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INDUSTRIAL WASTEWATER: TREATMENT & REUSE

Abdul Rahman Mohammed

With the evolution of technology and advance treatment methods, there are a number of wastewater treatment processes, but selecting the best solution, that's technically and commercially viable, is always a challenge.

The need for water is growing fast and millions of people, across the globe, are deprived of clean water. Population growth, rapid industrialization and urban migration have driven the consumption of everything from farm produce to goods manufactured in industrial units. The fast-depleting water sources and extreme climate change events have driven people from their land, and in some cases turned them into refugees. The world over, we have depleted most of the fossil water in deep artesian.

The existing and anticipated water scarcity has forced Governments, across the globe, to think deeply and take remedial actions towards water conservation and seeking alternative sources of generating water. Water reuse, the use of treated wastewater or reclaimed water for purposes such as drinking, irrigation, or industrial uses is gaining momentum. Municipalities and industries, across the globe, are contemplating or implementing water reclamation and reuse facilities by treating their municipal and industrial wastewater as the best possible option that can help in addressing water scarcity concerns and augmenting their water supplies.

INDUSTRIAL DEVELOPMENT IN INDIA

Industries are important engines for economic growth. They generate employment and provide livelihood, to many, across the globe. In India, the industrial growth picked up pace only after the independence as a large number of industries were established. But the actual surge in industrial development came after the reforms invoked after 1990s, as a new era in business helped India achieve the industrial growth of over 8% for a prolonged period afterwards.

A variety of industries were established that played a crucial role in adding to India's richness in production and manufacturing of goods and boosted the economic growth of the country. However, the industrial development also brought significant changes in the environment through emissions into the air and industrial wastewater into water bodies and the soil. Although the industrial sector in developing countries, consumes close to 10% of the total water, in case of India, as per the estimates of the World Bank, it is about 13% of the total freshwater withdrawal, in the country,

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and the demand for water for industrial use and energy production will grow at a rate of 4.2% per year, from 67 billion cubic metres in 1999 to 228 billion cubic metres by 2025.

INDUSTRIAL WASTEWATER

Industrial wastewater has variable quality and volume depending on the type of industry producing it. It may be highly biodegradable or may not contain compounds recalcitrant to treatment. These include organic synthetic substances or heavy metals whose content in waste water produced in developing countries' may be considerably different (in quantity and quality) from that produced in developed countries. The main concern with industrial wastewater is the increasing amount (in quantity and variety) of synthetic compounds contained in and discharged into the environment.

India is facing the dual challenge of declining water sources as well as increasing water pollution in surface and ground water sources. It is challenging for industries to find fresh water as its scarcity is threatening lives. It is quite evident that industries have to look for alternative sources of water supply, like making use of recycled water, if they are not self-sufficient, in water. Among different industry sectors, thermal power plants consume the most water and are termed water-intensive. In India, the thermal power plant sector is a major power-generating source and as per the Ministry of Power accounts for ~ 59% of the total installed power capacity. And in view of the huge demand for power, contribution of thermal power plants towards power generated, in the country, is expected to increase further, in the future. Not only is the thermal power sector most water intensive, but it also discharges huge amounts of wastewater and is one of the largest contributors to industrial wastewater discharge. A recent trend in Maharashtra indicates the increased dependency of industry on treated water which is gradually being used during production process.

> *If India reuses 80% of its untreated wastewater from 110 of its most populous cities, 75% of projected industrial water demand will be met by 2025.*

Industrial wastewater from chemical and pharmaceutical production often contains substances that need to be treated before being transported into a biological treatment plant and subsequently being discharged into water bodies. Generally this is done close to the site of production, in selected wastewater streams before reaching a central treatment plant. Each of the approaches used has certain advantages and some disadvantages. With the evolution of technology and advance treatment methods, there are a number of industrial wastewater treatment processes, but selecting the solution, that is technically and commercially viable, is always a challenge.

TREATMENT PROCESS

India is a large consumer of pulp and paper, meat and poultry. What needs to be noted in that manufacturing and processing industries produce large volumes of wastewater that contain high levels of degradable organics.

Industrial Water Treatment Plant

The meat and poultry processing facilities typically employ anaerobic lagoons to treat their wastewater, while the paper and pulp industry also use lagoons and anaerobic reactors.

The non-animal food and beverage industries produce considerable amounts of wastewater with significant organic carbon levels and are also known to use anaerobic processes such as lagoons and anaerobic reactors. Anaerobic reactors treating industrial effluents with biogas facilities are usually linked with recovery of the generated methane (CH_4) for energy. The most suitable approach for effective and efficient method of industrial

wastewater treatment is to understand how substances are dissolved or suspended in water and then to deduce reasonable chemical or physical actions that would reverse those processes.

