 650 MLD. Erratic rainfall, exemplified by South-west Monsoon shortfall of 271 mm in 2023 compared to the normal 369 mm, exacerbates Bengaluru's water scarcity. Four major dams' storage levels stood at just 49% in November 2023. Additionally, desilting efforts have left lakes like Bellandur and Varthur dry, further depleting the groundwater reserves. The situation is compounded by rapid

urbanisation and the disappearance of lakes, with Bengaluru losing nearly 80% of its lakes and 90% of its green cover in the last decades. This rapid urbanisation has led to an over-reliance on borewells. With over 10,995 government borewells in the city, water levels have decreased in 3,700 borewells, and 1,214 borewells have completely dried up. The groundwater levels have dropped by more than 1,000 feet in many areas, further aggravating the water crisis.

The Role of Used Water

In the face of this looming water crisis in metropolitan cities like Bengaluru, the reuse of treated wastewater or used

portion of treated water, totaling 419 MLD, has been allocated for lake rejuvenation by BWSSB to revive iconic water bodies such as Bellandur Lake, Venkalmakare Lake, and Yelmalappa Chertol Lake, etc., the delayed process of desilting has limited the percolation process.

Commercial Utilisation of Treated Wastewater: BWSSB currently supplies treated water for industrial and commercial use, amounting to 18 MLD. Also, BWSSB is promoting the sale of treated water from 24 Secondary Sewage Treatment Plants (STPs) and four Tertiary Sewage Treatment Plants (TTPs), as advertised on its website. However, more detailed information should be provided by BWSSB on the quality of treated water available and on possible utilizations. This transparency will enable end-users, particularly industries in water-scarce regions with high water demand, to swiftly access near-by STPs' treated water, enhancing its accessibility and acceptability.

Policy Framework: Despite BWSSB Sewage Treatment Plants meeting discharge and reuse standards, neglect persists among end-users, particularly in the industrial sector. Maintaining a significant price difference between freshwater and treated water can boost its economic viability and encourage greater reuse. Also, encouraging Public-Private Partnerships (PPPs) in wastewater and water reuse projects can further enhance efficiency and effectiveness by leveraging private sector expertise and resources.

Capacity Building and Public Perception: Building technical capacity and expertise in wastewater treatment and management is essential to ensuring the efficient operation and maintenance of treatment plants and distribution networks. Overcoming social stigmas and misconceptions surrounding the use of treated wastewater is crucial to garnering public acceptance and support for wastewater reuse initiatives.

Utilising treated wastewater, Bengaluru can enhance water security, diversify sources, and combat future crises. Stakeholders must prioritize reuse initiatives to pave the path for a sustainable future and inspire other cities.

Mandating treated wastewater use and reviving surface water bodies in Integrated Water Management (IWM) Plans can bridge supply-demand gaps. Pricing, policies, enforcement, awareness, and partnerships offer solutions for Indian cities' water crises.

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Coming together is the beginning.
Keeping together is progress.
Working together is success.

HENRY FORD

THANK **Y**OU!