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INDUSTRIAL WATER MANAGEMENT – NECESSITY OF MODERN INDUSTRIES

All manufacturing and most service industries have a need for large quantities of water. The needs vary from drinking requirements for the workers to process needs to utilities to fire-fighting to washing purposes. All industries recognize water as a critical need and work towards ensuring the quality and reliability of the water supply. With growing water scarcity and cost, industrial water management has come to the fore.

Most industries look at a wholistic approach to water management whereby they can conserve, harvest and reuse. The current thrust is towards reducing water-related costs and minimizing the environmental impact of discharge. Energy, consumable and labour contribute the biggest components of the operating cost of water. Superior planning, designing, selection, operation and maintenance can ensure better water management.

Certain industries find water to be a key raw material of their production process. This includes industries like pharmaceuticals, packaged drinking water, other beverages and food processing. The purity of the input water is extremely critical and the industrial water needs are accordingly precise. Other industries like cement, power plants, fertilizers and steel plants are particularly concerned about water management for their utilities like boilers and cooling waters. Usually, these consume large volumes of water and involve huge costs for treatment, transportation and pumping.

Many industries have realized that the wastewater within their industry might well be the cheapest and most reliable source of water for them. Applications like gardening, landscaping, washing and, particularly, cooling towers consume huge



volumes of water which need not necessarily be of very good quality. Recycled water makes ideal sense for usage in these uses.

In certain other industries like distilleries, paper and tanneries, the biggest concern area is the wastewater management, disposal and possible reuse. The highly difficult nature of their effluent means a high level of pressure from environmental agencies. Discharging these effluents after treatment is a difficult proposition and better solutions are constantly needed.

Thus, industrial water management is a complex and evolving field. There are no easy solutions as needs constantly change and the demands on a utility in charge are immense. The constant challenge is to provide practical solutions at the lowest cost. Naturally, any industry continues to look at water management as a support function and as a cost centre. There is a regular demand to lower operating costs and to consume less energy. Similarly, for large capital investments, a utility manager needs to justify the benefits and explain to the senior management on its efficacy.

Being a dynamic and changing field, the users need to stay updated on the latest developments in industrial water management. They need to be aware of the external environment and of the latest practices being followed by users in India and abroad. Industrial water management brings its own challenges and rewards. Hopefully, the readers of this issue would find more of the rewards.

thanks & regards,
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GOVERNMENT LEADERS ADDRESS WATER CRISIS CHALLENGES AND MANAGEMENT AT THE ARAB WATER CONVENTION 2023

Dubai, UAE, February 20, 2023: Held under the patronage of the League of Arab States, the Arab Water Council convened more than 10 Ministers, 400 officials and over 22 Arab Country representatives on the first day of the Arab Water Convention to listen to more than 60 speakers discuss critical regional water-related topics, including in-depth projection of future actions.

Held at the Ritz-Carlton Dubai International Financial Centre in Dubai, the sessions with experts, delegates and industry leaders at the Arab Water Convention addressed the depleting water tables and impending water crisis in the Arab World and how to overcome those challenges.

The opening ceremony saw regional leaders reiterating the importance of desalination projects, as it is essential to the social and economic development in the Gulf to meet the increasing water demand by increasing water productivity and improving water quality by reducing pollution.

VIP delegates attending included H.E. Prof. Hani Sweilam, Minister of Water Resources & Irrigation, Egypt, H.E. Dr. Amani Sulaiman Abdulwahab Buqamaz, Minister of Electricity, Water and Renewable Energy in Kuwait, H.E. Ali Ibrahim Al Malki, Assistant Secretary-General, League of Arab States, H.E. Prof. Dr. Mahmoud Abu-Zeid, President, Arab Water Council, H.E. Eng. Ahmed Alkaabi - Assistant Undersecretary for Electricity, Water and Future Energy sector, Ministry of Energy and Infrastructure – UAE, H.E. Dr. Tamam Raad, Minister of Water Resources, Syria, H.E. Mariam Al-Sadiq Al-Mahdi, Former Minister of Foreign Affairs, Sudan, H.E. Eng. Tawfiq Sharjabi, Minister of Water and Environment, Republic of Yemen, H.E. Eng. Awaidha Murshed Al Marar, Chairman, Department of Energy, UAE Ministry of Energy & Infrastructure and H.E. Eng. Mohamed Al Rumaithi, Undersecretary, Ministry of Energy and Infrastructure, United Arab Emirates.

The two-day event hopes to encourage governments, financial institutions, private sector and the civil society to engage in factual dialogues to address water scarcity and depletion of natural freshwater resources. It will place a special focus on the non-conventional water resources and is intended to timely bring all interested parties



together to embark on implementing the COP27 outcomes.

In his opening speech to the Convention, Dr. Mahmoud Abu-Zeid, President of the Arab Water Council, emphasized that water scarcity constitutes acute and worrisome security threats in our Arab world, in which the population is growing rapidly and facing the mounting dangers resulting from water scarcity and severe financial deficit. What exacerbates the dangers related to water scarcity is that more than half of the renewable water resources in the region originate from outside its borders, a fact that intensifies tensions and threatens stability and peaceful living. Dr. Abu-Zeid explained that, in view of this, participatory dialogue between different actors is required now more than ever to explore pioneering solutions and invest in new projects, especially that providing financial resources represents a major challenge in the implementation of Governmental plans in the Arab regions.”

What exacerbates the dangers related to water scarcity is that more than half of the renewable water resources in the region originate from outside, which exacerbates tensions and threatens stability and peaceful living. Dr. Abu Zeid explained that, in view of this, participatory dialogue between the various actors is required now more than ever to explore pioneering solutions and invest in new projects, especially the promise of providing financial resources, which represents a major challenge in the

implementation of Arab government plans.

During his participation in the convention, His Excellency Suhail bin Mohammed Al Mazrouei, UAE Minister of Energy and Infrastructure, said: “The Arab Water Convention is a leading platform for collaboration to meet collective water-related goals and develop solutions for eminent water challenges. The UAE stands ready to join forces with regional and international stakeholders to drive water-related priorities and provide water development aid to countries that face water scarcity. We are committed to providing affordable, accessible, and reliable energy and water services. In this context, we seek to increase the contribution of our private sector partners and form meaningful public-private partnerships to advance our development agenda, particularly in the energy and water sectors.”

Delivering the opening speech on behalf of Minister Al Mazrouei, His Excellency Eng Sharif Al Olama, Undersecretary of the Ministry of Energy and Infrastructure for Energy and Petroleum Affairs, said: “Water is a basic human need and at the core of sustainable growth. In the UAE, water security is a priority issue, given the country’s geographic location in a water-scarce region and the increasing demand on water for socioeconomic purposes. We are reliant on unconventional water sources, which include seawater desalination and wastewater treatment and account for 53% of our water supply.”

He noted that between 2021 and 2023, three reverse osmosis desalination plants started operations and add 420 million gallons of desalinated water per day to the current total daily capacity of 1,590 million gallons of desalinated water.

His Excellency Eng Al Olama added: “The UAE’s efforts to enhance water security are well recognized. According to a UN report, the UAE achieved 100% in providing safe drinking water services and sanitation services and scored an average of 79% in integrated water resources management. We will continue to build on our achievements and align our water, energy, environment, and food strategies to achieve optimal results.”

H.E. Dr. Amani Sulaiman Abdulwahab Buqamaz, Minister of Electricity, Water and Renewable Energy in Kuwait in her opening speech at the Arab Water Convention in Dubai, emphasized that Kuwait relies heavily on desalination of seawater to meet the increasing demand for fresh water, and that the demand for water is rising at a rapid rate year after year due to the increase in population pressure and the rise in the standard of living. From this perspective, in order to meet future needs, it will be necessary to invest heavily in expanding the capacities of desalination plants, and therefore urgent measures must be taken to develop water resources.

The minister said that innovative technologies must be adopted to treat wastewater, reduce pollution of available water and control it, reduce losses from the freshwater network and calculate the water losses periodically, adopt new technologies for water production and treatment, enhance water security and preserve its resources in the country.”

H.E. Ali Ibrahim Al Malki, Assistant Secretary-General, League of Arab States, stated “Arab Water Convention will disclose new business models for non-conventional water resources and will hopefully encourage more regional countries to explore pioneering solutions and mobilize public and private actions to promote better water resource quality and ensure sustainability.” He added that the non-conventional water reuse is a strategic option for alleviating the emerging problems of water scarcity, especially in light of the evolving climate change conditions. Yet, it requires significant investments in infrastructure to enhance water supply and easy access to clean water and improved sanitation services. He elaborated that at this stage, there is dire need to create an enabling investment environment to attract sponsors to this sector in view of the considerable financial, economic and environmental costs associated with the development of Non-Conventional Water Resources.”

“While economists classify water as a valuable and increasingly scarce natural resource, we know it is much more than that, being an indispensable human need. An adequate supply of water is not only fundamental for the economy, jobs and employment, but also for health and political stability. We have financed various Municipal Wastewater Treatment plants in Egypt, Jordan, Lebanon, Tunisia and Morocco, which in some cases, foresee water re-use for irrigation, if the location of the plant allows it,” added H. E. Gelsomina Vigliotti, Vice President, European Investment Bank.

The world-class Water Expo held on the sidelines of the Convention showcases the latest water-related technologies, innovative solutions, and equipment, hence enabling successful business transactions and interchange of knowledge and know-how.

The Arab Water Convention is addressing four critical themes including: Effective governance frameworks for the efficient use of non-conventional water resources; smart NCWR business opportunities focusing, among others, on digital transformation and artificial intelligence; financing new bankable NCWR business opportunities; and role of the private sector in promoting new NCWR business opportunities.

Delegates attending the Convention include governmental representatives, international and regional organizations, donors, investors, finance and business stakeholders, decision-makers, industrial engineers, and specialists in different disciplines of water, food, and energy nexus in a changing climate.

The Arab Water Convention is organized and promoted by GM Events, a Dubai-based multi-faceted event management company of international repute, having organized numerous unique forums and exhibitions that highlight the issues faced by various economic sectors across the Arab region.

BENTLEY SYSTEMS ANNOUNCES ACQUISITION OF EASYPower®, LEADER IN POWER SYSTEMS ENGINEERING SOFTWARE

EXTON, Pa. — Feb. 27, 2023 — Bentley Systems, Incorporated (Nasdaq: BSY), the infrastructure engineering software company, today announced it has acquired EasyPower, a leading developer of design and analysis software tools, including arc flash solutions, for electrical engineering professionals. Since its founding in 1984, Portland, Oregon-based EasyPower has innovatively combined graphics-based modeling and analysis in order to make solving complex electrical engineering problems ever more straightforward and accessible. EasyPower products are primarily used for designing, analyzing, and monitoring power distribution systems serving industrial and commercial facilities, to ensure safety, reliability, and regulatory compliance.

Bentley's acquisition of EasyPower, to extend integrated and iterative power systems design and analysis for infrastructure digital twins of every type, broadens its comprehensiveness in infrastructure engineering. With an increasingly electrified future and with disparate and widely distributed energy resources on both sides of "the meter," all infrastructure assets will benefit — in performance, economics, safety and resilience — from continued simulation and assessment of power distribution conditions and designs over their project and operating lifecycles. Priorities for Bentley Systems will include integrating EasyPower's schema and digital workflows with

Bentley's OpenBuildings, OpenFlows, OpenPlant, OpenRail, and Bentley Raceway and Cable Management applications.

CEO Greg Bentley said, "All infrastructure projects and assets have power distribution systems, which are too frequently analyzed using unnecessarily complicated software that is disconnected from 3D/4D BIM and digital twin workflows. By incorporating EasyPower within our design and modeling portfolio, and our iTwin Platform, we can help enable the distribution systems powering infrastructure to be more readily adapted to new imperatives for sustainability and resilience, while making electrical safety assurance more ubiquitous, accessible, and evergreen."

EasyPower CEO Kevin Bates said, "We are delighted to be joining Bentley Systems at this point of inflection for electrical power in infrastructure, and in infrastructure digital twins. For nearly 40 years, EasyPower has been simplifying complex electrical engineering problems and helping our customers to confidently complete the job at hand. Our purpose has been to make electricity more accessible, more reliable, and safer to use. Within and for Bentley Systems, we can now substantially scale up EasyPower's reach — across the world, across infrastructure sectors, and across digital twin lifecycles!"



BENTLEY SYSTEMS ISSUES CALL FOR NOMINATIONS FOR THE 2023 GOING DIGITAL AWARDS IN INFRASTRUCTURE

Winners to be Selected and Announced at the Year in Infrastructure and Going Digital Awards Event in Singapore

EXTON, Pa. – March 3, 2023 – Bentley Systems, Incorporated (Nasdaq: BSY), the infrastructure engineering software company, today announced its call for nominations for the 2023 Going Digital Awards in Infrastructure. The awards, which are judged by independent juries of industry experts, recognize infrastructure projects for going digital advancements in infrastructure. The deadline for nominations is May 8, 2023.

Users of Bentley software are invited to enter their projects in the Going Digital Awards in Infrastructure program, no matter which phase the project is in – preconstruction/conceptual, design, construction, or operations. The three finalists chosen for each awards category win a trip to Singapore to attend the Year in Infrastructure and Going Digital Awards event, as guests of Bentley Systems. As part of the conference, the finalists will present their projects before the judges, industry thought leaders, and more than 100 media members.

The Going Digital Awards in Infrastructure categories include:

- Bridges and Tunnels
- Construction
- Enterprise Engineering
- Facilities, Campuses, and Cities
- Process and Power Generation
- Rail and Transit
- Roads and Highways

- Structural Engineering
- Subsurface Modeling and Analysis
- Surveying and Monitoring
- Transmission and Distribution
- Water and Wastewater

These projects recognize innovative advancements and measurable impacts in infrastructure and sustainability. Projects may be recognized for their economic impact and innovative use of Bentley software, including the iTwin Platform and infrastructure digital twins, 4D modeling, Infrastructure Internet of Things, and artificial intelligence. Projects may also be recognized for advancements that empower sustainable development goals in terms of climate action, energy transition and efficiency, circularity of land and water resources, and healthy communities.

In addition to the juried awards, Bentley's Founders will honor select projects representing organizations or individuals whose undertakings contribute notably to infrastructure advancement and/or environmental and social development goals.

Every project nominated for an award receives recognition across the global infrastructure community in the following ways:

Having their infrastructure projects profiled in Bentley's Infrastructure Yearbook, which is distributed in print and digital formats to media, government, and industry influencers around the world;

Enhancing their competitive edge by demonstrating to existing and potential clients the value the participants add to projects through their digital innovations;



NEW TECHNOLOGY FOR SEWAGE TREATMENT TO BOOST LAKES' REVIVAL IN DELHI



NEW DELHI: To revive lakes in the city with quality treated water, Delhi government is adopting a new technology that does aeration and bacteria treatment of the sewage to augment efficiency of the sewage treatment plants (STPs). Officials said they aimed at treating over 500MGD sewage, and over 150MGD treated water would be infused into the lakes, including 25 acres of Sanjay Lake.

The technology uses aeration machines and the integrated fixed film activated sludge (IFAS) process to quickly enhance dissolved oxygen (DO) and reduce biochemical oxygen demand (BOD). While the city currently generates about 768MGD (million gallons per day) sewage, only 632MGD is treated, and at least nine of the 35 STPs do not comply with the standards for BOD and total soluble solids. The plan is to divert at least 150MGD of the treated water, which will better DO and lower BOD levels in the lakes. While the BOD standard depicts the minimum oxygen a waterbody requires to decompose organic matter, DO shows measures of life init.

“The idea is to give treated water more oxygen or air to enhance dissolved oxygen and reduce biochemical oxygen demand. For this, two techniques are being used, the first one being aeration that adds air in the treated water to increase its quality. It's just like

air machines we see in aquariums,” said an official of Delhi government. However, since only aeration is not enough, IFAS is being used to treat the sludge in the water using bacteria. For this, the official explained, additional films are put inside the water, which give space for the bacteria to grow and treat the sludge. The second technique improves BOD.

Delhi government aims to use the cleaner water with better BOD and DO levels for its City of Lake project, which aims at reviving 14 lakes initially and over 1,000 lakes in all. They include two lakes of 11 acres each in Pappankalan, three lakes of 10.5 acres each at Nilothi, and five lakes in Iradatnagar. Sanjay Lake is currently being cleaned along with others like Smriti Van Lake.

“Both the techniques are expected to give us quick results. While improving the capacity and enhancing the quality of the treated water using additional STPs may take over two years, these techniques could help us achieve the same in about six months,” said an official of Delhi Jal Board. The aim is to reduce BOD, which indicates the capacity of a water body to clean itself, from 30 to 10 units, officials pointed out.

ONLY 8 SEWAGE TREATMENT PLANTS IN BENGALURU MONITORED PROPERLY, STUDY FINDS



A study by an NGO has found that out of Bengaluru's 31 sewage treatment plants, only eight are monitored properly for chemical oxygen demand, biochemical oxygen demand, pH, total nitrogen, faecal coliform, ammoniacal nitrogen and suspended solids for wastewater treatment.

ActionAid Association's study found that the Bangalore Water Supply and Sewerage Board (BWSSB), which runs the sewage treatment plants, did not comply with the limits set by the Karnataka State Pollution Control Board (KSPCB) for the parameters. While the limit for total suspended solid—a parameter used to assess the quality of water after treatment—is <10 mg/l as prescribed by the KSPCB, the BWSSB has set the limit at <20 mg/l. The KSPCB's pH limit is 6.5-8.5 but the BWSSB limit is 6.5-9.

Said Raghavendra B Pachhapur, senior lead (projects) of ActionAid Association, "We have looked at the data available at the BWSSB STP dashboard, which monitors these parameters in all the 31 STPs across Bengaluru... Ammoniacal nitrogen and total nitrogen are not configured for seven STPs and faecal coliform data is missing across the STPs. Although sensors may not be available for coliform, it needs to be tested once a day and results need to be updated."

Raghavendra further said the values of several parameters remained unchanged. "If wastewater is being processed every day, it is practically impossible to record the

same readings for days together. So we concluded that the readings were wrong. There is an urgent need for the BWSSB to look into the data of STPs on the dashboard," he said. "Either the data is not captured effectively, sensors are not performing effectively, or the STP is not performing effectively."

The sewage treatment plants at Doddabele, Cubbon Park, Yelemellappa Shetty, Mailasandra, Kempambudhi, Rajacanal, Agaram and Hulimavu are properly monitored. Those at Kengeri, Rajacanal, Hebbal, K&C Valley-30 and K&C Valley 218 have not configured any parameters for monitoring, so all data is missing for them, according to the study.

FUKUSHIMA'S NUCLEAR WASTEWATER CAPABLE OF PRODUCING CANCERS AFTER RELEASE

Wellington, March 3 (IANS) Treated nuclear wastewater from Japan's damaged Fukushima power plant, which, if released into the Pacific Ocean as planned will ultimately reach the High Seas, is "capable of producing cancers", New Zealand



scientists said on Friday.

Japan has planned to release treated nuclear wastewater from the damaged Fukushima Daiichi nuclear power plant into the Pacific Ocean, reports Xinhua news agency.

Jamie Quinton, head of School of Natural Sciences, Massey University, said that in this original unprocessed wastewater, radioactive isotopes of concern were iodine-131 and caesium-137, and that they being used in nuclear medicine radiotherapy means that they have sufficient energy to cause cell death and mutation.

"In other words, they are capable of producing cancers," Quinton said.

International law expert Duncan Currie told Xinhua that Advanced Liquid Processing System (ALPS) treatment at best does not remove tritium, and there is next to no scientific information of the effects of tritium on the marine environment, including on different species.

Currie noted that planned target in treatment of Fukushima nuclear wastewater is only to remove other radioactive isotopes to "regulatory," rather than detectable, levels. Tests of ALPS treatment systems have not been encouraging, Currie said.

"There were several other radioactive products in the unprocessed water that are hazardous to living species and ecosystems. As organisms consume other organisms, more of these radioactive products accumulate in their bodies, which can in turn, end up in humans. So these radioactive elements must be kept out of natural ecosystems

as much as possible, especially the ocean," Quinton said.

David Krofcheck, senior lecturer in Physics at the University of Auckland, agreed by saying the danger of indiscriminately releasing nuclear fission products into the ocean is that the products can find their way into the food chain.

"Once in the food chain the long-lived nuclear fission heavy nuclei like cesium-137, strontium-90, and iodine-131 tend to concentrate in human muscle, bones, and thyroid, respectively. Cancers can be the result," Krofcheck said.

