Wastewater Management: New Technologies for treatment

In India, over one lakh people die of water-borne diseases annually. The country faces a huge challenge in ensuring safe water supply.

India, one of the world's fastest growing economies is home to 17 per cent of the world population. But, it ranks among the countries most vulnerable to climate change and extreme weather conditions. More extreme weather events resulting from climate change – including cyclones, ruinous flooding and prolonged drought could make it even harder for the poorest people to access clean water. In India, around 68 per cent of the country's population lives in rural areas and about 7 per cent of them even now is living without access to clean water. WaterAid's annual analysis examines the state of rural access to safe drinking water around the world and warns that diseases such as cholera, blinding trachoma, malaria and dengue are expected to become more common and malnutrition more prevalent. Rural communities dependent on farming to make a living will struggle to grow food and feed livestock amid soaring temperatures, and women – typically responsible for collecting water – may have to walk even greater distances in their daily struggle to access clean water.

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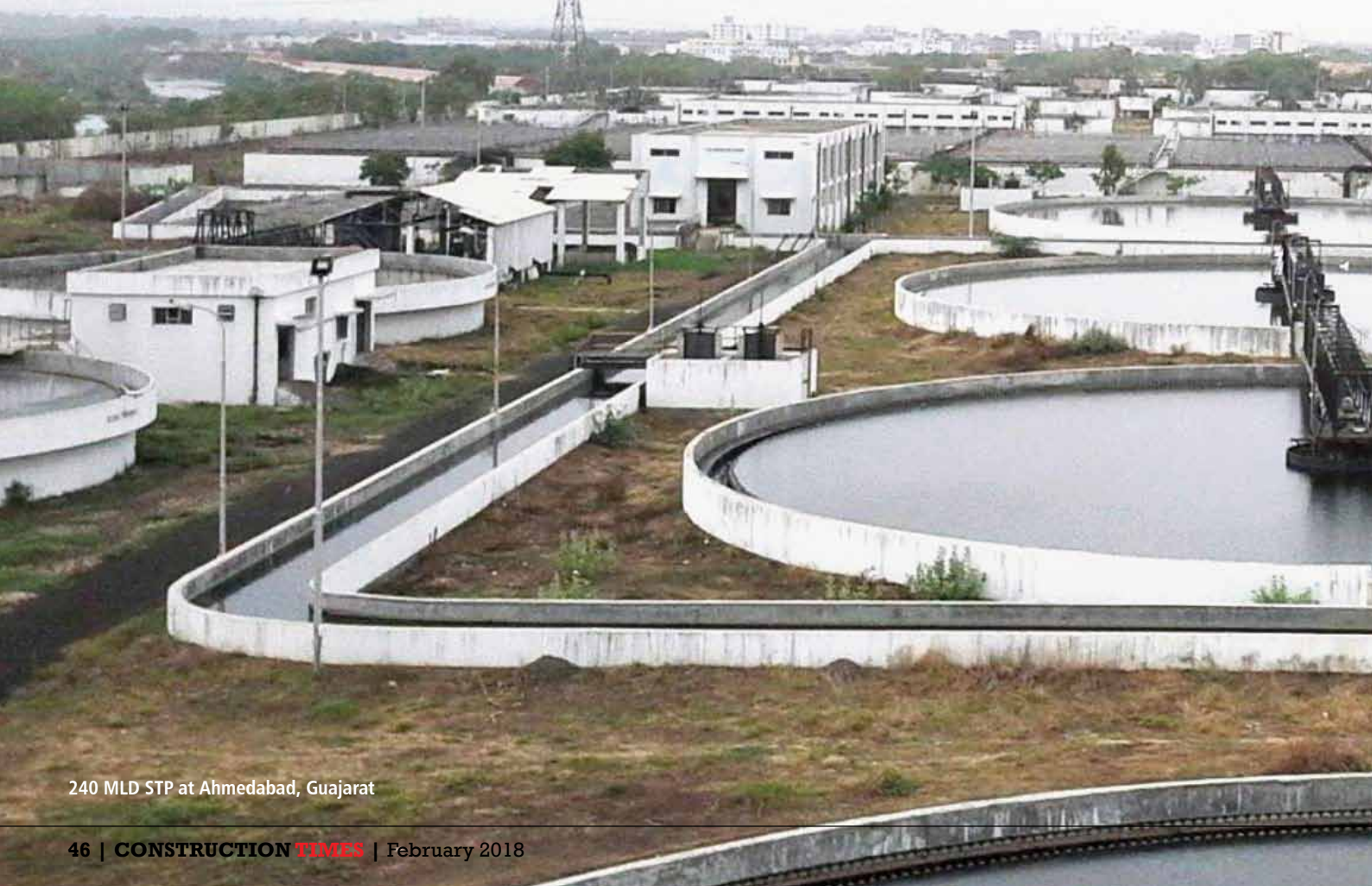

