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WSDS SPECIAL ISSUE

TERI's TADOX® Technology for Wastewater Treatment

Promising Approach to Achieve Water Vision@2047

In this insightful article, **Dr Nupur Bahadur** highlights that a technological intervention like TADOX® is a novel and innovative step towards adequate treatment of industrial and municipal wastewater. This novel technology holds great potential to achieve water security, 'monetize' wastewater treatment and management, support circular economy, and contribute towards achieving the WaterVision@2047.

“When treated water is reused, fresh water is conserved, it benefits the entire ecosystem. That’s why water treatment, water recycling is essential”.

Shri Narendra Modi

Hon'ble Prime Minister of India

The current wastewater treatment faces various issues and challenges, which majorly involve use of a large amount and large number of chemicals, which leads to secondary problems associated with toxic sludge generation, disposal and management; high dependence on biological

treatment systems, which involves large footprint, prone to shock loads and inadequate treatment, especially in case of industrial effluent treatment. More importantly, the inadequately treated coloured water that goes as the feed to tertiary treatment systems, involving RO/MEE/MVR, etc., leads to chocking and

biofouling of membranes. Moreover, it also creates associated problems leading to higher capital expenditure (CAPEX) and operational expenditure (OPEX) and makes the overall wastewater treatment and management highly unsustainable, unacceptable, unaffordable and non-compliant.

Further, with many National Missions centred around the theme 'Water' like the Namami Gange Programme or the National Mission for Clean Ganga, Jal Jeevan Mission, Swachh Bharat Mission (SBM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), etc., and the latest release of the 'National Framework for Safe Reuse of Treated Water', and having Water Vision@2047, laid down by the Hon'ble Prime Minister of India, Shri Narendra Modi, it becomes imperative for us to enhance the quality and quantity of treated wastewater, such that it becomes available to various stakeholders for high end non-potable reuse and the freshwater sources are available for potable use.

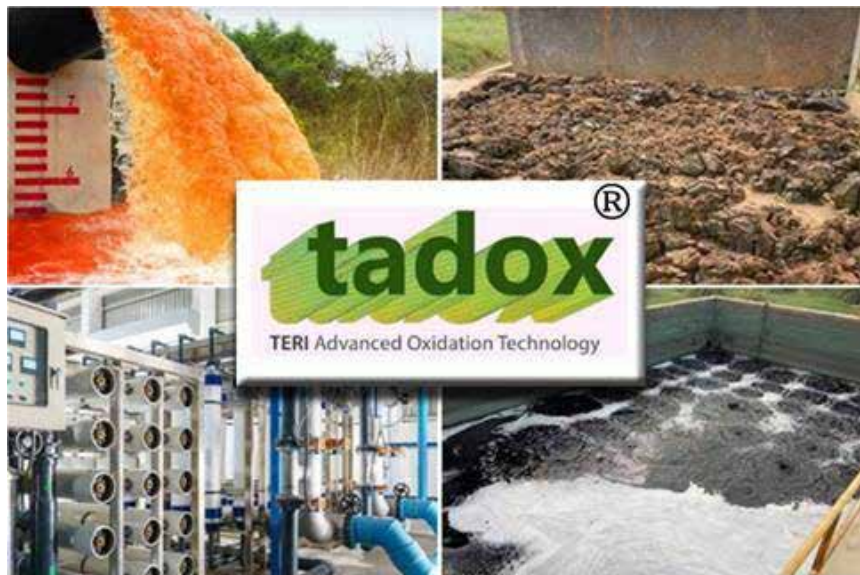
Thus, in order to support and make

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these National Missions truly successful, prevent water depletion and high dependence on groundwater, help all sectors of industries to become truly water secure and compliant, and provide safe and secure water and sanitation to rural and urban areas, we have to make wastewater treatment and management highly resource and energy efficient, much more sustainable, affordable, robust and future ready with augmentation of capacities within existing infrastructure. Thus, it is required to integrate in current systems, novel approaches and advanced technologies which could help in addressing these gaps and challenges.