New Zealand should be concerned over nuclear wastewater effects on the Pacific, Currie said, citing modeling that shows movement of radioactive water to the North Pacific, including for instance through uptake in highly migratory fish and marine mammals.

Currently, an independent panel of global experts on nuclear issues are supporting Pacific Islands Forum nations in their consultations with Japan over its plans to discharge treated nuclear wastewater into the Pacific Ocean.

Quinton noted that if the release of wastewater into the ocean is to proceed, "getting the process correct and within regulations is of particular importance to Japan's aquaculture-based industries".

It is in Japan's economic interest to ensure that waterways remain below internationally acceptable levels for background radiation so that food safety is assured, and their capacity for international trade remains unaffected, he said.



PUNJAB'S BIGGEST SEWAGE TREATMENT PLANT FOR REJUVENATING LUDHIANA'S BUDDHA NULLAH LAUNCHED

Reiterating the firm commitment of the AAP government to clean Buddha Nullah in Ludhiana, Punjab Chief Minister Bhagwant Mann on Monday dedicated sewage treatment plant (STP) and other projects of Rs 315.50 crore for cleaning and

rejuvenation of the drain.

The Chief Minister, while addressing the gathering during dedication of Punjab's biggest STP here, expressed concern over the polluted Buddha Nullah, adding this was the result of the callousness of successive governments of the state.

Mann said he had been raising this issue as a Member of Parliament too because the polluted water from the drain mixes with the Satluj river and causes havoc in other parts of state too.

He said the villages in Jalalabad (Fazilka) were worst affected by it but the former Deputy Chief Minister Sukhbir Singh Badal, who represented Jalalabad never did anything to solve this problem resulting in miseries for the people.

Meanwhile, the Chief Minister said the newly constructed STP with capacity of 225 MLD will be instrumental in the cleaning of the Buddha Nullah in the city.

He said this will act as a catalyst in checking the water pollution in this nullah which was flowing in the heart of the city. Mann said 14 km of the nullah crosses from within the city, adding a detailed project has been chalked out for its cleaning.

The detailed project has been chalked out at a cost of Rs 650 crore under AMRUT and Smart City scheme. He said as per the funding pattern, the state government is spending Rs 392 crore on this project whereas the Central government is giving a matching grant of Rs 258 crore.

Mann said that on Monday, projects worth Rs 315.50 crore, including STP with 225 MLD capacity and others, were dedicated to the people.

INDIAN RESEARCHERS DEVELOP TECH TO CUT WATER USE IN TEXTILES BY 90%

The Indian Institute of Technology (IIT), Ropar has developed a green technology called air nano-bubble, which reduces the quantity of water used in the textile sector. The institute has claimed that the technology can reduce the use of water up to 90 per cent. As per a rough estimate, 200-250 litres of water is required to process 1 kg of cotton.

"The laboratory reports suggest that the air nano-bubble dispersed in water can reduce water consumption and chemical dosage by 90-95 per cent which ultimately saves 90 per cent of energy consumption as well," Dr. Nirmalkar, who has developed this technology, said in a press release by India's ministry of science and technology.

"As one of the most water-intensive industries, there is an escalating need to address the problem of managing water usage in the textile industry associated with contamination of water. At IIT Ropar, we are inventing and incorporating new-age

processing methods to conserve water for our future generations," said professor Rajeev Ahuja, director, IIT Ropar.

In the textile industry, water is used at many steps in fabric preparation including for dyeing, finishing chemicals in the textile substrates, desizing (process of removal of sizing material from yarn), scouring, bleaching, and mercerising (chemical treatment of fabric to enhance affinity towards dye). At the same time the textile industry also produces the highest volume of wastewater. The major sources of water pollution are pre-treatment, dyeing, printing, and finishing of textile materials.

Dr. Neelkanth Nirmalkar describes the technology as based on nano-bubbles of air and ozone. The bubbles are hydrophobic in nature, and therefore interact better than



water with the fabric and distribute chemical and dyes in the fabric much more efficiently than just water. These bubbles are of a size equivalent to 1/11000th times of human hair. Ozone nano-bubbles remove the extra dye during fabric wash and degrade the dye in the water.

“Besides saving water consumption, the water after processing via a nano-bubble machine can be re-used. Nano-bubbles serve as carriers for the processing chemical and reduce the extra chemical required. “Treatment of the garment through this patented technology helps in maintaining its real colour for outdoor usage. It helps in obtaining 2-D effects, easy care, water repelling, and softening of fabric,” said Dr. Nirmalkar.

IIT, Ropar has developed this eco-friendly technology under a start-up named NanoKriti Pvt Limited, which is also working towards cleaning the environment and is developing new applications ranging from water treatment to health care.

DIARRHOEA OUTBREAK PROMPTS WATER TREATMENT PLANT IN HIMACHAL PRADESH CM SUKHVINDER SINGH SUKHU'S CONSTITUENCY

SHIMLA: The recent outbreak of diarrhoea in Jol Sappar area under Nadaun assembly constituency of chief minister Sukhvinder Singh Sukhu has prompted the state government to take action. To address the issue, the govt has decided to set up a water treatment plant for the three drinking water schemes of Kunah khad. A sum of Rs 1 crore has been immediately released to start the process, and the tender process will commence in the coming week.

Deputy chief minister Mukesh Agnihotri said the noose on illegal mining around the drinking water schemes across the state would be tightened. He said the officers of the Jal Shakti department had been instructed to register FIRs in such cases immediately.

Deputy chief minister Mukesh Agnihotri, who also holds the portfolio of Jal Shakti department, himself visited the affected areas to inspect and assess the situation. He said due to illegal mining in the area the water bodies were contaminated. The deputy CM said action would be initiated against the officials who failed to act against the illegal mining in the area.

He said after finding illegal mining responsible for water contamination in Kunah khad, strict directions had been issued for the water supply schemes across the state to

ensure their safety.

He said the state government was committed to provide clean drinking water to every household and comprehensive steps were being taken in this direction. He said a task force would be formed to check the sources of all drinking water schemes in the state.

Talking about the drinking water and irrigation schemes in Hamirpur district, Mukesh Agnihotri said a target had been fixed to complete the irrigation scheme of about Rs 156 crore for Nadaun area by March 31.

He said for a permanent solution to the drinking water problem of Barsar assembly constituency, tenders for a large scheme will be re-done, due to which the department would save about Rs 50 crore.

He said that for this scheme of about Rs 131 crore, instead of river Beas, water will now be lifted from Satluj. He said under the Jal Jeevan Mission, a provision of Rs 71 crore had been made for the drinking water schemes of district Hamirpur.

About half of this amount has been spent and all the remaining works under the mission will be completed expeditiously.

BACKED BY CIVIC BONDS, TERTIARY WATER TREATMENT PLANT IN GHAZIABAD LIKELY TO BE READY BY JUNE



GHAZIABAD : The tertiary water treatment plant coming up in Indirapuram may miss its March deadline but is expected to be ready by June. The Rs 319.14-crore plant with a capacity to treat 4 million litres of water per day will reduce the dependency of the over 1,400 units in the Sahibabad industrial area on groundwater.

“The work on the tertiary water treatment plant is 27% complete. We had set March as the target for commissioning the plant but the workflow was impeded after Graded Response Action Plan (GRAP) came into force. We are hoping that by June work on the plant will be over,” municipal commissioner Nitin Gaur said.

The work for the plant is being executed by a private firm, WABAG Group, on a hybrid annuity-based public-private partnership. Of the total 319.14-crore cost, Rs 169.14 crore is being borne by the firm and Rs 150 crore by the Ghaziabad Municipal Corporation, Gaur said. The civic body, which raised the amount through bonds, has paid two instalments of Rs 18.75 crore each to the firm so far, he added.

The GMC will sell treated water to industries in Sahibabad industrial area and earn revenue. The civic has already signed an MoU with Sahibabad Industries Association

under which the treated water will be supplied to them at the rate of Rs 45.9/kilolitre.

“There are over 1,400 industries in the industrial area and based on our survey the daily water demand of the industries is 36 MLD. The tertiary water treatment plant will have the capacity to treat 40 MLD of water, which is enough to cater to the needs of industries in the cluster,” Gaur said.

Currently, an 88-km water pipeline is being laid from the plant to the Sahibabad cluster to supply treated water.

“An overhead tank of 2,800 kilolitre storage capacity is being constructed in Indirapuram. An underground water tank of 40,000 kilolitre storage capacity is also being constructed in the Sahibabad area,” Anand Tripathi, general manager of GMC's water works department, said.

Not just preserving groundwater, early commissioning of the plant is vital for GMC's financial health. For the Rs 150-crore bonds raised for the project, GMC has to shell out over Rs 12 crore annually in interest on the amount. Once operational, the civic body can generate Rs 18 lakh per day revenue by selling treated water to industries

DROPLETS SNIPPETS



Bentley Systems Announces Retirement of Founder Keith Bentley and Promotion of Julien Moutte to Chief Technology Officer

Bentley Systems, Incorporated (Nasdaq: BSY), the infrastructure engineering software company, announced forthcoming retirements:

- As of April 2023 founder Keith Bentley will step down as Chief Technology Officer to assume the role of Technology Advisor through his anticipated retirement later in the year, and will continue thereafter his service on Bentley Systems' Board of Directors. His successor as Chief Technology Officer will be Julien Moutte, currently Vice President of Technology; and
- David Hollister, currently Chief Investment Officer, will retire as of March 31, 2023. He was succeeded as Chief Financial Officer by Werner Andre at the beginning of 2022.

1. WABAG ranked 3rd globally among "Top 50 Private Water Companies"

New Delhi, March 4 : VA TECH WABAG LIMITED, a leading Pure Play Water Technology Multinational has been ranked 3rd Globally, by Global Water Intelligence (GWI), London, under "The world's top 50 private water operators" for ensuring safe and clean drinking water and Sanitation for over 88.8 million people across the globe.

Speaking on the achievement, Rajneesh Chopra (Global Head - Business

Development, VA TECH WABAG LIMITED, said it's an extremely proud moment for all of us at Wabag to be rated amongst the top 3 Water companies globally, especially so, since we are the only Indian company to be there in the top 3 list. It is always our endeavor to ensure water sustainability, and we have been continuously innovating and implementing new and advanced technologies in the field of Water and Wastewater treatment across the world."

2. Jal for Aaj, Kal: PM Modi's Focus on Safe Drinking Water for All households in India

PM Narendra Modi will visit Shivamogga and Belagavi districts in Karnataka on February 27. The two districts will witness water supply projects under Jal Jeevan Mission, worth more than Rs 2,500 crore, which will benefit more than 13 lakh people of the two districts.

The trend of predominance of water supply projects is visible in most of recent projects inaugurated by PM recently across states.

3. NGT frames rules for sewage treatment plants

Chennai: To tackle pollution of water bodies, the National Green Tribunal has framed guidelines for sewage treatment plants in Chennai on removal of septage from unsewered areas, regulation of sewage tankers under local body limits and discharge of untreated sewage into water bodies. It ordered Greater Chennai Corporation, Metro water and the local bodies concerned to strictly implement them.



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DROPLETS **SNIPPETS**

The guidelines, framed by judicial member Justice Pushpa Sathyanarayan and expert member Dr Satyagopal Korlapati, are aimed at preventing letting out of raw sewage into stormwater drains or water bodies. The guidelines are under Municipal Corporation, Municipalities and the Chennai Metropolitan Water Supply and Sewerage Act of 1978 along with the January 2, 2023, GO.

4. Jaipur to get more water from Bisalpur dam in four months

Twenty-four years after construction, officials of the Public Health and Engineering Department (PHED) are set to augment the water supply from Bisalpur Dam to Jaipur under the Bisalpur-II project. The first phase of the project is expected to get over by May.

“The idea is to enhance water supply from 600 MLD to 816 MLD Bisalpur Dam to Jaipur. The augmentation is expected to start from May in phases. We are hopeful to supply around 630-640 MLD of water. The additional 30-40 MLD would help us to supply water at new areas and would also solve the water shortage problem of summer months to a great extent,” Satish Jain, superintendent engineer of PHED.

In order to augment the facility, PHED officials are first enhancing the capacity of the water treatment plant in Surajpura and would install nine new pumps at the intermediate pumping station in Renwal. From there, water would be supplied at the storage facility in Balawala located just at the entry point of Jaipur city in Sanganer.

“All these augmentation works are going on in full swing. By the last week of February, we are going to connect the hydraulic pipelines with the pumping facility in Renwal. This is one of the most important jobs for the project. For this we may have to stop the water supply for a few hours,” added Jain.

Bisalpur Dam was constructed in 1999 when the Congress was in power in Rajasthan and in 2004, the BJP-led government started laying pipelines to connect the city with Bisalpur. Finally, in 2009, water from Bisalpur started coming to Jaipur.

However, the project witnessed a major protest as farmers from Tonk, relying on Bisalpur water for irrigation, opposed demanding the share of the water. Even there were public outrage in surrounding districts like Ajmer and Bhilwara. The protest became so violent that on June 13, 2005, five farmers were shot dead while protesting the diversion of Bisalpur water to Jaipur.

“Such a situation is not possible this time. We are augmenting the supply of Bisalpur water keeping in mind the demand of water in Jaipur in 2023. As far as Tonk and Ajmer is concerned the present supply capacity is enough at least till 2029,” a senior engineer added.

With this augmentation additional water would be provided even in areas enroute like Basi, Dudu, Sambhar and Phulera.



HAPPENING IN THE INDUSTRY

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THE REMOTE ADVANTAGE – INDUSTRIAL WATER TANK INSPECTION & CLEANING WITH ROVs

By Riley Kooh, Content Manager, Pipe Trekker



Water is the single most important resource for supporting communities around the globe. Whether for residential, industrial, municipal, or commercial use, water is used in countless ways, many of which we rarely see. The United States alone uses 327 billion gallons of surface water every day. But where does this water come from?

An enormous amount of usable surface water is kept in water storage tanks. In North America, the market for water storage systems is estimated at \$US 3.4 billion and is expected to grow to \$US 4.1 billion by 2024. Inspecting these tanks is imperative for structurally sound, clean, and safe water for power, agriculture, mining, and household use. Without routine inspections, issues can arise quickly and sediment can build, compromising the integrity and cleanliness of the water.

Most Common Industrial Water Storage Tanks

Depending on the situation, budget, or environment, there are a variety of water storage tank options to choose from. Each type comes with its own pros and cons and is better suited for different purposes. Here are the eight most common types in the modern-day market.

Fiberglass

Fiberglass tanks are becoming increasingly popular in modern settings. Compared to steel and aluminum, fiberglass is not subject

to corrosion or rust. Weighing much less than concrete, fiberglass boasts a respectable strength-to-weight ratio. This makes it an excellent cost-effective option for both installation and long-term water tank maintenance. Fiberglass tanks are commonly used for a variety of commercial settings, and can easily be coated for potable water storage.

Fiberglass tanks can be installed both above ground and underground. Underground installation allows for a large amount of water storage, without affecting the usability of the ground topside. These tanks can be completely covered, using a manhole-style access point for inspections.

Pillow Tanks

Just as the name suggests, pillow tanks resemble that of a standard pillow. These tanks can be constructed of a variety of materials to store potable water, wastewater, stormwater, gray water, etc. Their flexible design allows the tank to collapse down for simple transport, with smaller models capable of fitting into a backpack. Commonly used for farms, tree nurseries, firefighting, and military bases, pillow tanks can range from 25 gallons up to an impressive 210,000 gallons.

Concrete

Concrete is the heaviest of material options for storage tanks, however, it is also one of the most versatile. Concrete is in large



Credit: <https://www.greatario.com/applications/wastewater/municipal/>



Credit: <http://photos.jdhancock.com/photo/2010-01-09-020519-the-city-of-victoria-water-tower.html>

supply all around the globe, making it an affordable and readily available option for most builds. Additionally, since concrete is a poor conductor of heat, it helps regulate water temperatures in hot climates.

Concrete tanks can be molded to countless shapes depending on the project, and typically last up to 50 years with proper maintenance. However, once degradation sets in, concrete is prone to cracking and has a relatively complex repair process. These tanks are popular permanent storage systems for potable water, rainwater, stormwater, or sewage.

Bolted Steel

As the largest storage tank option, bolted steel tanks can be built to hold millions of gallons of water. Although steel can be subject to corrosion, there are treatment options available to avoid this and extend its lifespan up to 40 years. These massive tanks are capable of safely storing potable water, and are best suited for large-scale permanent storage solutions. These projects can include the storage of city drinking water, fire protection, wastewater storage, or crude oil storage.

Stainless Steel

Stainless steel water tanks are popular for their safety and durability in both commercial and residential storage. Stainless steel can handle a wide range of temperatures, doesn't rust, and will not degrade in UV light. Typically used for small-mid-size projects due to pricing, stainless steel tanks are commonly used for potable water and beverage production.

Corrugated/Galvanized Steel

Steel tanks were some of the first renditions of modern water storage. Costing considerably less than its stainless counterpart, galvanized steel is a viable option for lower budget or short-term projects. Since steel corrodes and rusts, it's integral to

have an interior poly lining to protect the material. Even with this poly lining, steel tanks can expect a lifespan of 10 - 20 years. Following a dedicated and cautious inspection process helps maintain the integrity of the lining. Any direct water exposure to the steel tank will induce corrosion and rust.

Polyethylene

Plastic tanks are renowned for their affordability and durability. Polyethylene tanks are built without any interior coating or seams, making for easier water tank maintenance over the long term. They are also completely resilient to corrosion or rust. While steel or concrete tank options can be built to much larger specifications, plastic tanks generally max out at 50,000 gallons. However, for larger projects, multiple poly tanks can be coupled together.

Types of Water Storage Towers

A water storage tower differs from a general tank by its elevation. By raising a water supply in the air, the force of gravity can be used to create hydrostatic pressure to distribute water supply effectively. Typically water towers are constructed of steel, which provides lifespans in excess of 100 years, and are used to send potable water throughout municipalities.

Standpipe

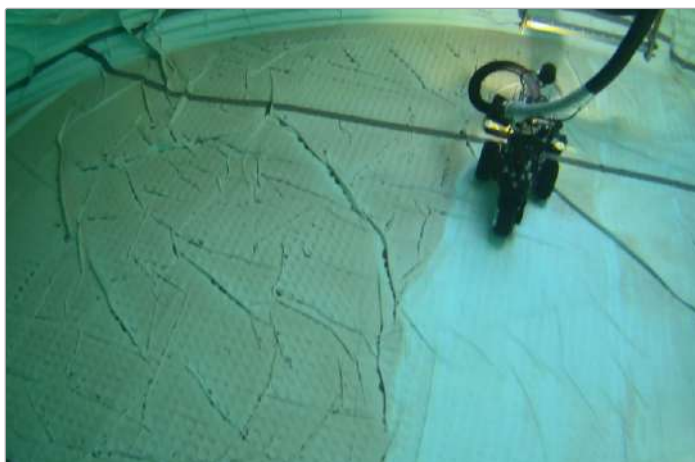
Standpipe water towers are generally the simplest design for elevated water storage at lower capacities. These ground supported structures resemble, as the name suggests, a standing pipe. This simple design lends itself to a lower upfront cost and a small footprint option for storing large amounts of water. A standpipe design does come with its setbacks though. Due to the high surface area to volume ratio, water temperatures are dramatically affected by weather conditions, resulting in issues with water quality, or thermal stratification.

Composite Elevated

Composite water towers are a popular choice for large storage projects over 500,000 gallons due to their efficient, stable, and aesthetically suited design for North American cities. Their design is based on a steel tank which is supported by a slimmer concrete pedestal that contains an internal storage and ladder system. The combination of concrete for a foundation structure and steel for water retention is ideal for keeping long-term maintenance costs down, however, it can be costly and time-consuming during initial construction.

Sphere/Spheroid

Spheroid water tanks are ideally suited for mid-size storage between 200,000 and 500,000 gallons. Their design resembles a large sphere supported by either a single or multiple thin legs or pedestals. Similarly to a composite tower, a sphere or spheroid tower benefits from its shape by sheltering much of its water volume from weather conditions, however, they generally have no internal storage or ladder system inside the thinner foundation.



Why Clean and Inspect Water Tanks?

Similarly to other assets, being on top of tank inspections will reduce long-term costs by properly prioritizing repair and replacement schedules. If left unattended, many common tank materials are subject to corrosion, cracking, or rusting. The American Water Works Association (AWWA) recommends that potable water towers be inspected every 3 to 5 years, although most tank cleaning specialists will recommend getting your tank professionally cleaned and serviced at least once a year. Additionally, many tank manufacturers offer warranties on the condition that tanks are inspected regularly.

