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WORKING WITH 'LEAN' TOOLS

EI - Interview

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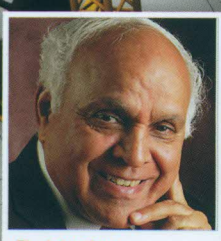

EI - Interview

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Issues, challenges & treatment process

A read into the latest developments in technologies and innovations and challenges related to wastewater generation and treatment

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The pace of urbanisation is faster than the GDP growth in India. This rapid expansion of the city combined with population growth has put tremendous pressure on public services which has not been able to keep pace with rapid urbanisation. India, being an emerging economy is facing two major problems; lack of sustainable infrastructure in the public utility sector and an ever-increasing urban population. The urban population in India has jumped from 81 million in 1960 to about 400 million in 2012. With growing concern on water availability, the wastewater treatment has not kept pace with its generation thus leaving a great void in water resources. Central Pollution Control Board (CPCB) has estimated that the wastewater treatment capacity developed so far is about 11,787 MLD that is around 30% of the generated wastewater. The status of wastewater generation and treatment capacity developed over the decades in urban centres is insufficient and unsuitable. It is estimated that the wastewater from urban India may cross 120,000 MLD by 2050. By that time, the rural India will also generate not less than 50,000 MLD.

Challenges

The importance of safely treated wastewater return to the ecosystem cannot be overstated. Despite the efforts, we are still a long way from the most efficient, economic and reliable ways to ensure that cities are properly equipped and ready for the challenge. We need to build around the efficiency in wastewater treatment and reuse to sustain the increasing demand of fresh water. In Indian scenario, performance of sewage treatment plants (STP) and common effluent treatment plants (CETP) for

The rising cost of fresh water and increasing pollution control enforcement are persuading industry to look at wastewater recycling

treating municipal wastewater and industrial effluent are not complying with prescribed standards. Thus, the treated water is often not suitable for household or industrial purpose and reuse of the wastewater is mostly restricted to agricultural purposes. There is an urgent need for better infrastructure and organisation with regard to wastewater management.

Old technologies, traditional methods and ageing infrastructure are other challenges in wastewater management. In the absence of a proper discharge and reuse of treated water utilisation, the treated water is released to the sewer line thus making the whole effort inept.

Around 269 sewage treatment plants were developed under various river action plans and are located in cities/ towns along the banks of major rivers. The arrangement of operation and maintenance (O&M) and power cost in the operational sewage treatment plants are one of the challenge. The infrastructure for transporting treated water is yet to be planned and developed for the use of resource generated after the treatment. The big gap between the generation and treatment poses big challenge for the country.

Most wastewater can be recycled and cleaned to the levels where it can be reused for all purposes except for drinking. Future challenges in wastewater management include development of new technical solutions and organisational methods in order to turn present problems into future opportunities. The current and emerging challenges include water for sanitation v/s sanitation without water, recycling of wastewater nutrients, wastewater irrigation, urban agriculture, treated water to feed depleted aquifers, future new system solutions, social equity and transfer of knowledge and new technology.

Innovations in wastewater management

Demographic trends and increasing urbanisation are the two key factors for increase in wastewater. Treating this wastewater poses a significant environmental challenge for municipal authorities and industries. The use of innovative techniques like physical, chemical, biological and ultrafiltration treatments are environment friendly and focus that wastewater can be resourced.

The innovations in wastewater treatment have to satisfy a number of criteria to integrate planning with other local services, such as solid waste, organics composting programs, energy and public services so that a community benefits are derived from wastewater treatment; to lower the costs of wastewater treatment through recovery and reuse; to minimise environmental pollution and to embrace flexibility, new innovations and technologies can be employed as they become available for better efficiency.

The innovations in wastewater treatment technologies can be implemented depending upon operating costs, potential revenues, the value of the resources and public acceptance levels for wastewater resources and the engineering needed to create them. Some of the latest innovations are:

- **Decentralised treatment plants:** smaller and locally based treatment plants on membrane-based technology to serve populated communities
- **Satellite Water Reclamation Plants:** such plants are set up to treat from nearby sewers to produce reclaimed

Demographic trends and increasing urbanisation are the two key factors for increase in wastewater

water closer to the user area

- **Membrane Separation Technology:** treated wastewater using membrane technology can be so clean that it is potable but mostly used for irrigation
- **Resource Recovery :** Biodiesel from fats, oil, and grease (FOG) from wastewater is collected during treatment in plants and converted to biodiesel through esterification and hydrogenation
- **Electricity & Heat from Co-generation:** Biogas fueled cogeneration systems helps a wastewater facility to utilize energy from the treatment process itself. Co-generation systems produce electricity and hot water from biogas, a natural byproduct of sludge dewatering. The electricity produced can be used to supply power to anaerobic digesters in the plant, thus saving on electricity bills
- **Electricity from biogas or sewage powered fuel cells:** Methane from sludge dewatering plants can be converted into biogas or hydrogen, direct fuel cells that can be used for powering of wastewater plants.
- **Water-source heat pumps:** used to extract residual heat from wastewater, after treatment and before discharge by outfall that can be used as an energy source.
- **Reclaimed water from wastewater:** using membrane technology, water can be purified and used for irrigation, recharging of water bodies or as a supplement to existing ground and surface water sources
- **Biogas from wastewater & sludge:** Biogas is produced from methane, which is a byproduct of bio solids processing; already being used to fuel cars, taxis, trucks and public transports in European countries. It can further be refined as a cooking fuel for use in homes and restaurants; biogas can also be burned in plants along with wood or other waste to generate power.