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With rapidly changing urban face of India and increasing demand for more quality water and better sanitation services, the most important issue we are facing is to deal effectively with our wastewater.

Traditional methods of wastewater treatment become increasingly challenging with the identification of more contaminants, rapid population growth, increasing industrial activities, and ever shrinking fresh water sources. The effectiveness of conventional process has become limited due to new challenges; increased knowledge about the water pollution and public demand for better quality water have enforced implementation of much stricter regulations. This is an age of smart technology and the same is applied in wastewater treatment and management also. Today we need smart treatment system for treating wastewater for complete reuse purposes for all our requirements except for drinking. Reuse of municipal and industrial wastewater and the recovery of potential pollutants used in industrial processes become more critical. The reclamation has become easier with advanced treatment technologies which can remove various potentially harmful compounds that could not be effectively removed by conventional treatment.

Wastewater as Resource

The innovations and new technologies and ideas revolves around the simple wisdom, reuse of wastewater results in less extraction of water and thus saving the fast depleting natural resource from extinction. It's a good proposition to address the ever increasing water demands and exploring new ideas for wastewater treatment.

New technologies for wastewater treatment

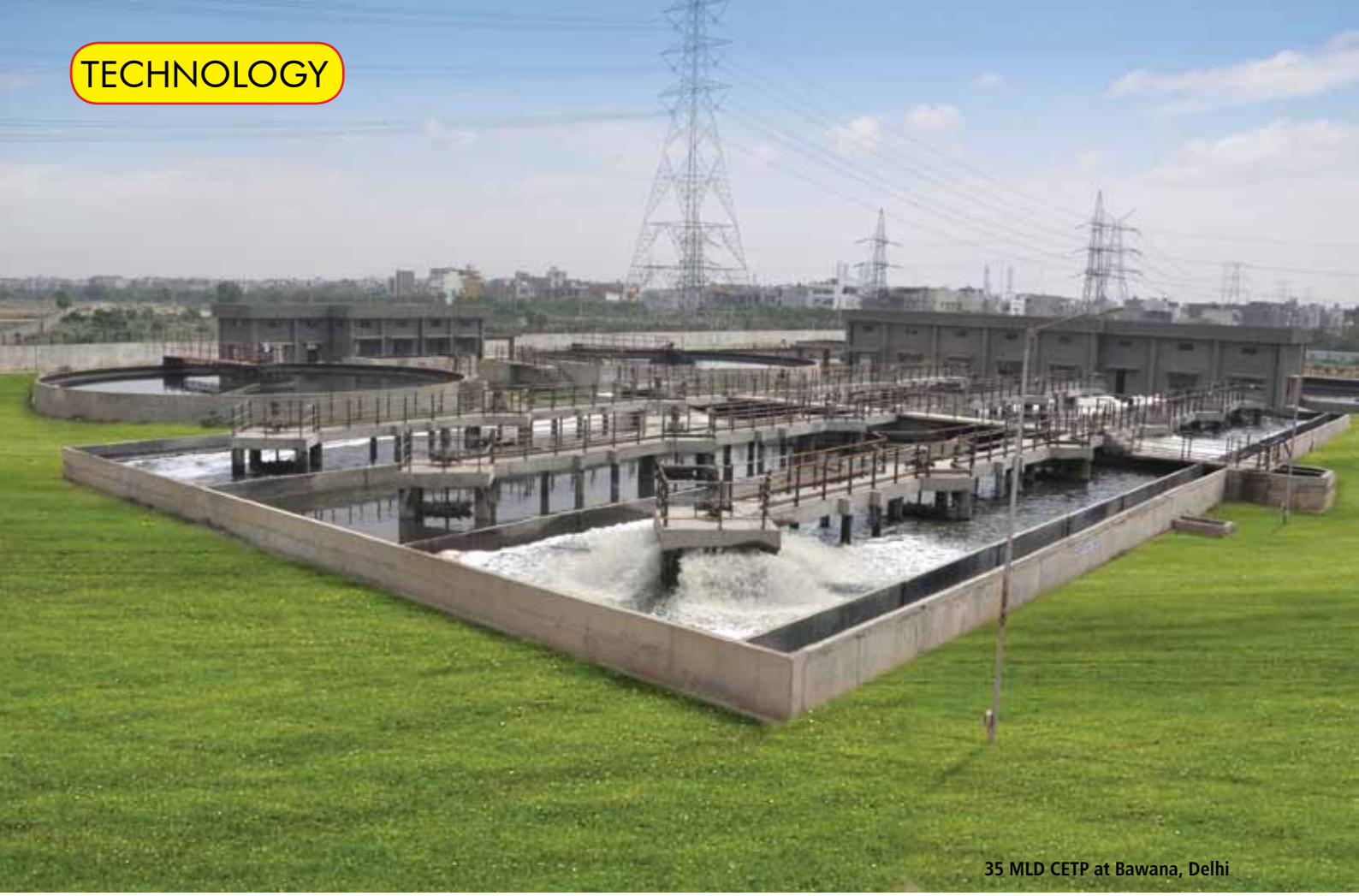
Wastewater treatment technologies are crucial for urban water systems. Some of the new technologies being used and introduced for wastewater treatment globally to reclaim the resources:

Membrane filtration

Membrane filtration is essential for advanced water reclamation. Micro and ultra-filtration membranes provide excellent pre-treatment to remove a wide range of dissolved contaminants. Membrane bioreactor filtration technology is being extensively used for advanced treatment followed by RO and UV treatment to produce non-potable water.

