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## WORLD SUSTAINABLE DEVELOPMENT SUMMIT 2024

LEADERSHIP FOR SUSTAINABLE DEVELOPMENT  
AND CLIMATE JUSTICE



WSDS SPECIAL ISSUE

# 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 Metali 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 Cooum 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



### Solution

**POLLUTANT**

Photo catalysis

CO<sub>2</sub>, H<sub>2</sub>O, NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, Cl<sup>-</sup>

### Benefits of TADOX®

- ✓ Removal of color & organics
- ✓ Improved shock load bearing capacity of biological treatment systems
- ✓ Improved biodegradability
- ✓ Less use of chemicals, hence less sludge generation; for e.g. from avg. 30 - 40 Kg/m<sup>3</sup> to 0.2 - 0.5 Kg/m<sup>3</sup>
- ✓ Clean & green approach
- ✓ No start up time
- ✓ Stream specific treatment leading to reduced total treatment time from avg. 36- 48h to 15-16h
- ✓ High resource & energy efficiency
- ✓ Small footprint / land requirement
- ✓ Reduced capital expenditure by 15 - 20% and operational expenditure by 30 - 40%

Oxidation Technology (TADOX®) (<https://youtu.be/tCt5rxC7eik>). TADOX® offers a solution for treating wastewater streams that contain high levels of colour, chemical oxygen demand (COD), biochemical oxygen demand (BOD), total organic carbon (TOC), dissolved organics, micropollutants, non-biodegradable substances, and persistent organic

pollutants (POPs) found in effluents from highly polluting industries and municipal wastewater.

TADOX® is a patented technology that employs UV-Photocatalysis as an Advanced Oxidation Nanotechnology (AON), which results in the oxidative degradation and mineralization of targeted complex pollutants. These

complex pollutants impart colour and high COD to the effluent. Moreover, TADOX® incorporates innovative approaches that minimize the use of chemicals in the overall treatment process, reducing the generation of sludge and thereby preventing secondary pollution. This approach also ensures a highly resource- and energy-efficient treatment process. The technology can be retrofitted in the existing effluent treatment plants to improve the overall treatment efficiency and treated water quality. In addition, highly polluting industries need to install tertiary treatment to comply with zero-liquid discharge (ZLD) norms by the government. The TADOX®-treated colourless and adequately treated water going to subsequent tertiary treatment, helps in the prevention of fouling and choking of membranes, enhances the lifespan and efficiency of three-stage reverse osmosis (RO) systems and reduces the load on subsequent evaporators such as multi-effect evaporator (MEE) enabling sustainable





## Textile CETP Effluent

Pre-TADOX®



5 h



Post-TADOX®



- COD: 1000 mg/L
- BOD: 112 mg/L
- Total Nitrogen: 223 mg/L

- COD: 256 mg/L
- BOD: 40.6 mg/L
- Total Nitrogen: 10.4 mg/L

### ONSITE PLANT



20 KLD TADOX® Plant in Textile CETP in Kanpur;  
Funded by National Mission for Clean Ganga, MoJS, GoI

and affordable ZLD compliance with 90–95% enhanced water reuse efficiency. This approach fosters a win-win situation for both industry and the environment.

The technology has been successfully demonstrated at 20,000 litres per day (20 KLD) TADOX® plant at Textile CETP in Kanpur. It has been developed and commissioned with an objective to optimize the wastewater treatment efficiency, improve the quality of treated water and increase water reuse efficiency of this cluster. This project is funded from National Mission for Clean Ganga

(NMCG), Ministry of Jal Shakti (MoJS), Government of India. This is the first of its kind demonstration in the World of UV-Photocatalysis-based Advanced Oxidation Technology for treatment of Textile Effluent in a CETP at 20 KLD capacity.

The key results involve end-to-end TADOX® demonstration with complete removal of colour, organics, and improved biodegradability, which in turn, paves the way for TADOX® technology integration as part of Phase 2, at pre-biological treatment stage in the existing

1.55 MLD CETP, where this integration is expected to achieve adequate treatment, safe surface discharge norms as per NGT and reuse norms together with reduction in overall treatment time from current average 36–48 h to 14–16 h, less use of chemicals in treatment leading to reduced sludge from current average value of 20–35 kg/m<sup>3</sup> to 0.4–2.0 kg/m<sup>3</sup>. Thus, such an integration of technology having smaller footprint and reduced treatment time, has a potential to augment capacities within the same infrastructure and meet future requirements.

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