Beyond the tank itself, potable water tank inspections are crucial for good water maintenance. Over time, sediment can gather and collect along the bottom of tanks. If in small amounts, sediment has no impact on the quality of the water or on the structural integrity of the storage tank.

However, over time as that sediment builds up and mixes into thicker 'sludge' material, issues begin to arise. These negative effects can result in health concerns for potable water or tank material degradation from the concentrated substances. Tank manufacturers generally recommend a minimum of one inspection and subsequent cleaning per annum. This is to ensure long-term integrity, extend the tank life, and avoid costly repairs.

What Causes Water Contamination?

Sediment Buildup

Small levels of mineral sediment in water tanks are common and can be safe, however, if left untreated, 'sludge' buildup can result in issues. If allowed to settle inside a tank for extended periods, sludge can wear away interior linings and induce corrosion or rusting on steel tanks. Additionally, sedimentation can attract pathogenic micro-organisms which can compromise water safety.

Lack of Circulation

Stagnant or motionless water can result in the production of biofilm, which is an ideal host for insects, crustaceans, or dangerous waterborne pathogens. To combat this, water tanks should implement a mixing system. These systems work to circulate different layers of the stored water to avoid stratification of surface and bottom water. Vandalization

Whether by humans, animals, or acts of nature, physical damage can pose a significant risk to water security. Damaged vents or screens can allow for the entrance of aquatic organisms into the water system.

What is the cleaning process for water storage tanks?

Due to the variety of water storage tank designs and styles, there may not be just one standard for cleaning routines. In Ontario, Canada, municipalities and organizations are bound to the Safe Drinking Water Act, 2002, which lays out a standard of care.

At any reasonable time, an officer can conduct an inspection to ensure that stored water is abiding by safety standards. As a general rule, it is recommended that water tanks should be inspected and cleaned at a minimum of once every six months for drinking water and once a year for non-potable water.



Option 1: Drain the Tank

The most traditional approach to cleaning a water storage tank is to completely drain and have certified workers enter and manually clean the tank. Whenever a human enters a water tank, contamination is a concern. To combat this, proper sanitary PPE must be worn, and all tools must be disinfected. The entire process can be summarized in five steps.

1. Empty The Tank for Entry to allow workers to enter and begin cleaning the tank, it must first be completely emptied of its water contents. Ensure that the water is drained into the ground away from plants for safe, legal disposal. All workers must be certified for working in enclosed spaces.

2. Clean & Rinse once emptied, workers can vacuum out any sediment, scrub the interior with a detergent, and pressure-wash rinse the interior until all traces of detergent are gone.

3. Disinfect depending on the size of the tank, a calculated ratio of water and chlorine-bleach should be added and allowed to sit for a minimum of 4 hours to disinfect the tank.

4. Drain & Refill once disinfected, workers can drain the tank again of the chlorine-bleach solution and refill it with clean water.

5. Test & Repeat if necessary to ensure that chemical levels are safe for human use after cleaning, workers should test water samples and repeat the drain and refill process if necessary.

This method can be extremely labor-intensive and costly. While conducting a dry inspection and cleanout, the water tank must be completely taken out of service. This means that alternative water supply must be implemented to prevent shortages and can be logistically or economically challenging. This method also puts workers in potential danger, working in confined spaces while handling chemicals. Additionally, cross-contamination is always a concern whenever humans enter the tank, even if all precautions are taken.

Option 2: Water Tank Cleaning Divers

As an alternative to dry cleanings, commercial divers can be hired to clean water tank interiors without any dewatering. Typically done in a team of three, one diver will enter the water while two remain topside as 'spotters'. Before entering, the diver's wetsuit will be completely disinfected. Once inside, they will use a vacuum system to pump sediment to the surface for removal and report on the condition of the tank structure.

The most notable benefit of this over dry cleaning is the ability to maintain water in the tank. Dewatering can waste thousands of gallons of water and can sideline water supplies for multiple days. However, some negative considerations of divers are the cost, risk, and time consumption.

Due to the complexity of performing submerged tasks, commercial divers undergo rigorous certification, which reflects in high hourly costs. Additionally, the associated dangers of diving in confined spaces with single exits put divers at risk and can increase the risk premiums. Divers are also limited to their gas supply, meaning frequent resurfacing which can extend cleaning times. While proper sanitation should always be performed pre-entry, having divers directly enter the water does carry the risk of cross-contamination as well.

Option 3: Robotic Tank Cleaning With ROVs

Implementing a Remote Operated Vehicle (ROV) is another option for tank inspections and cleanings without draining the tank. These vehicles come standard with HD cameras and can be equipped with multi-intake vacuum heads and pressure washers to complete a tank cleaning fully remotely.

The disinfection process is much simpler for an ROV in comparison to humans and



can be done by simply soaking or spraying the vehicle with a solution. Thanks to extended battery life, cleanings can be completed quickly with zero or minimal breaks. Since the operator can remain topside, there is no risk associated with diving or entering confined spaces, and all imperfections can be easily recorded and used for asset monitoring.

The benefits of using deep trekker rovs for water tank cleaning

Reduce the Use of Divers

While there will always be a place for commercial divers for certain projects, ROVs can effectively streamline tank cleanings in lieu of divers, thus lowering costs, improving efficiency, and maximizing safety.

For testimonial, we look to The Tank Inspectors, a 30-year established water tank service and installation company. After purchasing a DT640, Operations Manager Jo Hulands noted that where the team used to have to put a diver in the water, they can now use the ROV. "Pretty much 80% of the tanks that we do we can clean with the vacuum cleaner".

By using the ROV in lieu of a human diver, The Tank Inspectors not only keep humans safe but save time and money. In addition to OH&S standards regarding people in tanks and limiting the time people can actually be in the tanks, Dan noted that with the ROV "there's a lot less set up time, divers require a lot of set up." Furthermore, the divers require scheduling and coordinating where the DT640 can be deployed quickly and conveniently.

In addition, the use of the DT640 saves the Tank Inspector team significant amounts of money, estimating that the ROV is "40% of the cost of using divers." "In fact," Jo continued, "many diving companies themselves use the ROV to limit dive time by scoping out jobs with the DTG3 and undertaking cleans with the DT640."

Easy To Disinfect

One of the major risks associated with sending divers into tanks is the chance of contamination from their equipment if they do not follow a strict procedure. There are a lot of "nooks and crannies" on a dive suit that can hold bacteria and other potentially harmful materials that can contaminate the potable water.

For a Deep Trekker vehicle, disinfection is simple and reliable, thanks to its compact and intuitive design. To disinfect, simply spread the vehicle and tether on a clean and



disinfected ground sheet. Then, thoroughly spray down materials with a chlorine-bleach disinfection solution. Alternatively, the vehicle and tether can also be soaked in the solution. Note that all plastic ropes and cables, used to hoist a vehicle, for example, must be treated in the same manner.

Portable

Deep Trekker vehicles operate using lithium-ion batteries instead of direct power from generators. The absence of topside power drastically reduces the overall footprint of the setup, allowing for the vehicles to transport in either one or two Rugged Pelican Cases. At 34 lbs base weight, the DT640 VAC can be effectively hoisted to the top of water towers by a single operator.

The handheld controller and tether system are also designed with portability in mind. Replacing large control consoles and bulky tether is essential for maneuverability. The included tether utilizes a polyurethane outer jacket with embedded synthetic fibers to achieve a 200 lbs working strength at under ¼ inch diameter to fit on a compact reel system. The combination of controller, tether, and battery-powered vehicle simplifies working at heights and provides superior portability between jobs.

Keep Water Tanks Online

The main benefit of Deep Trekker ROVs in lieu of a dry cleaning is to keep water tanks online. With water conservation becoming a growing concern, throwing away thousands of gallons of usable water is far from the ideal solution.

For an example, we look to Ron Perrin Water Technologies. Previously, they would drain a 110ft standpipe of up to 100,000 gallons of usable water in order to clean the tank interior. After purchasing a DT640 VAC from Deep Trekker, they were able to accomplish this quicker and easier, while wasting zero water.

Affectionately called, “Wallie”, the team is able to clean sediment and sludge from the floor of the tank without taking the facility out of service using the Dt640.



Ron Perrin Water Technologies Hoisting a DT640 VAC up a 110ft Standpipe

Robert noted that the introduction of the DT640 changed the way that the Ron Perrin Water Technologies team conducted standpipe cleaning. "We use the vehicle instead of divers for tank cleaning," he said. "Before we got the vehicle we would have to drain the tanks and the utility would lose up to 100,000 gallons of water."

When using the DT640 for tank cleaning operators save significant amounts of time and money by keeping the asset in service.

DT640 In Lieu of Divers

Robert noted that the team uses the DT640 vehicle in lieu of divers. Using the utility crawler keeps human divers safe and out of potentially dangerous situations. Furthermore, the use of the DT640 allows for cleaning to be completed in a timely and convenient manner.

"On standpipes, we often deal with at least 100 feet of water so the divers can't stay down as long as the Deep Trekker can," explained Robert.

A purpose-built ROV, the DT640 is designed to work in tough underwater environments. A unique solution to various inspections and tasks, the DT640 is equipped with a camera specially designed to work in low-light conditions to provide high-quality feedback.

With lithium-ion battery power, the DT640 does not require a topside power source making the vehicle easily portable. The 360-degree turn radius makes the DT640 a highly maneuverable vehicle providing operators with an effective way in which to inspect underwater infrastructure.

Robert shared that one of his favorite things about the DT640 is "the fact that it works." Put simply, vehicles need to be reliable and durable to get the job done.

When speaking about the DT640 Robert said that "our crew likes the vehicle, they think it's fun to use."

In Conclusion

As Earth's most valuable natural resource, it's imperative that our systems for potable water storage are routinely inspected and maintained to ensure the safety and health of our communities around the globe. With modern advancements in technology and robotics, that mission has become much more affordable and efficient to undertake.

The use of ROVs has made the task safer for humans and easier than ever before, allowing municipalities to proactively deal with water treatment in much more manageable ways, which in turn improves the quality of life of our communities all over the world.



ABOUT THE AUTHOR

Riley has been the Content Manager at Pipe Trekker since late 2020. His experiences in the field working with dedicated customers in sewer, stormwater, general infrastructure, and other industries have shaped his work with various case studies and editorials about the use of robotics for pipe inspections. As a goal to limit the need for dangerous confined entry for workers around the world, Riley's work highlighting the benefits of remote inspections can be seen published in Trenchless Technology Magazine, The Journal of Ocean Technology, International Water Power and Dam Construction Magazine, Subtel Forum, and more.

To share your feedback or enquire about the author, write to us at deepak.chaudhary@eawater.com

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NEW TECHNOLOGIES FOR INDUSTRIAL WASTE WATER MANAGEMENT

By Pooja Nikhanj, Punjab Agricultural University



Ineffective wastewater treatment (WWT) methods are to blame for the deteriorating quality of fresh water and its decreased availability, particularly for home and industrial uses. For many years, traditional WWT procedures have been somewhat successful in treating effluents to comply with regulatory standards for discharge into water bodies. However, to make treated wastewater usable in the industrial, agricultural and home sectors, advances in WWT are the need of the hour. Thermal hydrolysis, microbial fuel cells and solar photocatalytic wastewater treatments are the emerging technologies for effective maintenance of WWT. Waste water from pharmaceuticals are somehow different with respect to their particular composition and harmful effect and needs different ways to get treated to get utilized for certain purposes. Application of these new emerging technologies for sustainable management and waste water conservation with re-use techniques will be facilitated by the creation of WWT blue prints.

New technologies for wastewater treatment

The following four exciting new wastewater treatment technologies are:

1. Thermal hydrolysis

Three functions of thermal hydrolysis technology are biogas production, waste byproduct reduction, and wastewater treatment.

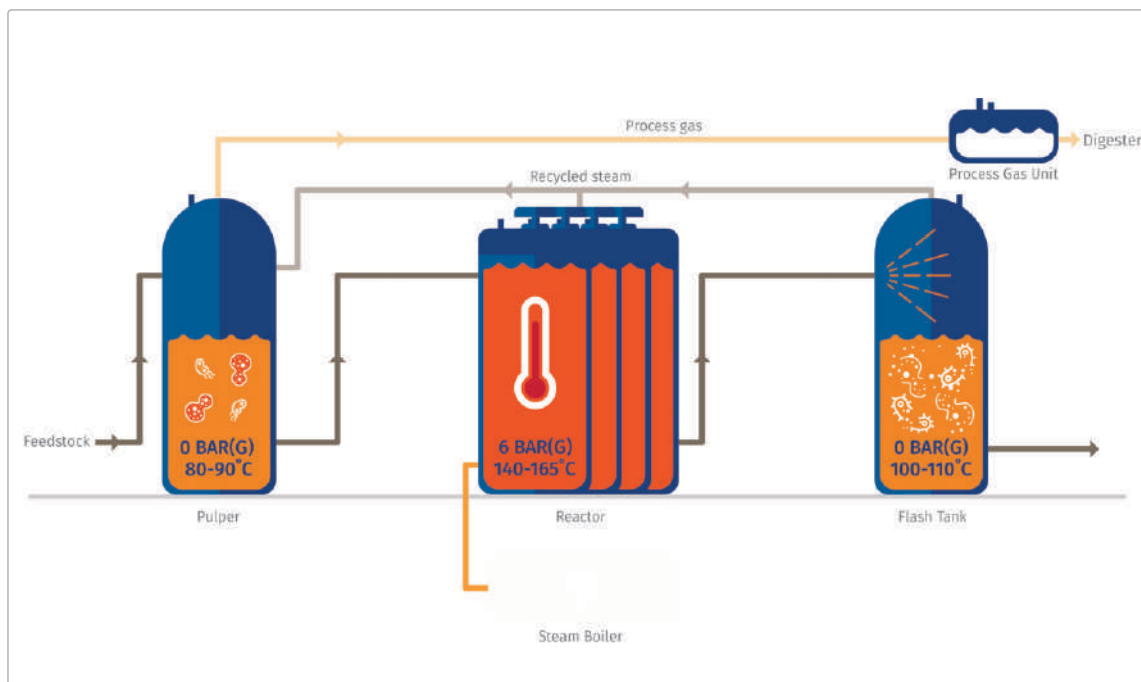
Large amounts of sludge produced during the industrial wastewater treatment process must be planned for by conventional wastewater treatment facilities. In contrast, thermal hydrolysis facilities view sludge as a valuable source of energy rather than as trash. Following wastewater treatment and sludge collection, biogas generation starts. In huge vats, the sludge is heated and compressed. The required pressures and temperatures range from high pressures of 7 to 11 or 12 bars and 160 to 165 degrees Celsius, respectively. There are two types of thermal hydrolysis: batch (also known as biotelys) and exelys.

A) Biothelys (Batch) Thermal Hydrolysis

Biothelys Technology requires large tracts of land for each plant and must be supplied with large quantities of wastewater every day in order to produce enough biogas to remain viable. However, for large municipalities, neither requisite is generally an issue and the production of biogas can be a considerable revenue stream.

B) Exelys Thermal Hydrolysis

Exelys Technology can be productive on less space and requires a smaller volume of wastewater to maintain viable. In addition to Exelys Technology requiring considerably less area, it produces 130 percent more biogas than the next most productive thermal hydrolysis systems using the same amount of sludge. The amount of end-waste is also reduced. The development of an Exelys Plant is expensive, the operating costs are far less than those of other

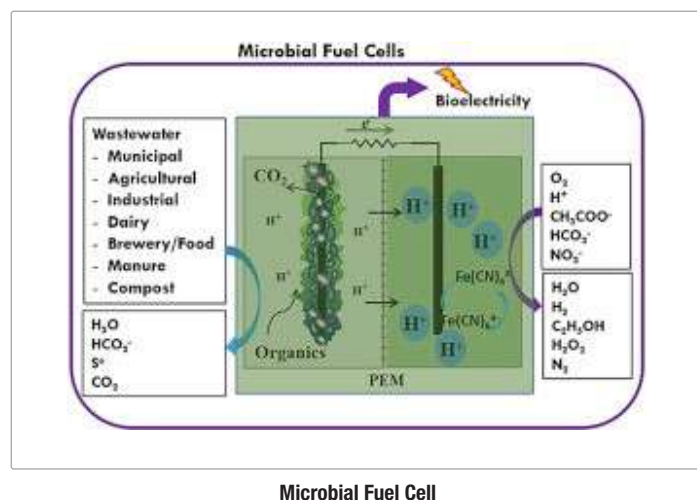


Thermal Hydrolysis process

thermal hydrolysis systems.

2. Microbial fuel cells

Microbial fuel cells (MFC) technology uses microbes to treat wastewater and is another technology that does three tasks at once. Even more astounding is the fact that the bacteria produce charged electrons that may be used to generate power as a byproduct of their consumption of wastewater sludge. By transferring the electrons generated during bacterial oxidation to an electrode, researchers have already achieved success in producing significant amounts of power under controlled laboratory circumstances. Electricity production would use fewer fossil fuels if MFC technology could be created on a wide scale.



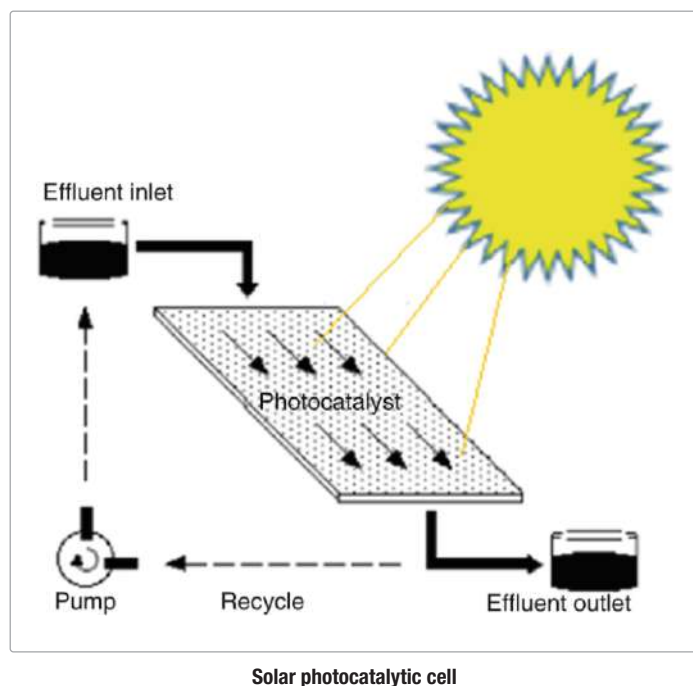
3. Solar photocatalytic wastewater treatment

Choosing what to do with the sludge produced as a result of wastewater treatment is one of the major challenges. When compared to conventional wastewater treatment systems, solar photocatalytic wastewater treatment can reduce the amount of sludge by over 80%. A photocatalytic device drastically reduces sludge, also known as "organic content," due to the microbial oxidation and degradation process known as "solar irradiation." As carbon is the main ingredient in organic material, solar irradiation has the synergistic effect of reducing the amount of carbon in the sludge when paired with hydrogen peroxide.

Importance of Water Treatment in Pharmaceuticals

The pharmaceutical industry, like many other areas of life, relies on clean water. To make different drugs safe to ingest, chemists need to use ultra-pure water in the production process. Industry standards like the European Pharmacopoeia even set regulations for water purity in pharmaceuticals. Pharmaceutical companies aren't merely concerned with treating water before they use it, either. As they use this substance in various processes, it comes out full of pollutants, as you'd expect of any industry. However, the contaminants that come out of pharmaceutical work can be particularly dangerous to both people and nature. The manufacturing process introduces a lot of chemical contaminants, both organic and synthetic. Drug companies need to use high-tech purification methods to make sure none of these chemicals gets outside. As a result, the industry is always looking into new technology to clean wastewater.

Here are five technologies improving pharmaceutical water treatment:



1. Membrane Separation

Membrane separation is one of the most widely used new approaches to treating pharmaceutical wastewater. There are various ways to purify water using membranes, but they all entail pushing water through a film that is packed with minute pores. The passage of liquid is unaffected, but contaminants are trapped. The ability to filter out many smaller pollutants has improved with modern membranes. Without contemporary manufacturing, the fibres that make up these membranes—each one containing millions of microscopic pores—would not be feasible. The intricate method of production pays off, though. Reverse osmosis and other membrane separation processes may purge water of 99.5% of contaminants. Only pores that are a mere fraction of a micron in size are able to produce this astounding statistic.