Nanotechnology

The emergence of nanotechnology and the incorporation of living microorganisms in bio-microelectronic devices has revolutionised the treatment process. The best part of nanotechnology is that it can easily merge with other technologies and modify, endorse and clarify any existing concept. It offers innovative approach to develop and exploit these processes in completely new ways. Nanotechnology concepts are being investigated for higher performing membranes with fewer fouling characteristics and improved hydraulic conductivity. A number of new researches are being conducted for producing fabrication of membranes from nano materials for decomposition of toxic compounds during the treatment. It will also provide effective segregation of metals, bimetallic nano particles, mixed oxides, zeolites and carbon compounds etc from the wastewater resources. With improved membranes and configurations, more



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efficient pumping and energy-recovery systems will be possible.

Automatic Variable Filtration (AVF) technology

Automated Variable Filtration (AVF) technology is a state-of-the-art technology used for wastewater treatment in which upward flow of influent is cleaned by downward flow of filter media. During the treatment process itself, the filter media is cleaned by the filtered influent thus there is no requirement for any additional filter media cleaning or fresh water. The AVF process comprises two sets of media filters that can be operated in series or in parallel. The two stage series configuration is used to produce very high quality filtrate. This mode is ideal for refining secondary wastewater for reuse. The AVF process is equipped with actuated valves, sensors and programmable logic controllers to automatically switch from serial mode to parallel mode during wet weather conditions or other preset operating conditions.