Wastewater treatment technologies

Wastewater treatment is a facility to remove materials that damage water quality and compromise public health and safety when discharged into water systems. Conventional wastewater treatment method consists of a combination of physical, chemical and biological processes and operations to remove contaminants from wastewater. To remove different level of contaminants, a number of treatment procedures are applied as primary, secondary and tertiary treatment. Natural systems are used for treatment of wastewater in some cases and to remove specific contamination the treatment process are more rigorous.

Preliminary treatment

The objective of preliminary treatment or screening is to remove gross pollutant, coarse solids and other large materials often found in wastewater.

Removal of these materials is necessary to protect the treatment equipment from damage and to prevent objectionable floating materials from entering the primary settling tank. This process enhances the functionality of the treatment plant and avoids the interference with plant operations. Preliminary treatment uses screening devices consisting of bars, rods, wires mesh, perforated plate to screen large floating and suspended material by either manually or mechanically cleaning.

Tertiary treatment is the advance process that goes beyond secondary treatment levels to remove specific wastewater constituents like nitrogen, phosphorus, heavy metals, biodegradable organics, bacteria and viruses

Primary treatment

The primary treatment of wastewater involves partial removal of suspended solids, organic and inorganic materials by screening or sedimentation process. Pre-aeration or mechanical flocculation with chemical can be used to enhance the primary treatment to produce wastewater suitable for secondary and biological treatment. The wastewater from primary treatment contains organic matter with relatively high BOD.

Secondary treatment

Secondary treatment is the further treatment of wastewater to remove the residual organics and suspended solids that are still present after the primary treatment. The biological process, treatment by activated sludge, fixed film reactors, sedimentation or lagoon system is used during the secondary treatment. Common processes include the activated sludge processes, trickling filters or bio-filters, oxidation ditches, and rotating biological contractors (RBCs). A combination of these processes is used to treat wastewater containing a high concentration of organic material from industrial sources.

Tertiary treatment

Tertiary treatment is the advance process that goes beyond secondary treatment levels to remove specific wastewater constituents like nitrogen, phosphorus, heavy metals, biodegradable organics, bacteria and viruses. More advanced and costly process of ion exchange and reverse osmosis is also implied for removal of ion and dissolved solids. However, advanced treatment processes are sometimes combined with primary or secondary treatment. This treatment produces water for specific use like irrigation, recharge water bodies and for reuse by industries.

Technologies

The technological advancements have led to the development of more sophisticated instruments for the wastewater treatment and wastewater characterisation is likely to improve further. With new equipment and devices, the measurement values in micrograms or even nano-grams per litre can be measured and contaminants present only in traces can also be accurately detected. Some of the new technologies being used and introduced for wastewater treatment globally to reclaim the resources are:

Membrane Filtration

Membrane bioreactor filtration technology is being extensively used for advanced treatment to produce water for reuse by the industries. Treatment with membrane bioreactor produces a highly clarified effluent that can be more easily disinfected and followed by RO and UV treatment is ideal for producing non-potable water.

Nanotechnology

The nanotechnology can easily merge with other technologies and modify, endorse and clarify any existing concept. Nanotechnology concepts are being investigated for higher performing membranes with fewer fouling characteristics and improved hydraulic conductivity. It provides effective segregation of metals, bimetallic

The technological advancements have led to the development of more sophisticated instruments for wastewater treatment. Additionally, wastewater characterisation is likely to improve further

nanoparticles, mixed oxides, zeolites and carbon compounds etc from the wastewater resources.

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 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.

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. The two most common processes used for the treatment of cokeoven effluents are trickling filter and activated sludge process.

Way forward

Suitable policy measures need to be formulated to encourage the reuse of treated wastewater for irrigation purposes. Measures may include incentives to Urban Local Bodies (ULBs) to construct treatment facilities using relevant technology, instituting a central and state level water sector regulator to regulate tariff and quality standards of fresh and reuse water.

Construction, operation and maintenance of treatment facilities should be given to specialized companies who will work under the respective ULBs. Developments in wastewater treatment and reuse practices from other states or developed countries could be made available through the creation of an information network, which can serve as a forum for the exchange of information and knowledge about the latest research, techniques and technological advancements in the realm of wastewater management and practices. Such a network must be broad in scope, addressing various aspects of wastewater management, including appropriate and affordable wastewater collection, treatment and disposal technologies and best practices as well as the planning and regulation issues that are fundamental to wastewater management. With the business environment improving, one can expect several new initiatives aimed at wastewater and sanitation sector. Different industrial segments also offer varied potential for the wastewater treatment markets.

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