2. Irradiation

Irradiation is a different, gaining in popularity method of purification. As the name implies, this method exposes wastewater to radiation in order to destroy organic pollutants and disintegrate inorganic ones. Gamma rays and UV light are only a couple of the sources that scientists can irradiate their subjects with. In particular, irradiation is excellent for eliminating contaminants like hormones and antibiotics. However, not only do these organic substances qualify as contaminants, but all types of contaminants as well. Some methods, such as ionizing radiation, can virtually completely remove contaminants from wastewater.

3. Nanoparticle Treatment

One of the most fascinating scientific advancements nowadays is nanotechnology, which deals with items smaller than 100 nanometers. Nanotechnology is frequently mentioned in relation to engineering and medical, but some chemists also use it to purify water. Recently, there has been a lot of growth in the use of nanoparticles to remove contaminants from water. For a long time, people have used substances like charcoal to filter water through absorption. This similar idea is applied, although on a

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much smaller scale, in nanoparticle treatment. To remove even the tiniest impurities from water, it makes use of nanotubes formed of absorbent materials, such as carbon. This method is less common than others since nanotechnology is still quite pricey. But as research continues, it will become more accessible and practical.

4. Bioaugmentation

Some pharmaceutical businesses use biological processes to clean their wastewater. Bioaugmentation is one of the most well-liked and promising biological methods for water filtration. This technique involves adding a variety of microorganisms to the liquid, which decompose and eliminate pollutants. Enzymes and specific, secure bacterial strains are examples of these microorganisms. These organisms offer an organic way to clean water by naturally degrading contaminants like oils or carbon substrates. However, because the microbes must be eliminated afterwards, bioaugmentation is typically part of a multi-step procedure. Sometimes there are additional advantages to bioaugmentation. In addition to eliminating dangerous contaminants, it can release nutrients as a byproduct, improving the overall health of the water. This process isn't as standard as some of the others, but it is steadily growing.

5. Hybrid Technology

Hybrid systems are among the most efficient modern water filtration techniques. Instead of favouring one aspect of the process over another, more and more

pharmaceutical companies are choosing hybrid membrane-bioaugmentation technology. An increasingly common example of this technology is membrane bioreactors. Water is initially fed via a device known as a bioreactor by membrane bioreactors. Active biological components, such as the bacteria and enzymes present in bioaugmentation, are housed in these containers. Following the bioreactor, water passes through a membrane that removes the bacteria and any lingering pollutants. One of the cleanest water treatment processes is produced by membrane bioreactors. Additionally, these technologies enable chemists to recycle some of the substances that have been taken out of the water. That added benefit makes hybrid solutions some of the most economically viable options for pharma companies.

Improving Wastewater Treatment

The use of water by the pharmaceutical sector can result in significant pollution. However, thanks to constant advancements in water treatment techniques, pharma businesses may use water without damaging the environment. The pharmaceutical business is also economically drawn to these purifying methods. Pharmaceutical businesses can recycle their water, saving money, by carefully cleaning it. The nearly flawless level of purity needed by pharmaceutical procedures can be produced by these contemporary purification techniques. These businesses lessen their water waste by recycling it, thereby preserving the environment. Untreated pharmaceutical wastewater endangers both people and the environment. However, modern treatment techniques make pharma's use of water both economically and environmentally sound.



ABOUT THE AUTHOR

Dr. Pooja is a Microbiologist in Punjab Agricultural University since 2018. She was an INSPIRE National fellowship holder from DST, New Delhi during her PhD and also qualified the ASRB-NET. She was awarded with two Gold medals for her excellence in academics during PhD and M Sc degree. She is currently working on Postharvest management of Horticultural crops along with quality analysis of water, waste water and all types of fresh and processed food products. She is handling researches on Fresh cut fruits and vegetables shelf life extension by the use of disinfection treatments, edible coatings and Modified atmosphere packaging techniques. She is also involved in the use of horticultural wastes for the production of valuable products by fermentation processes. She has published more than 25 publications including research papers, book chapters, review articles and popular articles on various aspects of fermentation, fresh cuts and value added products development.

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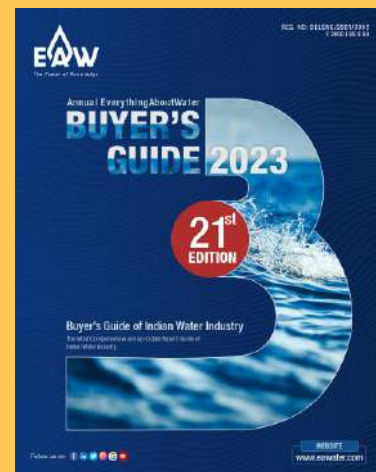
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ULTRASOUND – AN EMERGING SILENT PLAYER IN WATER QUALITY MANAGEMENT

By Sobhan Ghosh, Process Research Consultant, Managing Innovation



Till the last century, we considered water as an abundant resource and the concept of conserving or reuse of water was not much seriously pursued. The situation started changing during the last part of the preceding century. Today, water is considered as one of the most critical inputs in industry and domestic sector. While the purification and treatment for recycle /reuse are in focus, not much attention is given to the loss of water quality parameters, especially with respect to bacteria and biomass/algae growth during storage. These parameters (biomass/algae and microorganisms) are required to be controlled to the levels depending upon the end use of the stored water.

In any water circuit in industry there are two distinct sections where water is stored, namely, the intake reservoir and treated water storage reservoir prior to use. While the quality standard requirement for water in the treated water storage reservoir depends on its end use, the quality requirement of the water delivered from the intake reservoir is similar for almost all applications.

In the subsequent sections we shall briefly discuss the possible changes of water quality during storage and present the capability ultrasound devices to mitigate this problem.

Water Quality Degradation on Storage

Let us first consider an open reservoir which is most common for both intake and treated water storage. An open tank implies that the stored water is exposed to Sunlight during the day. This light energy is consumed by algae for their growth leading to biomass load in the water. As per estimate under Indian condition, about 10 gm/Sq. M /day algae is formed on the water surface. It was observed in Mathura refinery that the biomass content increases by about 10 to 12% during hold up in the intake reservoir before it enters the treatment section. (Ref. Publication by Mathura Refinery, Petrotech, 2011, Delhi).

The consequences are almost similar in case of other open reservoirs such as Fire water reservoir, intermediate or, finished water reservoirs.

The second area of concern is closed holding tanks, where Sunlight is absent. Of course, algae growth is no longer possible here, growth of biofilm and microorganisms are the predominant problem. Biofilm is known to be a menace in water system. The apparently harmless slimy layer which covers the surface of holding tanks for the stored water within two to three days, leads to total blockage of pipelines, pumps, or filtration equipment, if its growth is not prevented. The biofilm formation is extremely complex process. Once the stable slimy base is formed on the available surface of the storage vessel, it provides shelter for the growing bacteria and stores the organic

debris from water to provide the continuous supply of food to the microorganisms. As a result, in a short span of time it grows as a thick layer and occasionally dislodges to interfere with the water flow lines and pumps. In addition, these biofilm deposits induce corrosion.

The third area of concern is cooling tower. Here, the water is continuously exposed to Sunlight and picks up the contaminations from atmosphere to enhance the microorganism load into the circulating water. All the available surfaces of the cooling tower and the sump are highly prone to get biofilm deposits.

Biomass load in the intake pond is usually reduced during treatment using coagulation and settling followed by dosing of chlorine / ozone or, with addition of certain chemicals. Excessive load of biomass or, algae results in high consumption of these chemicals. On the other hand, prevention of biofilm formation and its runaway growth is rather difficult and expensive. The ultimate solution is periodical physical cleaning of the reservoirs, which is expensive, time consuming as well as may involve in temporary discontinuation of water supply from the tank under cleaning. The biofilm control in cooling tower surface and sump is more crucial because it may lead to corrosion in the entire process lines and equipment such as heat exchangers, pumps and filters. Therefore, several chemicals are added to prevent the biofilm growth and a residual chlorine level is maintained in most of the large industrial cooling water circuit.

Ultrasound Systems in controlling Algae and Biofilm

Since long time it was known that ultrasound can destroy microorganisms and algae in water. However, there was no widespread use of ultrasound technology due to its high energy demand and technical feasibility for large scale applications. Since last few years this chemical free ecofriendly solution is gaining attention due to the simplicity of application, long service life with low maintenance.

The ultrasound devices work in two distinctly different basic principles for algae and biofilm control. The first one is a high-power system where cavitation is the main driving force, and it effectively destroys algae and microorganisms. These ultrasound systems are characterized by high investment and energy demand. Typically, these devices are installed in the flowing water lines like the hydrodynamic cavitation systems. The ultrasound systems require less maintenance and consume lower energy than that of the hydrodynamic cavitation systems. Due to these advantages the usage of high power devices are slowly growing.

The working principle of the second type ultrasound devices is entirely different from the previous high-power devices. These are much simpler devices with exceptionally low power consumption.

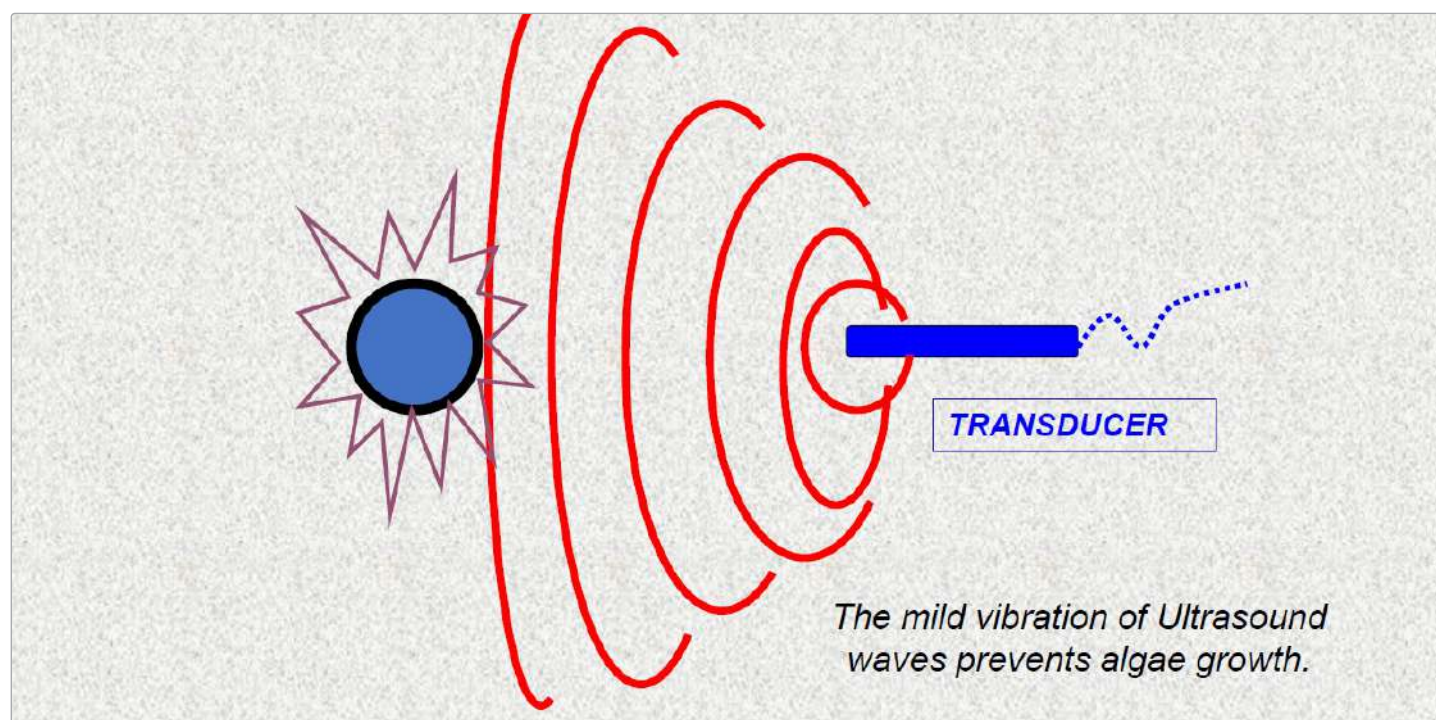


Fig. 1 Ultrasound Device

The delivered power level is much below the cavitation threshold. While the high-power cavitating devices destroy the algae and microorganisms, these low power devices prevent the growth itself for both algae and microorganisms and unlike the high-powered systems, these devices are typically installed in the stationary water bodies. The continuous mild vibration generated by the ultrasound system reduces the colonies of algae thereby interferes with their reproductive system and prevents the deposit of biofilm on the surface. Due to the simplicity of installation, low investment, power consumption, maintenance cost and long service life, there is a

phenomenal growth for these low power devices, in recent times.

In next section we shall discuss few recent reports for effective application of low power ultrasound systems for water quality control.

Low Power Ultrasound Devices for Water Treatment

Simplified sketches of the working principle of ultrasound device and its installation as shown in Fig. 1 & 2:

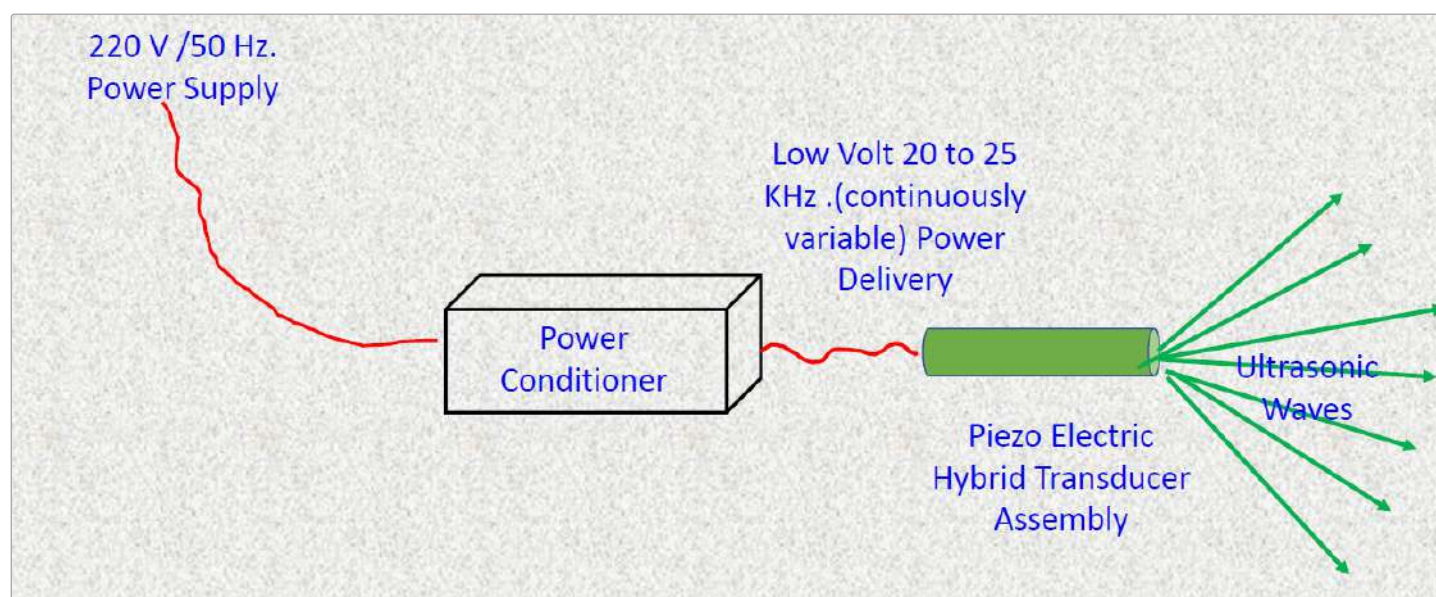


Fig. 2: installation of Ultrasound System

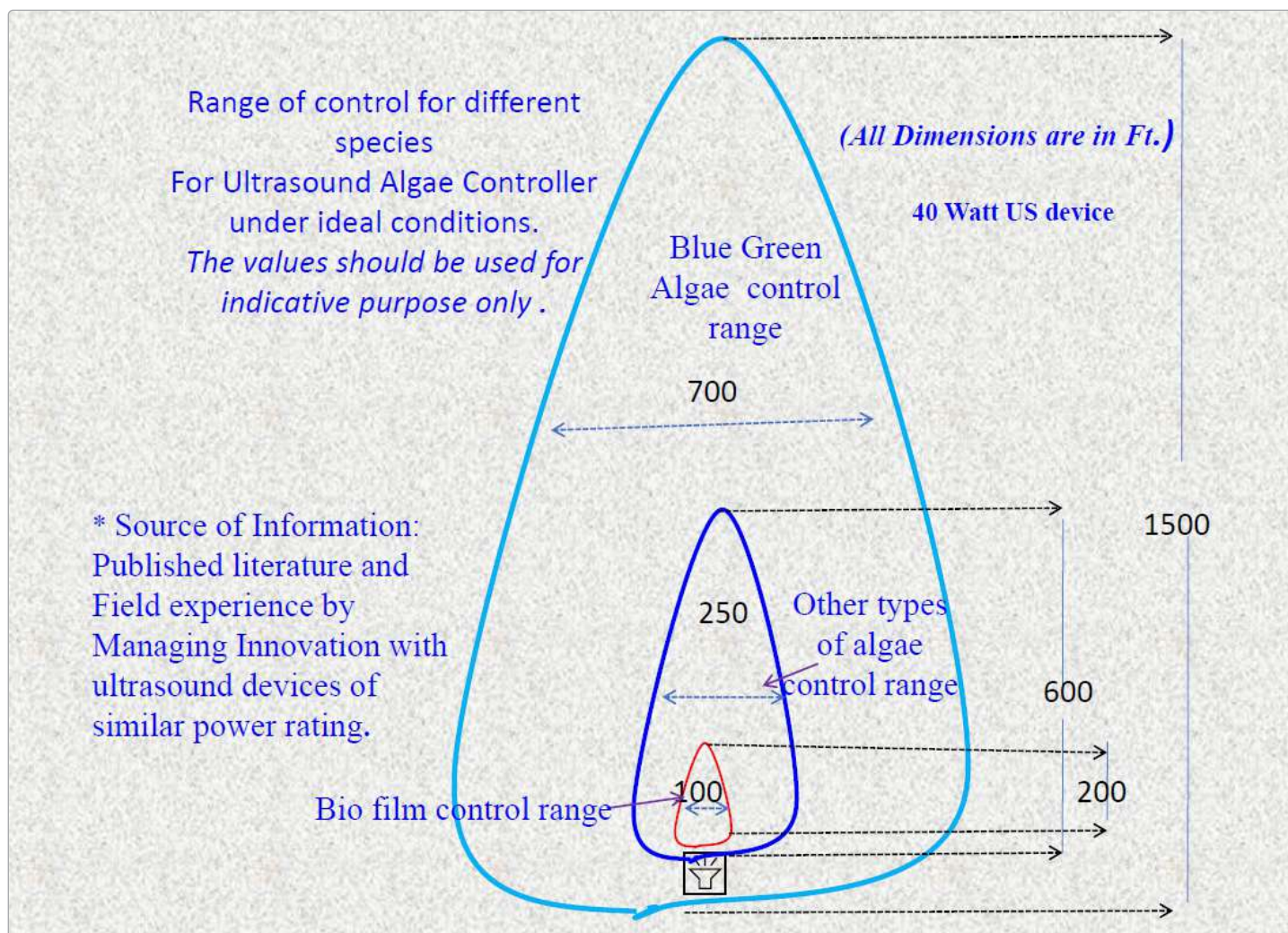


Fig. 3: Effective Range of Ultrasound System to control Algae and Biofilm in water.

The transducer is made of piezo electric crystals which are embodied in epoxy resin and encased in a Stainless-Steel shell. It is fully waterproof and only two wires come out of the transducer. The Power conditioner generates variable frequency low voltage AC, matching with the frequency of the piezo electric crystals and delivers to the transducer. Recent systems are fitted with the transducers containing multiple piezo crystals of different frequencies and the power conditioner also continuously supply the current of the matching frequencies to increase the power efficiency. However, there are many ultrasound devices for algae and biofilm control in the market which are fitted with single frequency piezo transducer, which are not very useful for the purpose it is intended to.

The coverage of ultrasound systems depends upon its power delivery. Since the attenuation of sound waves are very low in aqueous medium, with a surprisingly low

power system can cover a very large area to prevent the growth of algae. However, for controlling the biofilm deposits this range is much lower. In Fig. 3, a simplified sketch of the useful range of an ultrasound system delivering about 20-Watt average continuous power is shown. The sketch shows the approximate effective area under ideal condition. There could be significant reduction due to turbulence, obstacles etc. It could be noted that for biofilms the estimated area is much lower than that of the blue green algae.

