Innovative Wastewater Treatment

Rishabh Sethi, Executive Director, SPML Infra Ltd throws light on the innovations in the area of wastewater treatment that focuses on the principle that wastewater can be a resource.

Water, a prime natural resource, is a basic human need. Planning, development and management of water resources need to be governed as per national perspectives. Access to safe drinking water continues to be a major issue in many countries across the globe. Availability of water in different regions and different communities in the same region is imbalanced and has the potential of causing social unrest. Groundwater though part of hydrological cycle is still perceived as an individual property and is exploited inequitably without any consideration to its sustainability leading to its over-exploitation.

In the last one decade, one third of India's population has become urban. It is expected that India's urban population will reach 465 million by 2020 from the existing 370 million. The growth of the Indian economy has also increased water usage across sectors. As a result, fresh water resources are depleting and wastewater is increasing significantly and the facilities to treat wastewater are not adequate in urban India. Presently, only about 20% of the generated wastewater is treated; the rest is discharged into ground and water bodies without any treatment.

The current gap between available water and its demand is growing with every passing year. With the rapid growth in urbanization, the country is finding it difficult to keep pace with a rapidly-growing economy and increasing population. A recent study of water and wastewater management in 71 Indian cities described that Indian cities produce nearly 40,000 million litres of sewage per day. But, the sewage treatment capacity is only around 12,000 million litres per day leaving a big gap of almost 70%, which is an enormous waste of a critical resource. As per CPHEEO estimates about 70-80% of total water supplied for domestic use gets generated as wastewater. The per capita wastewater generation by the class-I cities and class-II towns, representing 72% of urban population in India, has been estimated to be around 98 litres per capita daily (lpcd), from the National Capital Territory of Delhi alone it is over 220 lpcd.

Performance of sewage treatment plants (STP) and common effluent treatment plants (CTP) for treating municipal waste water and effluent from small scale industries in many states are also not complying with prescribed standards. Thus the treated water is often not suitable for household or industrial purposes and reuse of the wastewater is mostly restricted to agricultural purposes. There is an urgent need for better infrastructure and

organization with regard to wastewater management. In India, it is assessed that there are 234 sewage treatment plants (STPs) most of which were developed under various river action plans and are located in cities/ towns along the banks of major rivers. Insufficient capacity of wastewater treatment and increasing sewage generation pose big question over the disposal of waste water.

Most of the wastewater can be recycled and cleaned to the levels where it can be reused. The rising cost of fresh water and increasing pollution control enforcement are persuading industry to look at wastewater recycling. For instance, the 35 MLD common effluent treatment plant built by SPML Infra for Delhi State Industrial and Infrastructure Development Corporation (DSIIDC) will serve more than 20,000 industrial units and the treated water can be made fit for reuse in industries or for irrigation thus leaving a lot of fresh water for drinking purposes. The standardization criteria followed by most responsible and large industrial players makes it mandatory to install zero liquid discharge plants. Refineries' wastewater can be reused as make-up water for firefighting, green belt development and other non-potable purposes after its treatment.

Key wastewater management technologies

With the economic and technological development, the last few years have seen a variety of new wastewater treatment

technologies coming into use. A variety of new wastewater treatment technologies such as membrane filtration systems; automatic variable filtration (AVF); advanced oxidation processes (AOP); UV irradiation has been proposed, tested and applied to meet both current and anticipated treatment requirements. These new treatment technologies have been proven to successfully remove a wide range of challenging contaminants from wastewater. Innovations in the area of wastewater treatment focuses on the principle that wastewater can be a resource.

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

Membrane Filtration: 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 to produce water for reuse by the industries.

Nanotechnology: 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 efficient pumping and energy-recovery systems will be possible.

Automatic Variable Filtration (AVF) Technology: Automated Variable Filtration 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 by fresh water. 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.

Microbial Fuel Cells: 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 by using electron transfer to capture the energy produced by micro-organisms.

Natural Treatment Systems: 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 competent 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 coke oven liquid. The two most common processes used for the treatment of coke oven effluents are trickling filter and activated sludge process.

These new wastewater treatment technologies can significantly reduce water abstraction from our already resource constrained world. Reclaimed water must be managed properly to maintain the integrity of the overall treatment system. The challenge is to choose the most appropriate technology from the available options and developing institutional arrangements for implementing them in the most effective ways.

The emergence of nanotechnology and the incorporation of living micro-organisms in bio-microelectronic devices have revolutionized the water and wastewater treatment process. Nanotechnology can easily been integrated with any other technologies to modify, endorse and clarify the existing operations. This technology offers innovative approach to develop and exploit these processes in completely new ways making complex process of treatment much simple. Other remarkable innovation is the emergence of state of the art Automated Variable Filtration (AVF) technology used for water and wastewater treatment. This technology uses the filtration process to clean the filter being used in which upward flow of influent is cleaned by downward flow of filter media. During the treatment process itself, the filters are cleaned by the filtered influent and haveno requirement for any additional filter cleaning using fresh water. SPML has brought this technology exclusively designed for India and a number of pilot projects are underway to test its adaptability and ease of operation and maintenance. EPC

About the author:

Rishabh Sethi is the Executive Director of SPML Infra Ltd. He leads the execution of corporate functions and handles water and environment projects of SPML. Under his leadership, SPML has grown year over year, during which he has directly overseen the execution of construction projects of over $800 million. Prior to SPML Infra, Sethi served as a Management Consultant in AT Kearney Inc. He is a graduate in Industrial Engineering and Economics from Northwestern University, USA.