It is in this pursuit, The Energy and Resources Institute (TERI), New Delhi, has developed a novel technology called TERI Advanced Oxidation Technology (TADOX®), which provides treatment of wastewater stream containing high colour, chemical oxygen demand (COD), biochemical oxygen demand (BOD), total oxygen demand (TOC), dissolved organics, micropollutants, non-biodegradable and persistent organic pollutants (POPs) in effluents



from grossly polluting industries and municipal wastewater. TADOX® is under TERI's Patent and a registered Trademark and involves UV-Photocatalysis as an Advanced Oxidation Nanotechnology (AON), leading to oxidative degradation and mineralization of targeted pollutants. Also, it involves novel approaches which make very less use of chemicals in the overall treatment leading to much

reduced quantum of sludge, preventing secondary pollution and provide highly resource- and energy-efficient treatment [<https://youtu.be/prHy2Gu13Mk>]. This technology has been developed under DST Water Mission, Water Technology Initiative (WTI) Programme of the Ministry of Science & Technology, Govt. of India during 2017–2020 and the outcomes were announced through





its Press Release on August 25, 2021 [https://pib.gov.in/PressReleasePage.aspx?PRID=1748888]. Also, the Department of Science & Technology, Govt. of India published the successful outcome on its website at https://dst.gov.in/new-advanced-oxidation-technology-can-enhance-waste-water-reuse-lower-cost

This technology has received various prestigious Awards including 2022 FICCI Water Award, for the 'Innovation in Water Technology' category.

TADOX® as Decentralized Wastewater Technology for Industrial Effluent Streams

TADOX® has been tested for diverse effluent streams such as textile, tanneries, pharmaceutical, petrochemical, chemical & pesticide manufactures, oil & gas, etc., across the country. Figure 1 depicts TADOX® treatment in industrial wastewater in Textile ETP, Sonipat TADOX® could be a retrofittable and integrated solution at either pre- or post-biological treatment stages of the existing

wastewater treatment plants (WWTPs), depending upon the effluent matrix and requirement of treatment or even at the end of treatment trail to polish any stream like the MEE condensates, etc. It could be noted that along with improving the water quality, the technology has very less treatment time, small footprint and together with resource and energy efficiency, TADOX® integration is expected to bring down ZLD CAPEX by 20–25 per cent and OPEX by 30–40 per cent than current values.



Figure 1: TADOX® treatment in industrial wastewater

TADOX® Technology for Municipal Sewerage Treatment

In case of municipal sewage treatment, TADOX® requires no stream segregation of black and grey water and also could be directly used for inlet stream or could treat the outlet, i.e., polishing of the treated wastewater. Also, no biological treatment of any kind is required at any stage. Thus, implementation of TADOX helps in reducing overall footprint of municipal sewage treatment and makes it more resource and energy efficient.

Figure 2 depicts treatment of mixed sewerage at 10 KLD TADOX® WWTP plant at TERI, Gurugram campus, where it is treating without any stream segregation, the mixed effluent from research labs, hostels, canteen, and toilets. This TADOX WWTP is successfully running since 2.5 years.

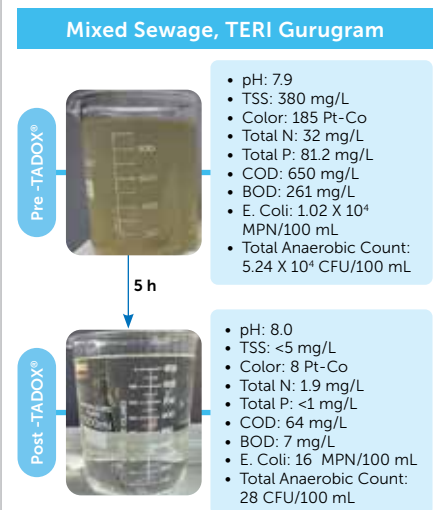


Figure 2: TADOX® treatment for mixed sewage at 10 KLD WWTP at TERI Gurugram

The results clearly indicate reduced biological parameters like *E.coli* and total coliform along with substantial reduction of recalcitrant organics, colour, 97 per cent reduction in BOD and 98 per cent reduction in COD, together with treatment times to few hours as compared to 12–24 hours



in conventional biological treatment. TADOX® makes it an excellent choice in augmenting capacities and improving efficiencies of current sewage treatment plants. TADOX® treated municipal sewage wastewater is aesthetically pleasant and certified by NABL accredited Labs for high end reuse for land irrigation, cooling tower make-up water as well as green building wastewater management plan.

Thus, a technological intervention like TADOX® is a novel and innovative step towards adequate treatment of industrial and municipal wastewater together with ensuring high water reusability, help in achieving decarbonization in wastewater treatment, meeting various regulatory norms and help in meeting the objectives of various National Missions together with meeting United Nation's

Sustainable Development Goal 6, and in particular SDG 6.3, 6.4 and 6a. This novel technology holds great potential to achieve water security, 'monetize' wastewater treatment and management, support circular economy and contribute towards achieving the WaterVision@2047.

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