The key benefits of the system are:

- Higher solids capacity
- Continuously cleaned media beds
- Elimination of ancillary equipment
- Even flow distribution
- Cost effective to install and low operating and maintenance costs
- Average reject of 5-15 per cent
- Extremely low power consumption
- Ease of Operation & Maintenance.

Microbial fuel cells

Microbial fuel cells is a breakthrough technology where electrical energy could be extracted directly from organic matter present in the waste stream by using electron transfer to capture the energy produced by microorganisms. Microorganisms are grown as a biofilm on an electrode; the electron donor is separated from the electron acceptor by a proton exchange membrane, which establishes an electrical current. This technology is still in its development stage and significant advances in process efficiency and economics will be necessary before it could be used widely to produce electrical energy directly from organic matter present in the wastewater.

New urban sanitation technology

The new urban sanitation technology aims at wastewater treatment with reuse of energy and minerals with a combination of Electro flocculation (Elflox) and Anaerobic Digestion technologies.

Elflox treatment is based on separation of the organic pollution from community wastewater with Electrocoagulation (ECF reactor). Organic sludge of the ECF reactor is sedimented in a circular sedimentation vessel; Sludge (organic compound) which then fed to anaerobic reactor gets converted biogas which can be converted in to Energy for captive utilisation.

Anaerobic fermentation technology, generates optimum biogas due to two separate processes of Hydrolysis- the long-chain carbon compounds is broken down into smaller compounds such as fatty acids; and Methanogenesis the fatty acids gets converted into biogas.

Natural treatment systems

The natural treatment systems (NTSs) is also improving with the emergence of new methods and technologies and a variety of physical, chemical and biological processes work simultaneously to remove a range of contaminants comprehensively. Natural treatment systems are increasingly being used to capture, retain and treat storm water, thereby converting this sheer wastage into a valuable source of water. These natural systems have the advantage of

being able to remove a wide variety of contaminants including nutrients, pathogens and micro-constituents including endocrine disrupting chemicals. This treatment process is very effective for water reclamation.

Cokeoven (CO) byproduct wastewater treatment

The steel producing plants in India are using this treatment process to recover ammonia from cokeoven liquid. Water pollution problems would be worse if ammonia is not recovered, the most polluting among all the wastes from production units. In the CO effluent, most of the pollutants are in the dissolved state. Other pollutants are subjected to biological treatment along with residues of phenol and ammonia. The two most common processes used for the treatment of cokeoven effluents are trickling filter and activated sludge process.

Urine separating process

Urine is part of domestic wastewater which contains up to 90 per cent of the nitrogen and 50 per cent of the phosphorus. The development of urine separating toilets and technologies for treating it to produce fertiliser products is a key to managing nutrients with minimal requirements for outside resources, such as additional energy. Producing the same amount of petroleum-based, nitrogen-rich fertiliser takes an enormous amount of energy and non-renewable resources.

Urine-separating toilets have already been developed and advanced research is going on to refine it further and use them for wastewater management and creating resources.

Way forward

These new treatment processes with resource recovery along with the integration of urban water and waste management systems will improve the sustainability of our water resources. New wastewater treatment technologies can significantly reduce water abstraction from our already resource constrained world. Reclaim water must be managed properly to maintain the integrity of the overall treatment system. The energy consumption in treatment plants also requires active management to make the entire process efficient and effective. Technologies to meet these challenges already exist and work is going on to refine and integrate them into higher performing more sustainable systems. The challenge is to choose the most appropriate one from the available options and developing institutional arrangements for implementing them in the most effective ways. ■

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42 MLD Sewage Tretament Plant, Kanpur

11 MLD Decentralised Sewage Treatment Plant at Mira Bhayander