Field Experiences in Indian Refineries

In Table 1 we have tried to summarize the findings of different Indian refineries with low power ultrasound systems. In all these cases the average power rating of the ultrasound devices were about 20 watt and the number of units deployed were

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Table 1: Trials in India with Ultrasound Systems

Sr. No	Parameter / Conditions For trial	Performance evaluation and observation	Source of Information	Reference
1.	Mathura Refinery raw water reservoir, 50*25 Sq.M	a. Fresh Growth of OM reduced from 12 to 4% b. Overall OM growth reduction 40% c. Thick greenish layer of algae on the wall surface removed. d. HCL, caustic and chlorine consumption was reduced significantly	Trial was carried out during 2009-10	Poster by Mathura Refinery, Refining Technology Conference, 2011, New Delhi
2.	Panipat refinery Cooling Tower Sump - 7 * 30 Sq.M	a. About 60% reduction in monthly chlorine consumption b. Sump surface was clean and free from biofilm deposit.	Trial was carried out during 2010.	Publication by Panipat Refinery in Everything about Water, Sept 2010 and Petrofed Journal, April -June, 2010
3.	Gujarat Refinery Eco Park - 50*110 Sq.M	Reduction of turbidity due to algae from 110 NTU by about 50% within one month	Trial carried out during 2010	From personal communication
4.	BRPL Clear Water Pond in Refinery, two units: 130*80 Sq.M & 80*60 Sq.M	Within one month, there was significant visible reduction in floating algae in both these sections	Trial was carried out by BRPL during 2011 Feb and June	Publication in Everything about Water, Nov. 2012
5.	BORL Fire water reservoir of uneven shape, approximately 150*160 Sq. M. The results were compared with another similar reservoir of comparable size here no Ultrasound system was installed	1. Turbidity: NTU 2.5 vs.11.2 (77% reduction) 2. Organic Matter: 8.4 % lower 3. Visible algae- 90% surface was free from algae Other observations: a. Low chemical consumption c. Less biofilm deposition on pumps, pipes, and nozzles d. Less shutdown for cleaning of strainer, nozzle e. Lower maintenance of Reservoir due to less deposition	Trial was carried out by BORL during 2017	Publication by BORL in Refining Technology conference, Bhubaneswar, 2018

depending upon the size of the water reservoir. It could be seen that, there was significant improvement in the quality of stored water in all the cases.

Emerging Areas for Use of Ultrasound Devices in Water Quality Management

Low power ultrasound systems for algae control started appearing in the market around the beginning of this century. However, the widespread use started in the last decade only. With increasingly systematic reports of large-scale field trials in several parts of the world it has proven its simplicity and cost effectiveness. While in the initial phase the use was mainly restricted to reduce growth of algae, very soon it was realized that these systems are very effective in biofilm control. Today, this is the main area where the usage is increasing rapidly.

The emerging areas of applications are:

- Fresh water storage for horticulture and poultry to reduce bacterial growth during storage. It is also useful in preventing deterioration of quality of poultry waste while awaiting treatment before discharge or, reuse.
- In aquaculture to keep the bacterial load under control and reduction of water consumption with higher recycle ratio.
- Food processing is another important application since all the contact surfaces are very much prone to biofilm contamination and addition of chemicals to control the biofilm growth is not desirable.

- One of the most interesting applications is in the bed filters where dirty water is filtered. Here frequent clogging of the filter due to excess growth of biofilm on the bed is the main problem. Ultrasound device mounted close to the filter bed emitting airborne ultrasonic waves, help prevention of biofilm formation on the filter bed and frequent clogging of the filter bed.
- Municipal water supply network is another fast-growing area. Usually, the biofilm growth in the main pure water storage and the supply lines is prevented by adding chlorine. Now a days low power ultrasound systems are installed in the main pure water supply tank to reduce the chlorine dosing level. Also, the reduced chlorine smell is welcomed by the users.

In fact, there could be many other areas where these devices could be used with great benefits. While algae control application is well established, the biofilm control area is much more diverse and having very high potential.

Summary and Conclusion

The high power ultrasound cavitation devices are able to control algae and biofilm growth in water very efficiently, without leaving any chemical residue. These devices are competing favorably with the hydrodynamic cavitation. Typically, both the ultrasound and hydrodynamic cavitation devices are mounted on the moving water line. On the other hand, the low power ultrasound systems are suitable for use in stored water only, where the turbulence is minimum. While the high-power systems

kill both the microorganisms and algae the low power devices only prevent their growth. Both devices are environment friendly, low investment, operating and maintenance cost.

As all the new technologies face entry barriers, the low power ultrasound systems also had to face challenges to be widely accepted by the industry. Issues of water quality control is traditionally handled very effectively by using different chemicals. Therefore, it is generally difficult for the users to perceive the capability of such a physical method to perform the task. However, today there are many similar products in the market and results of innumerable studies are available in open

literature. Industry acceptability has increased significantly.

One needs to be careful in selection of the rated power of the system depending upon the intended application and the area it is proposed to control. Moreover, care should be taken while installation of the transducer in the water body so that it is away from turbulent area and there are no obstructions for the waves to propagate. A failure to select the right device power or improper installation strategy may lead to disappointment. It is expected that within few years, many new applications of these low power ultrasound devices will be reported.

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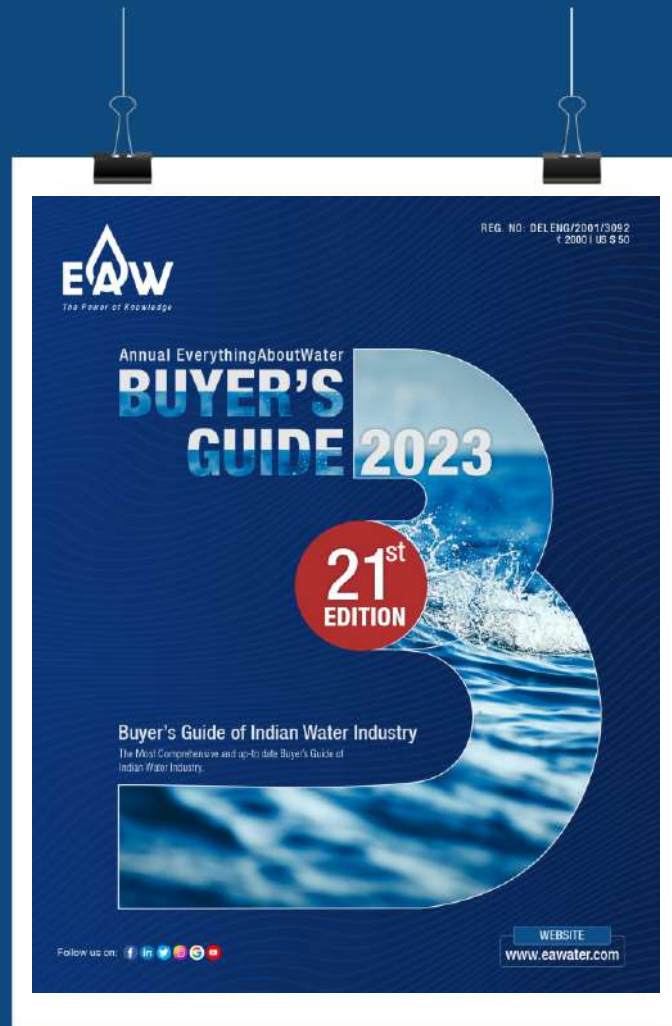
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HOW INDUSTRIAL WASTEWATER MANAGEMENT CAN HELP OVERCOME CLIMATE CHANGE?

By Mangesh Dashrath, Founder, Envicare



Untreated wastewater has been increasing at an alarming rate globally. India integrally needs to take actionable decisions to make the developing country a frontrunner in arresting climate change. Let's understand how industrial wastewater impacts the environment and that its effective treatment and management will help restore sustainability

Wastewater has been increasing at an alarming rate and its direct release in natural water sources like rivers, lakes, etc. has been impacting mankind and the flora and fauna gravely. While domestic wastewater has already been deteriorating the quality of water globally, industrial wastewater has been doing it at scale making several natural waterbodies a breeding ground for diseases and also drying them up leading to droughts and dry spells in various regions. This state of shock of the waterbodies leads to climate change and irregularities are seen as we experience heat waves during summers and monsoons extending for longer durations than earlier. We all know the famous tale of the Mithi River of Mumbai – once a river, now labelled as nothing but a 'sewer'. Our mere negligence even led the natural storm drainage system to the flooding of the coastally low-lying business capital of the country - Mumbai back in 2005. As the river's bank is flanked by illegal domestic as well as industrial establishments, a staggering 1500+ industries dump their wastewater directly into the Mithi river which includes solid waste like plastics and metals and soluble chemical waste like cement, concrete, detergent, etc. It is so gravely polluted that its water has been declared by the governing bodies as unfit to drink and also said that the junction where the river meets the Arabian Sea cannot support aquatic life.

This is just one example that showcases how we are sitting on a ticking bomb of unsustainable practices that can go off at any time leading to the raging fury of the environment. We can already witness the climate changes that man-made actions have brought. Excessive pollutants in the air, Greenhouse gases being dumped in the air and through water bodies have led to the depletion of the Ozone layer that paved way for UV harm to living beings. Moreover, acute changes like the drying up of rivers are regarded as seismically active zones and are prone to earthquakes. There are many more alarming changes that our negligent actions are bringing in the key resource that supports life, i.e. water. It all boils down to us taking mindful water recycling measures to make the usage of water sustainable and gradually arrest the undesired climate change and the subsequent adverse effects on mankind and other living beings.

Why do Industries need to treat their wastewater?

Let's consider the Indian picture at large. Being a developing country, India is witnessing rapid industrial development across its length and breadth. Moreover, ours is also an agrarian country with a majority of water-intensive cash crops like rice and sugarcane, etc. Both require a humungous amount of water which will not be

available through existing fresh sources of water. Industries will need to treat their water to reuse it and likewise, leftover wastewater from agriculture needs to be managed and properly post the harvest to be reused for agri-use. So, to understand the larger picture, wastewater treatment by industries helps the water stress and imbalance between water demand from industries and domestic users and also leads to benefits for the economy of the country at large.

How does industrial wastewater management contribute to arresting climate change?

Let's zoom into the dynamics to know it better. Suppose a thermal plant uses water for its industrial needs and dumps its untreated wastewater into a nearby natural waterbody that supports aquatic life that the nearby neighbourhood cities depend on for their seafood requirements. The excessive dumping of polluted wastewater will gradually impact the marine life in the water body and lead to its depletion. This will lead to decreased freshwater seafood supply to the cities leading them to depend on the supply of the fish coming from a neighbourhood city or importing from a neighbouring country altogether. This logistical support is mostly supported by waterways-laden boats and ships which again directly pollute the water. Also, the transportation cost gets incurred by the end user leading to a crunch of capital.

Also, let's understand that the same waterbody supported the water supply to the housing societies in the vicinity. The increased dumping of wastewater by the thermal plant will make it unfit for drinking purposes. Hence, a crunch in water led to a fiasco that supports several households. This will lead to the dependence of the tenants to rely on water tankers coming from a neighbourhood and hence the stress on one freshwater body leading to its drying sooner. And we already saw above how dry water bodies lead to climate change and the adverse environmental impact.

Hence, the need for industrial wastewater management is crucial that not only decreases the burden on the economy but also supports the environment to function at equilibrium.

What are the results that we can measure with industrial wastewater management?

With a range of wastewater treatment products that help segregate both organic as well as inorganic wastewater coming from industries, the burden on natural sources water can be brought down exponentially. The sustainable dependence of industries on recycled water will reduce the burden of depending on new sources of water and hence reduce their procurement cost for water. This way their bottom line can be guarded and keep them self-sufficed for long. Agriculture and agri-based manufacturing companies too can use the treated wastewater for various diverse purposes that

will reduce their dependence on water supply otherwise used to suffice domestic needs.

Summing them up, treated water, even if released into the water bodies, will have

permissible levels of pollutants that might not impact aquatic life or the needs of human beings for domestic purposes. This will hence restore the natural form of waterbodies at scale and make the globe a sustainable planet with minimal climate change in the long run.

ABOUT THE AUTHOR

Mangesh Surve is a Chemical Engineer and has been leading ENVICARE for the last 22 years as its MD. With corporate offices in Pune, Dubai & Malaysia, he uses his knowledge to navigate the company in various related offerings. The innumerable awards in his kitty speak for his work. Envicare's team of committed engineers, managers, consultants & technicians are sought-after in India & internationally for their resourcefully sustainable technological & after-sales know-how. Their devoted R&D laboratory, AQUA Laboratories, runs actively on the ISO guidelines for water, wastewater & effluent testing.

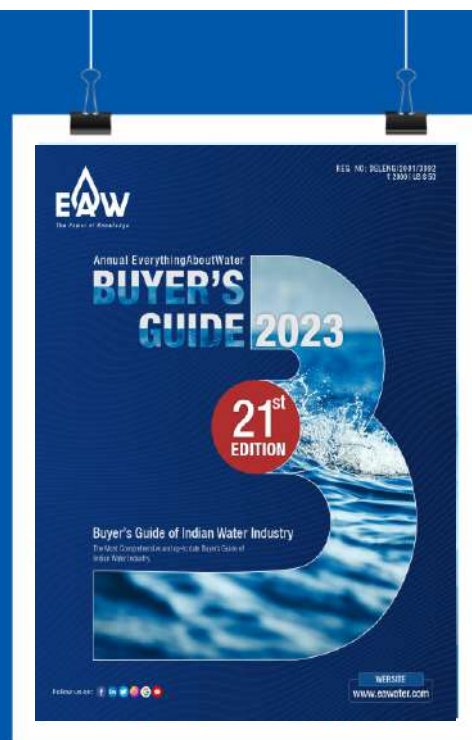
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ROLE OF CHEMICAL AND FERTILIZER INDUSTRIES IN WATER CONTAMINATION

By Dr. Anil Kumar Mishra, Bacteriologist, Quality Control Laboratory, Delhi Jal Board, Govt. of NCT Delhi.



Water is central hub for all type of economies (agriculture, industries etc.), required for sustaining life on earth and other activities. Without water, we cannot get anything like food, oxygen, shelter etc. It is also playing important role in climate change/ maintaining environment. In the view of above facts, various agencies like Government, NGOs, regulatory organizations, public and other stakeholder making their best efforts to manage it in useful manners, so that sufficient quantity of good quality of water (potable and wholesome) may be available for everything like plants, animals and others activities like agriculture and other industries. In present scenario, Ground as well as surface water pollution is a serious issue and this problem must be sorted out for the survival of life on earth. The government and other organizations should take due care to prevent excessive groundwater extraction, nitrogen, Phosphorus and other chemical contaminants pollution in surface water bodies (river, lakes, ponds etc.), caused by chemical fertilizer and other industries, runoff water from agriculture land or from other sources.

Due to urbanization and industrialization, quality and quantity of fresh water reducing drastically in India as well as in other countries. Farmers using sewage water (untreated/partially treated) for irrigation of herbaceous vegetables, fruits, and other crops and these practices are drastically increasing day by day due to scarcity of water, urbanization and its economic and agronomic importance. This water is easily available in metropolitan cities and having sufficient amount of Macronutrients (Ca, N, P, Mg, K etc.) and Micronutrients (Cu, Zn, Mo etc) which are required for the proper growth of the plants but in the other side this sewage water also contains pesticides, heavy metals (Hg, Pb, As etc), microorganisms, organic and inorganic pollutants which are very harmful for human, plants and other animals; As through plants food chain, these pathogens and organic/inorganic contaminants reaching in our metabolic pathways and its concentration increasing day by day in our body or in other plants and animals due to biomagnifications of pesticides and other toxic metals.

Now a days, farmers are using different type of chemicals (pesticides, insecticides, plant hormone and other growth regulators) and fertilizers for increasing crop production and to control attack/infection by different type of insects, pests and other microbes. Now, the requirement of these chemical fertilizers and other chemicals increasing day by day in agriculture sector, for getting more crop production, for the fulfillment of the requirement of growing population, which is increasing day by day due to various reasons. For the fulfillment of required demand of different type of fertilizers like Urea, DAP, Superphosphate, insecticides, pesticides, plant growth regulators and other chemicals, many new industries are establishing by Govt. and other agencies. These fertilizer and chemical industries/plants using huge quantity of water for production and other purposes (water foot print) and further waste water of these industries (chemically mixed industrial effluents) mixing into (untreated/ partially treated/ rarely properly treated)

different type of drains, lake, ponds, rivers and other water bodies. This waste water contains higher concentration of Nitrogen, Phosphorus, pesticides, antibiotics and other chemical contaminants which deteriorate the water quality (surface and ground water) as well as causing soil and air pollution also. Due to severity of such type of contamination, process related industries, Govt. and consumers think about it and adopt alternate resources and technologies to reduce it (by using manure, bio-fertilizers, bio-pesticides and other practices as a alternate of chemical fertilizers and pesticides). This contaminated water also reaching into aquifers by percolation; resulting, the concentration of these chemical contaminants also increasing in ground water day by day. Due to excess concentration of these chemicals, pesticides in water bodies, the concentration of chemicals also increasing in animals (like fishes, crustaceans etc), plants (water hyacinths, algae etc.) which are growing on it. Due to excess concentration of nitrogen and phosphorus in water bodies, water hyacinth and other algal growth (algal bloom) increasing by the process of Eutrophication.

In present scenario, farmers are using urea in different type of crops in large scale as a fertilizer and its level (constituents) reaching at alarming stage in surface and ground water sources and this level of nitrogenous compounds drastically affecting the environment and human health. The maximum surrounding areas of fertilizer, pesticide and other such type of chemical industries, ground water contains excess quantity of nitrogen, phosphorus and other chemical contaminants. These fertilizers emitting Carbon di Oxide, Nitrous Oxide and other nitrogenous compounds in environment which creates air pollution also. Due to production of these gases in excessive quantity, soil also becoming acidic; resulting pH of soils changing and crop production also reducing drastically. Due to acidic pH useful micro flora (microorganisms/insects/other animals) of that field also affecting, which are playing pivotal role for maintaining texture of soil, naturally synthesis of nitrogen and other nutrients required for normal growth of crops, prevent different type of pests/insects (which are affecting crops production) etc.

Eutrophication is a process in which excessive growth of water plants observed (water bodies having excess quantity of chemical contaminants like Nitrogen, Phosphorus and other organic and inorganic contaminants). These nutrients induce for the growth of water hyacinths, and other microalgae (algal bloom) in uncontrolled condition, resulting the water quality deteriorated due to depletion of oxygen, lack of penetration of sun light (required for photosynthesis) into bottom or due to some other reasons. For Eutrophication, Nitrogen and phosphorus are acting as major limiting factors. Eutrophication shows negative impact on water quality, which ultimately affects the usability by human, plants, animals industrial purpose etc. Sometimes, the dead algal blooms and water hyacinths settled in the bottom of water bodies and after anaerobic digestions releasing green houses gases (CO₂, Methane etc.) which are affecting environment. Due to lack of sufficient oxygen, fishes and

other invertebrates die and food chain and food web of not only that water body disturbed, even the ecosystem of surrounding areas also affected drastically.

Type of Eutrophication: On the basis of nature/mode of increasing the concentration of Nitrogen, Phosphorus and other chemical contaminants, two type of Eutrophication occurs in water bodies. These are:

A. Natural Eutrophication: In this type of Eutrophication, Phosphorus, Nitrogen and other inorganic and organic contaminants reaching into water bodies through natural process like degradation of minerals, growth of normal algae, fungi, mosses and other reasons. This is very slow process and not affecting water bodies and its ecosystem drastically.

B. Anthropogenic or Cultural Eutrophication: In this type of Eutrophication, Nitrogen, Phosphorus and other organic and inorganic contaminants/ nutrients reaching into water bodies due to various human activities like mixing of untreated/ partially treated waste water (industrial and household), mixing of fertilizers, insecticides, pesticides containing water directly into water bodies, run-off water of roads and other areas and other such type of activities. In present scenario, this is the major and most common cause of water contamination and Eutrophication in water bodies.

Effects of fertilizers and chemicals in Plants and animals:

Different types of chemicals are reaching in human body, plant, animals etc. through food chain, food webs or other sources. These chemical contaminants affecting our metabolic system like nervous system, digestive system, circulatory system, endocrine system, skeleton system, muscular system etc. Due to excess quantity of heavy metals or other organic and inorganic contaminants, Growth retardation, kidney stone, cancer, joints pain, Immunological and hormonal disorders etc. observed in human being, different type of developmental and metabolic aberrations in plants and other animals. Excess concentration of nitrate causes Blue baby syndrome in human being.