At Sahara Industry, we offer a variety of water and wastewater treatment solutions based on the nature of wastewater coming from either municipal sources or industries. The treatment methods are mostly customised based on the treatment requirement that may vary from disposing off or reclaiming it for reuse. The electro-coagulation (EC) based system to remove pollutants from municipal or industrial wastewater is the commonly used method. The Sludge Activated Flocculation (SAF) technology and activated treatment process helps to treat industrial wastewater with high turbidity, coloration and harmful chemicals having very high content of Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD) and Total Dissolved Solids (TDS).

Sludge from treated wastewater can irrigate upto 3 million hectares of land annually, while providing nutrients to crops and reducing fertiliser dependence by 40%.

3672 FRP Pressure Vessel for Industrial RO Water Purification System installed in Le-Meridien

Sedimentation technology is the simplest and most economical method of treatment as the process allows separating solid substances from the liquid by allowing it to settle in a sedimentation tank. The settled sludge is then removed from the tank. The treatment method is specially used for effluents with high fibre concentrations.

Anaerobic treatment of industrial wastewater has found widespread application for treating a large variety of different effluents. This treatment is most commonly used for effluents originating from paper and pulp factories along with other manufacturing plants.

Aerobic treatment requires oxygen to support the micro-organisms and metabolic activity. In effluent treatment, oxygen is supplied to the effluent in the form of air by a special aeration equipment. Aerobic treatment allows fully biological degradation of effluents. Aerobically operated plants exhibit higher plant stability and are less sensitive to fluctuations in effluent and plant parameters.

Electrodialysis is an electrochemical membrane separation technique for ionic solutions that has been used by industries for decades. It can be used in the separation and concentration of salts, acids, and bases from aqueous solutions, for separation of monovalent ions from multivalent ions, and for separation of ionic compounds from uncharged molecules.

Advanced flocculation treatment is a crucial process as it promotes the aggregation of particles after being destabilized by a chemical agent. It is used in the industrial wastewater treatment to separate the colloidal material and in sludge thickening.

Membrane treatment serves to optimize loop closure and therefore helps to reduce fresh water intake as well as wastewater treatment. Other purposes of membrane processes are improved product quality because of lowered pollution of loop water, re-use of treated effluent in production, recovery of valuable substances and minimizing environmental impact because of improved effluent quality.

Electro Oxidation technology is a multi-stage controlled wastewater treatment process. It can treat very high content of organic carbon, oxygen demanding substances and a host of other pollutants present in industrial wastewater. After the treatment, reclaimed water can be used for a variety of non-potable purposes based on its quality.

Advanced and tertiary treatment is used to remove specific wastewater constituents that cannot be removed by secondary treatment. Different

treatment processes are necessary to remove nitrogen, phosphorus, additional suspended solids, and refractory organics or dissolved solids. Sometimes it is referred to as tertiary treatment because advanced treatment usually follows high-rate secondary treatment.

There are other emerging treatment methods too that are being used but the modern treatment facilities also require the use of innovative technology, such as sensors, Internet of Things (IoT) devices and Artificial Intelligence (AI)-based trackers.

GOING FORWARD

India generates nearly 14,000 million litres daily (MLD) of industrial wastewater, which require treatment before being discharged so that it meets environmental norms. Studies suggest that around 60% or a little over 8,000 MLD is being treated leaving a gap of almost 6,000 MLD that does not receive any treatment before its disposed into land and water bodies, thereby highlighting the need for better wastewater management, in the country.

A serious consideration of the current situation is required and policy reforms and strategic planning is needed to make the paradigm shift from "use and throw - linear" approach to a "use, treat, and reuse – circular" approach towards managing wastewater. There should be a policy intervention for the following steps:

- Every drop of waste water (be it from the domestic sector, industries and commercial wastewater) must be treated.
- There should be adequate capacity to treat wastewater and sewage.
- Infrastructure should be properly maintained, and cost recovery should be ensured through reuse and/or recycling of treated water.

Reusing wastewater that is treated is becoming a necessity as water scarcity is not only affecting people but also the industrial production. It was reported that nearly 7 billion units (kWh) of coal power, with an estimated potential revenue of INR 2400 crore were lost in the first five months of 2016 due to lack of water for cooling the thermal power plants. In addition to augmenting water supply, wastewater treatment also offers new economic opportunities for energy production and fertilizer reclamation. We at Sahara Industry have been advocating for integrated water management practices while providing advance treatment solutions to a large number of industries and commercial units across the country. The testimony of our efforts towards making industrial plants water positive is the success rate of our products which provide quality and longevity. It will be our endeavour to drive, facilitate, and sustain wastewater management interventions across the Indian industry ■

Abdul Rahman Mohammed, is the CEO, Sahara Industry. He is an MBA with rich experience in handling focussed business activities. His modern business approach supported by technological interventions has catapulted the turnover of his group companies in excess of INR 100 crore, in a short span of time.

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