Methods, which mitigates the pollution caused by Chemicals (insecticides, pesticides and fertilizers etc.) in water:

For controlling pollution (caused by organic and inorganic contaminants) in surface water or mitigation of these organic and inorganic contaminants, many methods/ technologies/ practices are available. Some important methods/ practices are as underneath:

A. Use of Bio-fertilizers: Now a days, Bio-fertilizers are boon for different type of crops; as these fertilizers are increasing crop production without any negative impact on soil and its natural habitants like microorganisms, insects etc. These are also helpful for maintaining soil texture like pH, moisture etc. Different type of biological agents like microalgae and other plant or its parts are applied as bio-fertilizers in different type of crops in different forms.

B. Use of Manure: Manure (green or other manures) are very useful substitute of chemical fertilizers. These manures replenish N, P, K and other macro and micro-nutrients into soil without any side effects, maintaining good health of soil (soil texture). These are also known as organic fertilizers. They release nutrients more slowly. Manures may be prepared in garden by using cow dung, algal biomass with green plant waste (leaves, grass, husks, etc.).

C. Use of Bio-pesticides: Now a days, farmers are using chemical pesticides,

insecticides (except some farmers), which creates different type of pollution like water, soil, air etc. If we use different type of biological agents or genetically modified crops (resistant for different type of insects, pests and other microbes), then without the use of chemical pesticides crop production may increase manifold.

D. Proper management of use of chemical fertilizers: If we apply chemical fertilizers in very less quantity, right time, right place and right method then its side effects may be reduced upto maximum extent. Many plants not require more fertilizer, as often as we apply or apply it at the wrong time; it may easily wash off into water bodies and the concentration of chemical contaminants increased in surface water sources, which results Eutrophication and water quality deterioration.

E. Crop rotation: Crop rotation (means sowing different type of crops in different seasons) is an important practice for restoring the macro and micro nutrients into soil. As different type of crops requires, different type of nutrients and some crops also synthesizing some important nutrients by different natural mechanisms like thundering, symbiosis in leguminous crops etc. So, if we rotate crops in land then the nutritional value of soil retained naturally and without the use of chemical fertilizers, we may increase the productivity of crops.

F. Adopt mixed cropping: It is also an important practice for retaining the nutritional value of soil, if we use different type of crops in same land in same season then one crop utilize one nutrient then another crop release it and utilized by another crops, By adopting this practice, we may increase crop productivity without adding much more chemical fertilizers.

G. Up-gradation of waste water treatment technologies: In India and worldwide, many treatment technologies are available for proper treatment of waste water (contaminated water) but they are not working properly due to various reasons; resulting the higher concentration of Nitrogen, phosphorus and other organic and inorganic contaminants reaching into water bodies and affecting the ecosystem of that water body. Many microalgae species may grow efficiently in different type of wastewater and help in removal of macro-nutrients, micro-nutrients and other chemical contaminants. Nitrogen and Phosphorus can be removed by rapidly growing cultures of algae; as these macronutrients directly utilized by microalgae for their metabolism and converted into valuable algal biomass and this biomass may be utilized as bio-fuel, feedstock, bio-fertilizer etc. The main mechanism to remove these pollutants includes accumulating and/or using them in their metabolism.

H. Soil testing and modeling: Soil testing and its modeling is an important tool for avoid, use of excess quantity of chemical fertilizers in the field. If we test different parameters of soil like pH, moisture content, N, P, K etc. then we may decide/ optimize the quantity and nature of manure/ fertilizer, required in particular field for getting proper production of crops.

I. Adopt Phyto/bio-remediation technology: Since ancient time, Bio-remediation or phyto-remediation is an important practice for naturally cleaning of water bodies. Phyto-remediation is a technique in which, plants reducing different type of pollutants by using those pollutants as a source of nutrition for performing their different type of metabolic activities or other modes. Aquatic plants like microalgae, water hyacinths, Typha, Eichornia, Azolla, Lemna, Wolfia etc. have ability to grow in polluted water (higher concentration of various organic and inorganic pollutants present in water).

J. Geo-engineering: It is also an important technique for reduction of phosphorus and other chemical contaminants in different water bodies. In this technique, some chemical compounds are being used for absorption of phosphorus and other such

type of chemical contaminants.

In conclusion, we may conclude that water contamination (surface and ground water) caused by fertilizers, pesticides and other organic and inorganic contaminants are challenge for natural resources like water, air, soil etc. and required to address these problems by all the stakeholders like industrialist, farmers, Govt. and non- Govt. organizations etc. For mitigation of such type of contamination, we should make serious efforts, to reduce water footprint using in agriculture and other industries,

adopt rainwater harvesting in industrial premises and other places to recharge groundwater and neutralize the chemically contaminated water, establish effluent treatment plants (required to run as per national and national norms), use bio-fertilizers, manure and bio-pesticides instead of chemical fertilizers, and pesticides, incentives may be given to those farmers, industries and other stakeholders, who have adopted and promoted different type of advanced and sophisticated technologies/ practices required to mitigate such type of contamination in different type of natural resources like water, soil, air etc.



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Dr. Anil Kumar Mishra is presently working as Bacteriologist in Delhi Jal Board, Govt. of NCT Delhi, since August 2007. He has qualified CSIR-UGC (NET) June 2002 for Lecturer-ship and ICAR (NET) 2004 and 2006 for Lecturer-ship. He also qualified UNERA fellowship of Australia government for advance studies in January and June 2006. He secured IInd level prize in senior level comprehension certificate test on Right to Information Act-2005 in the year 2011 conducted by Govt. of NCT Delhi.

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PE PIPES: A VERSATILE APPS BECAUSE OF 'ELITE PROPERTIES' (WATER SUPPLY, WASTE WATER, HVAC)

By Dilip Yewalekar and Manisha Kinge, Jain Irrigation



Introduction

Since its discovery, PE has grown to become one of the worlds most widely used and recognized thermoplastic materials because of its high level of stronger molecular bonds & compatible engineering properties and is most suitable to replace aging Concrete or PVC, or Metal piping systems. Being flexible (not rigid), it is used & popular to transfer water, oil, chemicals, gas, and various applications such as city & rural water supply, Sewer as well as ducts for optic fiber cables, electrical cables, fire systems, storm water, the drainage system in the globe. In this article, distinct properties PE have been elaborated on and made then used for various applications from agriculture-irrigation, water supply, wastewater, and HVAC to space. PE also meets safety & health, environmental, and food grade norms, so it is widely used in the pharmaceutical, food, marine, aerospace, biotechnology, nuclear power, and arms industries.

Mechanical Properties

1. Poisson's Ratio

Any stretching or compressing of a test specimen in one direction, due to uniaxial force (below the yield point) produces an adjustment in the dimensions at right angles to the force. A tensile force in the axial direction causes a small contraction in the lateral direction. The ratio of the decrease in lateral strain to the increase in axial strain is called Poisson's ratio (). Poisson's Ratio for ambient temperature for all PE pipe materials is approximately 0.45 in tension & compression condition.

2. Impact Strength

The concept of impact strength covers at least two important properties:

- i. The magnitude of a suddenly applied energy that causes the initiation and propagation of a crack.
- ii. This is usually assessed by the results of tests on un-notched or, bluntly notched specimens.

PE is recognized for its very high resistance to crack initiation under very rapid loading.

3. Abrasion Resistance

PE pipes are preferable for the transport of granular or slurry solutions, such as sand, fly ash, and coal. The advantage of polyethylene in these applications is its wear resistance, which for example when conveying fine grain slurries has been shown in laboratory tests to be three to five times greater than for steel pipe. Silica-coated PE pipes have more advantages for the smooth transport of fluids because of greater resistance to abrasion.

4. Thermal Coefficient of Expansion/Contraction

An increase/decrease in temperature results in an increment /decrement of the length of pipes that are unconstrained. Both these

effects must be given adequate consideration for the proper installation, design, and operation of the PE piping system.

5. Thermal Conductivity

The thermal conductivity of PE materials is very poor and is around 1/100th that of steel or copper.

6. Flexural Modulus

The flexural modulus is determined at the point when the strain in the outer fiber reaches a value of 2%. The modulus is the ratio of the stress in the outer fiber that results in the 2% strain.

7. Tensile Strength at Yield

PE exhibits a yield point in the tensile test prior to this point the slope of its stress/strain curve decreases with increased strain. And, prior to yielding there is somewhat less than full reversibility in the strain that results from a certain stress.

8. Electrical Properties

Being a poor conductor, PE is a very good electrical insulator and is used as such in wiring and in many other electrical applications

9. Chemical Resistance

PE, being a poor conductor of electricity, is immune to electrolytic corrosion such as can be caused by salts, acids and alkalis. However, strong oxidizing agents can attack the PE molecule directly and lead to a gradual deterioration of properties. Certain organic chemicals can be gradually absorbed by PE, through a process called solvation, causing some swelling, softening and a decrease in long-term strength that largely depends on the chemical configuration of the organic material, but is also affected by, other operating variables.

10. Permeability

The property of permeability refers to the passage of a substance from one side to the other side of a membrane. Polyethylene has very low permeability to water or fluid.

11. Weather-ability

All polymers (resins) are susceptible to gradual degradation when continually exposed to ultraviolet (UV) radiation in sunlight. There are two effective means for protecting a resin against this effect. One is the addition of a screen that blocks the penetration of UV rays into the material. The other is by the inclusion of a stabilizer that protects the material by chemical means.

For PE piping materials it has been shown that the most effective screen is achieved by the incorporation into the material of 2 to 3 % of finely divided carbon black, which also results in black color. Experience and studies show that in outdoor applications such material will retain its original performance properties for periods longer than 50 years.

12. Biological Resistance

Biological attack can be described as degradation caused by the action of microorganisms such as bacteria and fungi. Virtually all plastics are resistant to this type of attack. Once installed, polyethylene pipe will not be affected by microorganisms, such as those found in normal sewer and water systems. PE is not a nutrient medium for bacteria, fungi, spores, etc.

13. Toxicological Health and Safety Concerns

a. Health

The Food & Drugs Administration issues the standards and requirements of PE materials for Food, Health & Safety, Recycling, and Environmental safety. PE materials do comply with the given regulations. Potable water piping materials, fittings, and pipes are currently tested according to the standards developed by the National Sanitation Foundation (NSF).

b. Static Charge

Since plastics are good insulators, they also tend to accumulate a static charge. PE pipe can acquire a static charge through friction. Sources of friction can be simply the handling of the pipes during storage, shipping, or installation. Friction can also result from the flow of gas that contains dust or scale or from the pneumatic transport of dry materials. These charges can be a safety hazard if there is a possibility of a combustible leaking gas or of an explosive atmosphere. A static charge in PE piping will remain in place until a grounding device discharges it. A ground wire will only discharge the static charge from its point of contact.

c. Flammability

After continuous contact with a flame, PE will ignite unless it contains a flame retardant stabilizer.

d. Combustion Toxicity

The combustion of organic materials, such as wood, rubber, and plastics, can release toxic gases. The nature and amount of these gases depend upon the conditions of combustion.

Polyethylene does not give off any corrosive gases such as hydrochloric acid, since it does not contain any chlorine in its polymer structure.

14. Engineering Properties

Property	Value	Units
Density	940-965	Kg/m ³
Melt flow index (1900C)	0.2 – 1.1	9/10 minutes
Crystalline melting Range	130-133	°C
Viscosity Number	390	cm ³ /g
Hardness	56-65	Shore 'D'
Tensile Strength at yield	20-26	Mpa
Ultimate Tensile Strength	30	Mpa
Elongation at break	>600	%
Elastic modulus	800 - 1200	Mpa
Flexure Stress	13.8 – 20.3	Mpa
Carbon black content	2- 3	%

Why to choose Polyethylene pipes in place of MS, DI, CI & Concrete Pipes?

Polyethylene (PE) piping system offers significant advantages over the conventional piping system. i.e. MS, DI, CI & Concrete Pipes. Its major advantages are listed as under.

1. Longevity

PE pipes have a long track record of excellent performance, approaching 100 years.

2. Corrosion Resistance

PE is basically chemically inert. It does not rust and corrode like metal pipes.

3. Leak Tight

Butt-fused joints create homogenous watertight jointing for the pipe system. Unlike-type joints or other mechanical jointing systems existing in the conventional system, there is no risk of leakages resulting from joint distortion due to soil settlement or the corrosion effect of conveyed water or the soil in which it is buried.

4. Optimum flow rate

Smooth inside pipe surface allows for a high friction coefficient 'C' factor and it remains constant throughout the lifetime of the PE piping system due to innate resistance to scaling and biological build-up.

5. Excellent water hammer characteristics

The inherent properties of polyethylene allow the system to significantly lower the effect of surges due to water hammer when compared with any other rigid pipe materials of construction.

6. Flexibility

Small diameter PE pipes can be coiled and supplied up to 2000 m in length. This helps to contribute to saving in the cost of laying, jointing and accessories during the installation process.

7. Resistance to geological conditions

PE systems have an inherent resistance to ground temperature fluctuations and earth instability because of high impact and breakage resistance.

8. Seismic Resistance

The toughness, ductility, and flexibility of PE pipe combined with its other special properties such as its leak-free fully restrained heat-fused joints, make it well-suited for installation in dynamic soil environments and in areas prone to earthquakes.

9. Abrasion Resistance

PE pipe is a frequent choice for the transport of granular or slurry solutions such as sand, fly ash, and coal. The advantage of polyethylene in these applications is its wear resistance which for example when conveying fine grain slurries has been shown in laboratory tests to be three to five times greater than for steel pipe. PE Pipe has elastic properties that under proper flow conditions allow particles to bounce off its surface. This feature combined with PE's toughness results in a service life that exceeds that of many metal piping materials.

10. High Strain

High strain-ability under stress virtually eliminates failure due to the freezing of conveyed water during extremely cold weather conditions.

FAQs – Frequently Asked Questions about PE pipes.

What HDPE stands for?

High-Density Polyethylene. It comes under the family of polyethylene and is derived from crude oil (petroleum). There are different types of polyethylene for various applications Low-Density (LDPE), Medium-Density Polyethylene (MDPE), High-Density Polyethylene (HDPE).

What are the different applications of Pipes?

HDPE pipes are used for different application as potable water supply, sewerage water, slurry conveyance, mining and dredging pipes, sub soil drainage, chemical conveyance, ETP/STP, lift/gravity, seawater intake outfall, gas distribution, electrical cable, ducting, optical fiber cable conduit, underground fire hydrant network, air conditioning ducting-ventilation, etc.

Is the HDPE piping system a green solution for piping?

The manufacturing process of PE pipes is environment-friendly and does not emit CO/CO₂/CO₃.

How are HDPE Pipes joined to uPVC, MS, DI or CI pipes?

The method of, joining HDPE pipes to uPVC, MS, DI, and CI pipes varies with the size and ends of pipes. Commonly the method is 'flanged joints' preferred which have the equivalent strength of pipe materials.

What is meaning of SDR?

SDR means 'Standard Dimension Ratio', which is the average outside diameter divided by the minimum wall thickness.

Is it possible to do but weld for different SDRs together?

Yes. It is possible to do but weld for different SDR pipes. If both pipes are more than one SDR, it is recommended to bore (thinning smoothly) the end of the pipe to match the wall thickness.

How HDPE pipes are located in the ground?

HDPE pipes are manufactured with the option of copper tracer wire, which helps to detect the buried pipeline with a metal detector device. Otherwise ground-penetrating radar or acoustical resonance test is performed to detect/locate buried HDPE pipes.

Is PE pipe affected by exposure to UV light?

PE80 & PE100 materials are normally compounded with uniformly dispersed special additives including UV Stabilizers which protects the pipe from degradation caused by exposure to UV radiation.

In what lengths HDPE pipes are available?

HDPE pipe manufacturing (extrusion) is a continuous process, pipe can be manufactured to any length. However, considering the transportability and handling, it is available in lengths 6 m, 12m, or coils of lengths 50 m, and 100 m as per diameter. Up to 110 mm in diameter, HDPE pipes are available in coil and above 110 mm sizes are available in straight length.

What are the relevance of PE63, PE80 & PE100?

PE63, PE80 & PE100 denote MRS (minimum required stress) as per ISO9080. MRS test is determined by regression analysis, allowing for the prediction of minimum strength for a specific service life. The data is extrapolated to predict the minimum strength at 200C and at the specified 50 years design lifetime.

Various applications of PE Pipes.

1. Irrigation & Agriculture

- Replacement of Open canal to HDPE pipe.
- Lift Irrigation.
- Distribution network.
- Drip (Micro) Irrigation System.
- Sprinkler Irrigation System.
- Water Transport pipe in Cold Climate (Himalayas).

2. Water Supply

- Drinking water pipeline.
- Pumping main and gravity main.
- Waste water Treatment plants.
- Infiltration gallery.
- Bore well pipes.

3. Sewerage & Waste Water

- Pumping main for sewerage.
- Gravity conveyance for sewer.
- Rehabilitation of Sewer lines.
- Untreated and Treated effluent.

4. Industrial

- Pulp & paper industries.
- Chemical process lines.
- Corrosive liquids.
- Effluent disposal.
- Building & construction.
- Fertilizer industry.
- Fire Fighting piping.
- Air conditioning duct.

5. Marine

- Marine intake and outfall.
- Desalination plant.
- Dredging and Sand stowing.
- Salt pans.

6. Mining

- Leaching lines.
- Coal Decant System.
- Mine Drainage.
- Coal Tailings
- Slurry and Sludge Transport.
- De-watering
- Dust Suppression.

7. Ports and Highways

- Stay cable pipes for cable bridges.
- Culverts and storm water drains.

8. Power Generation

- Thermal and nuclear power stations
- Hydel power plants.
- Fly-Ash Slurry and others.



Application in Cold Climate & Hilly Terrain
PE pipes resist water freezing sub-zero temperatures at 14,000 ft altitude. Himalayas region for drinking water and waste water transport.



Application : Agriculture – Drip / Sprinkler Application



Marine Applications: (Bay of Bengal)
PE Pipes installation in sea water intake for desalination plant at Chennai Municipal corporation. Himalayas region for drinking water and waste water transport.



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By Eyal Harel, CEO, BlueGreen Water Technologies



Overview

Scientists have concluded that Earth is warming at an alarming rate and, without significant intervention on a global scale, they warn an irreversible climate breakdown is on the horizon. An estimated 50 billion tons of greenhouse gases – carbon dioxide (CO₂), methane, nitrous oxide, and hydrochlorofluorocarbons, to name a few – are released into the atmosphere every year, trapping heat and disrupting Earth's radiative balance. The consequences are sobering: disappearing glaciers and rising sea levels, record wildfires and extreme heat events, megadroughts, killer storms, and epic floods. The very survival of ecosystems and life itself are at stake.

The window for limiting global temperature rise to 1.5 degrees Celsius, as world leaders committed to in the 2015 Paris Agreement, is closing, and that necessitates bold thinking and innovating on an unprecedented scale. Aggressive action to remove carbon dioxide from the atmosphere must be accelerated and it must be accomplished at an unprecedented rate if we are to have a fighting chance. This can only be achieved by leveraging water, the world's greatest natural carbon sink.

Why water?

The ocean is the world's most important sink for anthropogenic carbon dioxide, absorbing more than 30 percent of CO₂ emissions globally. Similarly, coastal ecosystems – wetlands, salt marshes, seagrass beds, estuaries, lagoons, and mangrove swamps – are incredibly effective and efficient at capturing and sequestering carbon. In fact, scientists say coastal wetlands sequester even more carbon than mature tropical forests – at a rate ten times greater. Thus, water is essential for keeping our climate in balance.

For this we can thank phytoplankton – microscopic marine and freshwater algae which pull gigatons of CO₂ from the atmosphere via photosynthesis, using chlorophyll and sunlight to create energy. When an aquatic ecosystem is balanced, these microalgae also serve as a source of food for marine life; when phytoplankton die, they sink to the bottom of water bodies carrying their sequestered carbon with them. Some will form fossil fuels and some will mineralize into sediment, essentially locking away carbon forever.

When too many nutrients are present in a water column, certain species of phytoplankton, such as cyanobacteria (commonly known as blue-green algae), explode in numbers, producing powerful toxins and triggering harmful algal blooms – a cycle exacerbated by climate change.

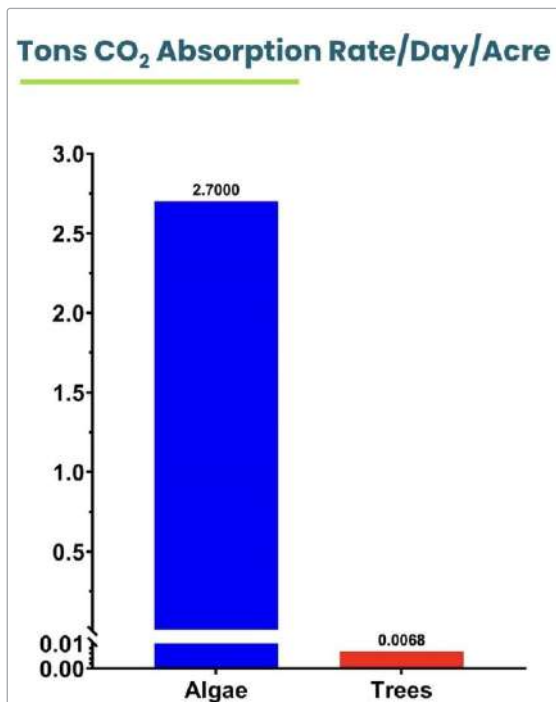
Left untreated, harmful algal blooms pose a serious threat to the health of humans, wildlife, and aquatic ecosystems. From vast stretches of oceans to coastal ecosystems to freshwater lakes and rivers, harmful algae are thriving – infecting water bodies worldwide with increasing intensity and frequency and, in some cases, ultimately resulting in huge expanses of aquatic dead zones.

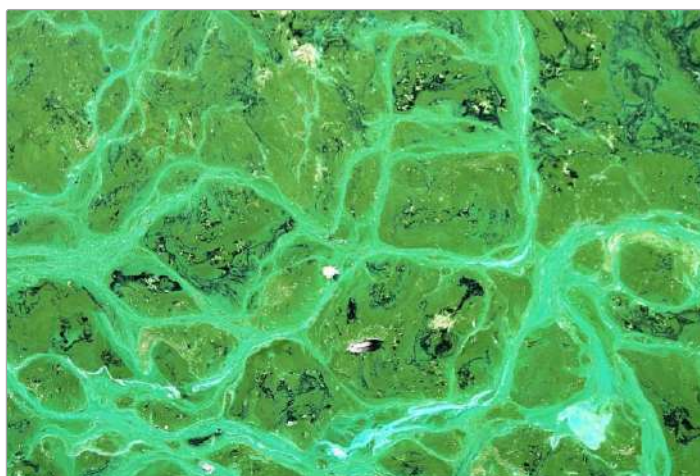
Harmful algal blooms not only suffocate and destroy vital ecosystems, they threaten drinking water supplies, drive down property values, and harm livelihoods and local economies. If left untreated, these outbreaks return to the same water bodies year after year, and most of the CO₂ absorbed by the blooming microalgae will be released back into the atmosphere.

Natural carbon removal via water

After successfully remediating hundreds of harmful algal blooms on multiple continents, water scientists with BlueGreen Water Technologies were able to develop a new methodology for measuring carbon removal via water. Treating a severe bloom of just one hectare, for example, can remove more than 100 tons of CO₂ within a few short days.

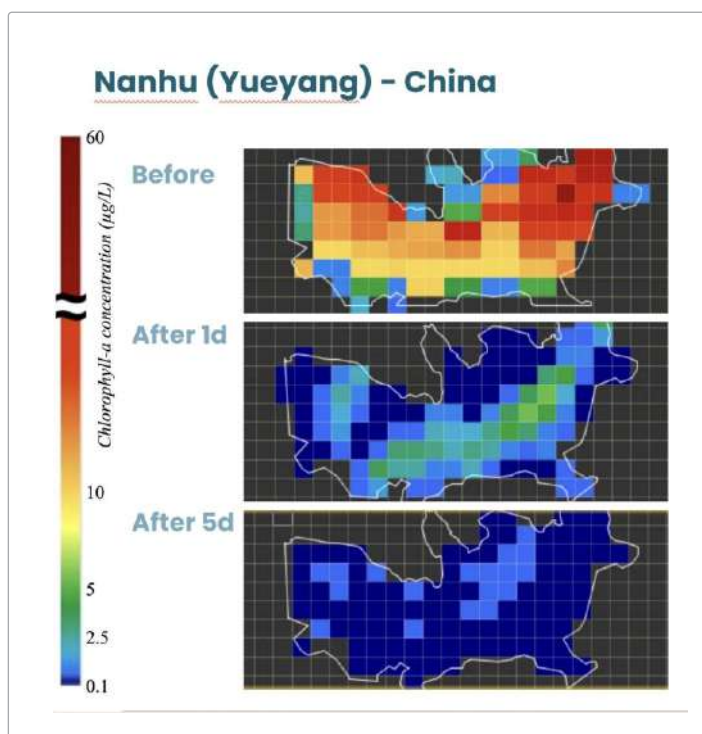
When analyzing a potentially infected water body, scientists use





satellite imagery to identify and quantify phytoplankton levels and gain a comprehensive understanding of the condition of the ecosystem. An advanced algorithm then classifies individual pixels within the satellite imagery and enables scientists to quantify BlueGreen relative chlorophyll units (BGChl) in the water and to monitor spatial and temporal patterns of a particular bloom and estimate its intensity. Scientists observe and define trends based on that analysis and combine that data with in situ measurements and other information obtained in the field to develop a treatment plan specific to each water body.

During remediation, BlueGreen Water Technologies deploys a timed-release, floating algaecide that moves with the wind and current to target the harmful algal species, which may also be toxic, resulting in a programmed cell death or “collective suicide” of the harmful organisms. The affected microalgae sink to the bottom of the water body along with the carbon they have sequestered. The process can be scaled to cover water bodies of any size, including oceans.



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By triggering and accelerating an entire population collapse within a harmful algal bloom, enormous volumes of carbon can be scrubbed from the atmosphere, allowing beneficial, nontoxic species to repopulate the ecological niche, restore biodiversity, and reactivate the natural carbon pump that is intrinsic to their subsistence.

Water versus land-based carbon capture

Land-based carbon capture and sequestration (CCS) certainly can be part of the solution to our climate crisis, with the caveat that it is not feasible at scale and cannot happen rapidly enough to hold global temperature rise to 1.5C.

Scientists have tested numerous mechanical and chemical solutions for scrubbing CO2 out of the air; however, the process of concentrating this gas is inefficient in that it requires significant amounts of energy and heavy investments in machinery.

Only a few dozen CCS projects exist worldwide and their track record is well documented. Many projects have been plagued by chronic mechanical problems, outages, and a failure to reach stated targets. Thus, underperforming CCS installations outnumber successful ones. Those that have succeeded have been criticized as serving to enhance the fossil fuel industry's production of more fossil fuels, which pumps even more harmful emissions into the atmosphere. According to the Institute for Energy Economics and Financial Analysis (IEEFA), nearly three quarters of CO2 captured annually is reinjected into oil fields to extract more oil and gas, exacerbating the very cycle that is causing our climate crisis.



Rapid decarbonization at scale can only be achieved by investing in ocean ecosystems and the carbon stored within. This natural process does not incur the inefficiency, energy load, or high costs of land-based CO2 removal systems and it is immediately deployable, economical, and scalable.

Demonstrated impacts

By targeting harmful algae and sinking huge volumes of algal biomass, BlueGreen Water Technologies' global commercial operations have removed an estimated 3.3 million tons of CO2 over the course of four years. Water bodies chronically plagued by harmful algal blooms have been restored, at times within hours of treatment.

The technologies described here are not only helping to address the challenges of

climate change, but also are helping to alleviate water insecurity. More than 2 billion people live in chronic water-stressed conditions. They exist without access to clean, healthy water.

As one example, the Setumo Dam in South Africa's North West province suffered chronic outbreaks of toxic blue-green algae for years. As seen in the photos above, remediation efforts cleaned the contamination and restored safe drinking water to 500,000 residents and, in the process, removed hundreds of thousands of tons of sequestered carbon.

In conclusion, our planet is in peril, warming at an alarming rate due to the overabundance of greenhouse gas emissions. By leveraging the awesome carbon-absorbing powers of our oceans and coastal ecosystems we can accelerate decarbonization and give our planet a fighting chance.

ABOUT THE AUTHOR

Eyal is a lawyer, entrepreneur, and investor with almost two decades of experience in technology development, transfer transactions, and global, multicultural negotiations. He is also an owner, and served as CEO, of the XinTech (BioSciences) group of companies – a boutique investment bank promoting Sino-Western technology transfer transactions and strategic collaborations in the life sciences. Formerly, he was Legal Counsel (in Israel) for China Civil Engineering Construction Corporation where he was involved in some of Israel's biggest construction projects. Eyal holds an LLB. and a diploma in East Asia Studies from the Hebrew University in Jerusalem and an MBA from the Hong Kong University of Science and Technology.

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LA SOCIÉTÉ WALLONNE DES EAUX CREATES DIGITAL 3D DATABASE OF COMPANY ASSETS

By Aude Camus, Senior Solution Marketer, Bentley Systems



Bentley Applications Enable Long-term Planning and Preventative Intervention by Automating Crack Detection

Optimizing Management of Water Assets for Reliable Water Supply

TLA Société Wallonne des Eaux (SWDE) is a regional water corporation that owns and maintains a series of water towers throughout Belgium. The organization is the dominant producer of drinking water in the Wallonne region, supplying almost 2.5 million people with 1,317 water tanks and towers. The overall goal of SWDE is to provide reliable access to water for individuals and businesses as the population and economy of the region grow.

Some of the structures that SWDE utilizes are very old, so the data on those structures was no longer accurate or, in some cases, available at all. To improve and streamline the management of all SWDE infrastructure, SWDE needed a database to increase the accessibility and accuracy of information about the company's assets. This goal would lead to more reliable water, higher quality food safety, prevention of structural defects, and a lower cost of structural interventions.

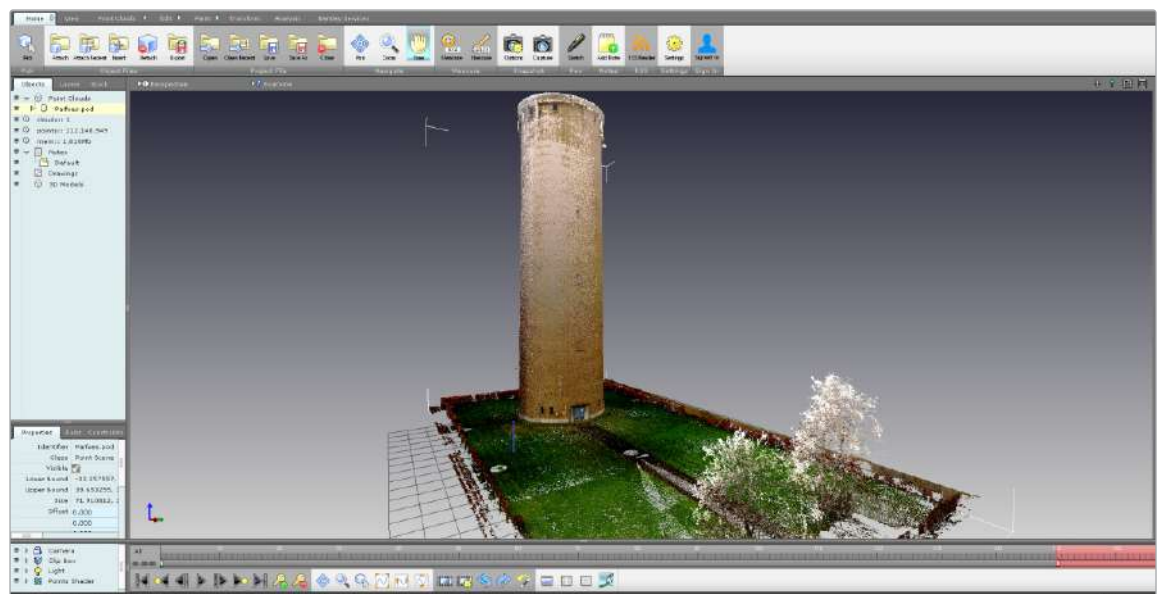
SWDE tower, built in 1981 in Juprelle, Belgium, was deteriorating and in need of support. The tower has a storage capacity of 500 cubic meters, and is supported by eight columns and beams. The tower's exterior features siding brick connected by galvanized metal anchors to a supporting wall constructed from terracotta. The concrete helped to reduce the amount of stress put on the brick and

to link the exterior and inner structure; however, it also caused some challenges. The concrete caused condensation on the interior walls, which led to significant degradation over time. The degradation included burst joints, cracks, and the separation of edifice bricks. Operating inspectors have also seen superficial cracking on the brick siding. To ensure safe and reliable water service to the area, SWDE needed to repair the tower.

"Water towers are generally tall, imposing structures. A manual inspection from the ground does not allow proper diagnosis, and a complete inspection takes a long time," said Christophe Taelman, engineer at SWDE. Typically, SWDE would conduct a survey of the damage using traditional manual surveying methods, including taking photographs from the ground or using elevators to lift workers up onto the tank. Given the challenges presented by the tower's size, SWDE quickly realized that their traditional approach did not provide a complete or efficient solution.

Manually Analyzing Drone Footage

SWDE decided to use drones to survey the damage, as that would allow them to provide a more complete picture of the damage without asking workers to spend as much time. They began to apply photogrammetry by using a Blade Chroma drone to take videos of the tower. Over 3,000 images were extracted from the drone video. However, they faced another roadblock while using drones: the vantage points gathered by the drones still required human interpretation, which came with a significant risk of error, as workers looking at drone footage could easily overlook small cracks. SWDE



needed to find a way to ensure that cracks of all sizes could be identified efficiently so that necessary intervention could be taken early on to mitigate long-term deterioration and maintain a reliable and safe water network.

Applying Texture Skin Images to Develop Automated Crack Detection Software

SWDE discussed their options with Bentley Systems representatives, who worked with SWDE to develop technology specifically to meet their need for automated crack detection. SWDE determined they could create a 3D plan for the structure of the water tower in MicroStation. Once this model was complete, the next step was to refine a deep learning approach to analyze images and automate crack detection. They used Pointools to clean up and export the plan as a model in ContextCapture. While ContextCapture does not have crack detecting capabilities, Bentley developers worked with SWDE to refine an artificial intelligence (AI) capability for that purpose.

“With this new analysis using artificial intelligence on the 3D photo reconstruction in ContextCapture, we were able to detect cracks faster and more accurately in both masonry cladding and concrete,” said Taelman. The 3D visualization allowed them to see all angles clearly and analyzed cracks precisely in real time. The precise and efficient crack detection system allowed SWDE to automatically identify cracks with diameters as small as 0.1 millimeters, and the software helps to predict further development of these small cracks. An algorithm quantified the length, width, and depth of each crack and categorized them by their size and trace patterns. The resulting statistics contributed to an analysis of the overall condition of the water tower.

SWDE tested the module on the damaged water tower, by capturing 3,000 images with drone surveys and then using ContextCapture to create a reality mesh of the tower. They then used the AI capability to scan the reality mesh and detect cracks. The scan detected 1,704 cracks in the tower, 520 of which were less than 2 millimeters and, therefore, could not easily be detected by the human eye. The AI also detected that the façade had detached more than 10 centimeters from its original placement, which the human eye also would have overlooked.

Sustainability through Prevention and Savings

This project was a pilot for SWDE, resulting in a new method to efficiently, accurately, and safely detect cracks in infrastructure. The technology used on the project allows for faster and better-informed decision-making on renovation plans and techniques, ultimately saving costs. The solution reduces the time needed for surveys by 66% and saves significant costs by helping SWDE identify and plan for any necessary renovation work. “The collaborative work with Zheng Wu has allowed us to go beyond our intended aim and be able to calculate the lengths of cracks and classify them by width,” said Taelman.

The accurate digital renderings have also established a baseline that SWDE can

compare to future surveys to identify any degradation, helping them be proactive about preventing any risks of interruption to the water supply. In a comparison of the ContextCapture AI technique and on-site measurements using an electron microscope, SWDE found that Bentley's software was twice as effective and reliable. They determined that the automated crack detection sped up the diagnostic process by more than 600% and increased detection reliability by 100%.

The organization also estimates that the automated approach saved more than EUR 2 million in initial costs. The software works for damage prediction, decision-making, and cost reduction. The solution contributes greatly to SWDE's broader goal of secure, efficient, and reliable management and provision of water resources. By saving time and costs, the automatic crack detection software helps SWDE sustainably maintain millions of households' access to clean drinking water.

PROJECT SUMMARY

Organization: La Société Wallonne des Eaux

Solution: Water and Wastewater

Location: Juprelle, Belgium

Project Objectives:

- To create a database of water asset models for future analysis of degradation.
- To sustainably ensure an accessible water supply throughout the region by identifying cracks in the infrastructure early.

Project Playbook: ContextCapture, ContextCapture Insights, MicroStation, Pointools

Fast Facts:

- La Société Wallonne des Eaux (SWDE) is a regional water corporation that owns and maintains a series of water towers throughout Belgium.
- While an unmanned aerial vehicle gathered high resolution images of the tower, manual analysis of the images failed to detect small cracks.
- The automatic crack detection technology in ContextCapture helped quickly find cracks as small as 0.1 millimeters.

ROI:

- The automatic crack detection technology created using Bentley applications resulted in a 600% faster process of crack detection and analysis.
- SWDE's solution was twice as reliable as manual surveying methods.
- Using Bentley's software, SWDE saved more than EUR 2 million on this complex project.



ABOUT THE AUTHOR



Aude Camus is a senior solution marketer with Bentley Systems, responsible for ContextCapture, Orbit 3DM, OpenCities Planner, Descartes, and Pointools. She is part of Bentley's digital cities business unit and focuses on Bentley's reality modeling products. Graduated from SKEMA Business School in France, Camus has nearly 15 years of experience in selling and marketing engineering and geospatial software.

To share your feedback or enquire about the author, write to us at deepak.chaudhary@eawater.com

DIGITALIZATION OF WATER INDUSTRY AND HOW CIMCON HELPED UTTARAKHAND STATE TO IMPROVE EFFICIENCY

By Suraj Gupta, Director India & APAC, CIMCON Software India Pvt. Ltd

The global research and advisory firm, Gartner defines digitalization as “the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.”

The digitalization of the water industry means adopting a smarter approach to water generation, water distribution and water treatment. Digital technologies offer unlimited potential to transform the world’s water systems, helping Water departments become more resilient, innovative, and efficient as well as empowering them to use more cost-efficient processes.

Traditional water and wastewater systems were built decades ago. Due to the changing stresses of climate and rapid urbanization, water and wastewater systems cannot keep up. The aging infrastructure brings with it risks of potential failure and poor environmental compliance; these issues are key concerns for municipalities around the world.

More than ever, water treatment operators across the world are turning to digital solutions to transform their day-to-day business outcomes. The latest digital technologies are not only helping industry become more efficient and effective but also transforming the way the water industry creates and captures value. Therefore, it is imperative that companies strengthen their core competencies with an eye on the future and understand how the digital journey will ultimately transform the relationship between customers and providers.

Challenges Faced by the Water Sector

Municipalities face challenges when looking to accelerate the adoption of digital water technologies. There is the challenge of overcoming data silos and of integrating systems, especially legacy systems. There are human resources challenges as well as a need to clearly define the return on investment of new systems. Some of the common challenges are listed below.

Aging Infrastructure – The state of rapidly deteriorating water infrastructure is a known issue, driven by inadequate investment in rehabilitation and replacement of equipment and facilities. This matter weighs heavily on the minds of the industry professionals—according to Black & Veatch’s annual survey of water, wastewater, and stormwater professionals, nearly 80 percent of water plants respondents see aging infrastructure as the most challenging issue facing the industry today.

Energy Consumption In municipal wastewater treatment plants 50-60 percent of the energy is used to operate the wastewater and other plants. It is estimated that the plants consume 60 terawatts-hour every year. Due to the large energy consumption, a lot of the time focus is on reducing the energy consumption to effectively run the plants throughout the year.

Population Growth – Population growth and urbanization put an extra load on aging systems. The first challenge of urbanization is



meeting supply demands. The second is in maintaining water quality and reducing environmental pollutants because of urban spread.

How Digitalization Improves the Water Industry

Access to digital control means using IoT-supported, data-driven models that integrate and optimize smart pumps, valves, sensors, and actuators. Digital controls also enable devices to “talk” to each other, send data to your smartphone, and produce real-time information that can be accessed and shared over the cloud. Municipalities can analyze, automate, correct, and predict risks in real time by adopting digital infrastructure. This will equip them to address many of the current challenges they face, including extending the life of aging assets, reducing leaks, thwarting cyber-attacks, and preventing other abnormalities in the distribution network service levels. This increases the reliability of supply, promotes water conservation, and increases revenue through operational efficiencies. The following are some further benefits of adopting digital technologies:

1. Increasing Resilience – Digital solutions such as a dense network of sensors, intelligent equipment, real-time source-to-tap digital twins, data analytics, and advanced simulation tools enable municipalities to be better prepared for their changing environments. By improving day-to-day water management and building long-term resilience to disasters and climate change, digital solutions address municipalities’ priorities.

2. Improving Efficiency – Digitalization of water management is a huge leap for both infrastructure and society. It will put an end to many hassles and inefficiencies associated with older equipment. Increased efficiency positively impacts the customer. Digital solutions such as detecting leaks, excess vibration, pump bearing failure, cavitation and asset management platforms can provide preventive and predictive maintenance capabilities which can help reduce downtime of critical assets and maximize effectiveness and efficiency of operations.

3. Remote Monitoring and Data Collection – With the advent of the digital revolution in the water industry, data collection and exchange are growing exponentially, replacing traditional methods and practices. Being able to monitor machines, pumps, and other instruments in the water sector as well as collecting precise data is hugely advantageous for water management.

The Way Forward to Fully Digitalized Water Infrastructure

To reap the full benefits of digitalization, companies in the water industry must follow global standards for connectivity, data storage, data availability, and legislation as well as provide ways to easily integrate their system with other systems. Thus, new water technology systems need to be developed based on new data sources, more intelligent products, and robust planning tools. There is also a need for more service-based business models, collaborative systems based on intelligent water technology components, and multi-utility systems that combine water treatment, energy, and resource recovery in a cyber-safe framework.

Hence, having the right products together with an understanding of customer needs and applications combined with intelligent connectivity, are key factors for success in the water industry for the years to come.

Areas where Digitalization play an important role

Water Treatment Plant – The water treatment plants face some common challenges in manual labor due to leakage of pipes and valves to electrical and mechanical instruments. Add to that the energy consumption and there is a huge challenge that needs to be addressed. With Digitalization, water treatment plants can not only automate the processes but can also manage the assets in real-time and can work on strategies to minimize wastage and maximize purity of outgoing water.

Water Generation Plant – The water generation plants also face challenges with

CIMCON has helped Uttarakhand State to save water and improve efficiency



Provide drinking water
to 1 crore citizens

CASE STUDY ➡

the ageing infrastructure coupled by reduced ground water level and surface water not being chanelized. With proper digitalization, the plants can reduce maintenance and operation costs improve the product quality and increase productivity to enable timely decision making and better process control.

Water Distribution – The water distribution plants face some common challenges with physical loss of water due to leakage and wastage and decrease in water pressure which leads to degrading the water quality. With the help of Digitalization, water distribution plants are able to reduce the wastage of water maintain the quality of water with proper monitoring of the assets in place to enable efficiency.

Sewage Treatment Plants – The sewage plants also face challenges in operation with high energy consumption and with shortage of manpower, there are ill effects on environment with no proper management in place. With Digitalization, the plants can not only reduce the energy consumption but also automate the processes to counter the shortage of manpower and manage the assets in real-time.

Is Digitalization Hard to Implement?

While digital water technology offers considerable promise, there are challenges in scaling adoption of these technologies. One of the main challenges is workforce capacity and training.

Whether the issues are real or perceived, the water sector is slow to adopt new technologies due to a lack of incentives, the risks of adopting new products, and individuals being siloed in their own department. As a result, proven technologies are strongly favored over unproven or emerging technologies in the water industry. In general, water workforces are not trained in digital technology solutions; this type of training is necessary to scale the adoption of digital technologies.

CIMCON's Remote Terminal Units or RTU's and SCANET Software systems has helped



cities and municipalities efficiently deliver water and wastewater treatment for over 30 + years. With CIMCON's vast experience in the water sector, these training and staffing issues are resolved. Instead of having to re-train the workforce in new technologies, CIMCON guides the water departments by taking care of the IoT Part in managing their assets in a better, more efficient manner.

How CIMCON has helped Uttarakhand State to save water and improve efficiency

Uttarakhand, one of the northern states in India is known for its beautiful natural environment of the Himalayas and is also referred to as "Devbhumi" or the land of Gods. The government of Uttarakhand had given a contract to the Uttarakhand Peyjal Nigam to provide drinking water to 40,000 villages in the Uttarakhand district which are spread far and wide across the mountains and difficult terrain. The mission was to provide proper drinking water to one crore citizens.

Due to hilly areas, pumping stations are deployed for proper generation of water. But there were quite a few challenges in the pumping stations. Due to hilly areas, in some extreme weather conditions, the pumping operators were not able to reach the pumping stations. Also, the operators used to handle the pumping stations manually which led to loss of time and water not being pumped on regular intervals. All these challenges followed by manual intervention led to operators not following whether the overhead tanks were full or not which led to water mismanagement.

Due to all these issues, Peyjal Nigam implemented CIMCON's wireless remote monitoring solution to tackle the challenges. The remote terminal units along with CIMCON's SCADA Systems were all connected with the central monitoring systems of the Peyjal Nigam and through GSM technology the operators of the Peyjal Nigam were noted about the water issues through messages. Through CIMCON's remote monitoring solutions, the flow, the level and the pressure of the water pumps can be measured effectively and reduced manual intervention with time.

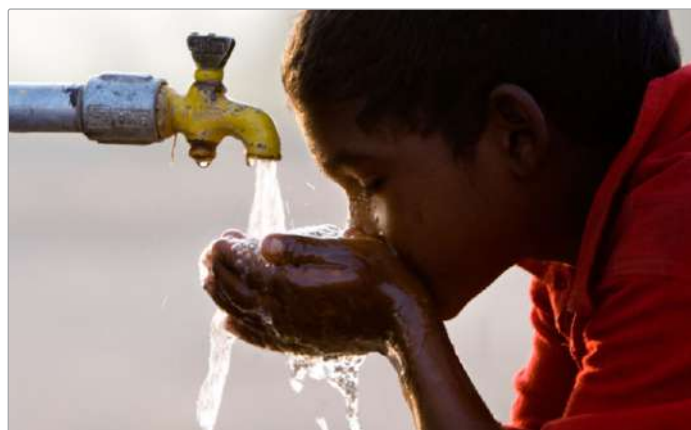
Post implementing the solutions, the Peyjal Nigam not only were able to manage the pumps effectively, but improved the efficiency of the pumps and reduced downtimes with proper interventions leading to improved productivity. CIMCON's Remote Terminal Units and SCADA systems not only helped the water system to be managed automatically but the alerts were generated earlier so that the field workers can go there and rectify the issues if needed so that no major problem occurs. This has helped the Peyjal Nigam to save water and energy consumption by 60 percent and

improve productivity by 40 percent.

So, is Digitization difficult?

The water department has made great strides in the uptake of digital technology. However, there is still plenty of room for improvement. Because technology has evolved, it is possible to take a great leap forward to achieve true digital transformation with minimal investment. Water departments need to start with a clear strategic plan to create a full digital ecosystem. This can start by dividing the water network into discrete zones and identifying what is needed to address the specific challenges in each. Effectively, it is best to start small by adding to existing technology. CIMCON can do this through connecting to a variety of existing water instruments without having to invest in new, expensive systems. Our product uses wired and wireless networks to communicate with water assets distributed over a large geographical area throughout a city. Then, it communicates this data back into the cloud using available network.

So, is digitalization hard to implement? With CIMCON's experience in the water



industry and its wide range of solutions from hardware, software, SCADA and the latest predictive maintenance solutions with AI & ML technologies, Digitalization has never been easier to implement.



ABOUT THE AUTHOR

Mr. Suraj Gupta is Director India & APAC at CIMCON Software India Pvt. Ltd. a global automation company with a footprint across several countries and cities with products that fulfil the vision of a connected city. He is a master in Instrumentation with over 25 years of experience in the field of Automation. He started his career as a Maintenance Engineer, worked on Plant equipment maintenance and project business, and moved on to Project Engineering and Project Management, in India including various Factories. He has experience across all the Businesses of the Automation Industry and has travelled to various countries for Business.

As Director of CIMCON he is focused on the Automation, Internet of Things covering applications in Water, Smart City Lighting, Oil & Gas sector, Security Systems, and Power Equipment monitoring.

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HYBRID COAGULANT FOR RAW WATER TREATMENT PLANT (WTP)

By Amit K., Pushkar S., Sanjeev G., Hiten M., Water application and product development centre,
Grasim Industries Ltd., Bharuch, Gujarat

Introduction

Water is the vital natural resource with social and economic growth for human beings [1, 2]. At present around the globe, more than 1.1 billion people do not have adequate access to clean drinking water and it is estimated that nearly two-thirds of all nations will experience water stress by the year 2025 [3]. For all living needs, water security is not only threat in terms of water scarcity but also in term of comprehensive variation in good quality water, which elicited a change in the focus from water quantity to quantity along with quality in Millennium Development Goals to Sustainable Development Goals [4]. As Anthropocene is projected to enhance the complexity of water issues around the world, the most prominent factors of global changes are population growth, urbanization and climate change which pose significant challenges to water management and governance [5, 6].

Fertilizer industry is one of the water intensive industries where large volume of water is used for different operations. In present case study, we will discuss the treatment of raw water using hybrid coagulant and its comparison with conventional coagulant.

Present Case Study

Present case study is based on treatment of raw water in one of the biggest private fertilizer industry in India. Raw water is being

collected from Gomati River, treated and used in different operation in the plant. Currently non-ferric alum, PAC (PAC dosed especially in rainy season only) followed by cationic polyelectrolyte used for treatment of raw water. It was intimated that due to usage of PAC, there is significant contribution of chloride which reduces COC (cycle of concentration) of cooling tower.

Based on the above problem statement, jar test was conducted with VYTAL 3305 which was specially developed to use where chloride is an issue using conventional coagulant.

The above results indicate that Vytal 3305 is having 80% low dosage as compared to non-ferric alum and contribute negligible chloride content. Good floc formation was observed while using VYTAL 3305 as shown in Fig.1. While Non ferric alum contribute ~17 ppm sulphate content which further decreases pH of the treated water. Based on the jar test results, plant trial was planned optimized dosage of 8 ppm VYTAL 3305 and 0.25 ppm VYTAL A 971.

Plant Trial:

Raw water was continuously collected from intake well situated at bank of Gomati river at rate of 790 m³/hr. The suspended particles were settled in the clarifier using coagulant and treated water pumped to pressure sand filter. The filtered water utilized for different operations i.e. demineralized plant (DM), cooling tower etc.

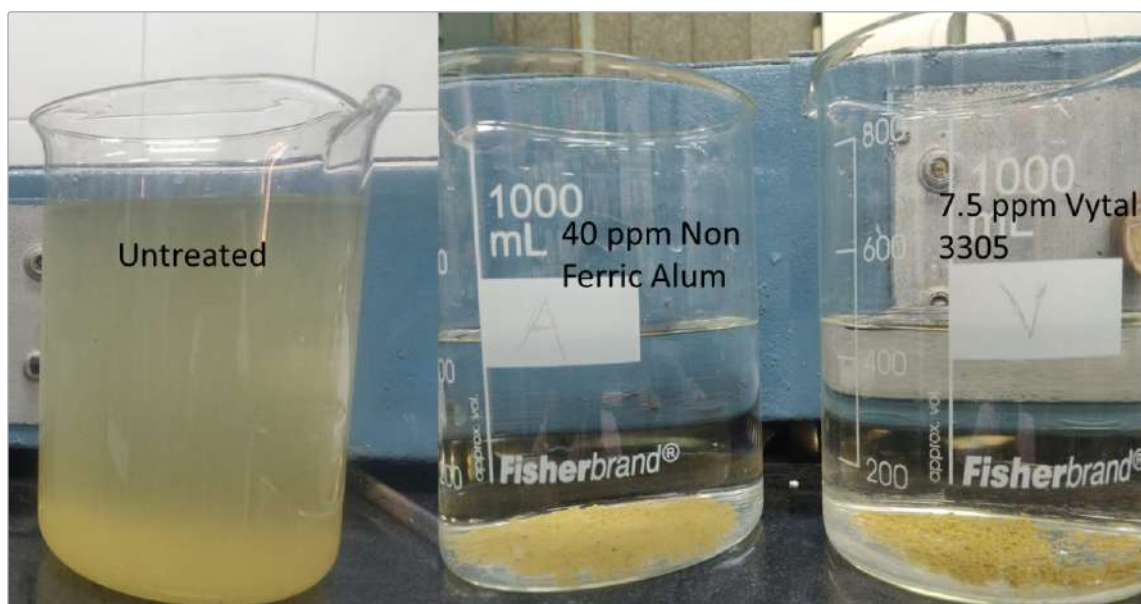


Fig.1 Jar Test Photograph at optimized dosage

Table 1: Results of Jar-test Conducted

Detail of coagulant	Parameter / Conditions For trial	Flocculant (Vytal A 971) dosage, ppm	Turbidity, NTU	pH	Chloride, ppm	Sulphate, ppm
Control (Gomati River)	-	-	43	8	18	Nil
Non Ferric alum	40	Cationic polyelectrolyte 0.5 ppm	2.3	7.6	18	17
Vytal 3305	5	0.25	3.1	8	18	Nil
	7.5		1.2	8	18	Nil
	10		1	8	18	Nil
	12.5		1	8	18	Nil

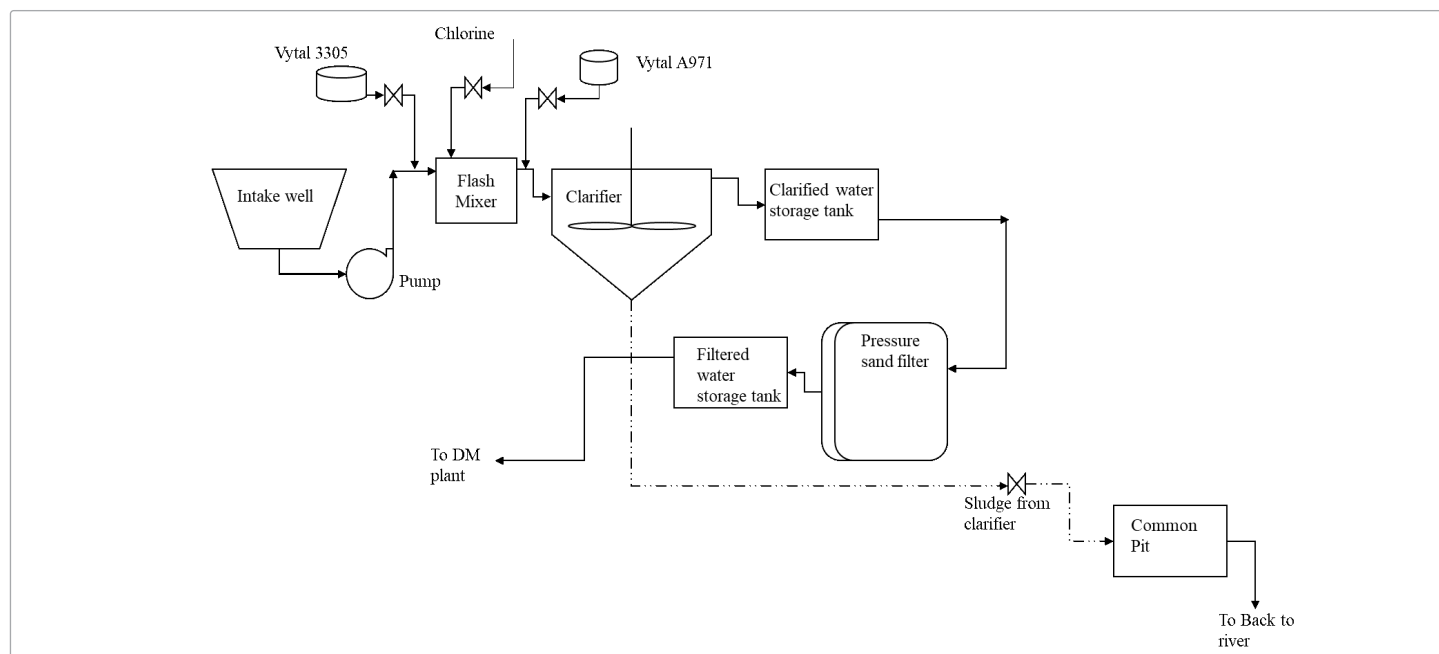


Fig. 2. Treatment scheme at Raw water treatment

The treatment scheme is shown in Fig 2.

Dosage and outlet parameters were observed for existing treatment system i.e. 40 ppm alum and 0.3 ppm polyelectrolyte for five days.

5% solution of Vytal 3305 was prepared in 8 m3 tank. 600 ppm solution of Vytal A971 was prepared under continuous agitation in 8m3 tank. Based on jar test, 8 ppm of Vytal 3305 and 0.25 ppm of Vytal 971 was added. Sample of untreated and treated water was collected in every shift for 7 days to analyse for different parameters i.e. pH, Turbidity, active silica and free mineral acid (FMA) as shown in Fig 3 and table 2.

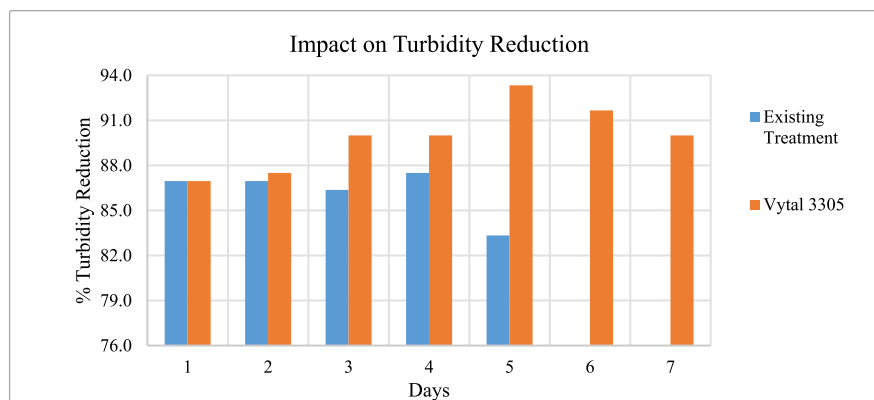
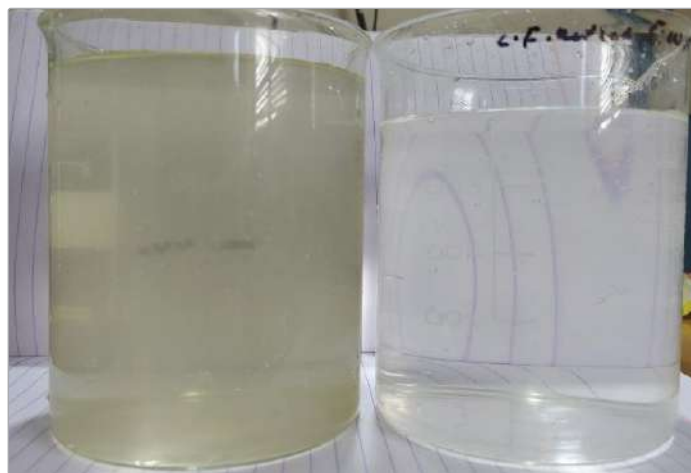


Fig.3 Comparative impact of VYTAL 3305 with Non Ferric Alum

Table 2: Comparative results of treated and untreated water during plant trial

Dosage, ppm		Trial days	Final pH	Initial turbidity, NTU	Final Turbidity, NTU	Active Silica, ppm	FMA, ppm
Coagulant	Flocculent	1	7.5	23	3	0.16	86
		2	7.5	23	3	0.15	87
		3	7.5	22	3	0.14	86
		4	7.5	24	3	0.15	88
		5	7.5	21	3.5	0.17	88
Non Ferric Alum (40 ppm)	0.3 ppm Chemifix 40	1	7.65	23	3	0.16	76
		2	7.75	24	3	0.14	74
		3	7.5	30	3	0.15	74
		4	7.6	30	3	0.19	75
		5	7.6	30	2	0.18	74
		6	7.65	30	2.5	0.17	74
		7	7.75	30	3	0.17	76

FMA: Free Mineral Acid


Fig. 3 (a) Clarifier

(b) Untreated and treated water

The above results indicate that turbidity reduction and floc characteristic were better while treating water with VYTAL 3305. There is negligible impact on the pH was observed as the product is having high relative basicity. There was similar reduction in silica observed for both the products during plant trial. It was also observed that 10-15 % reduction in free mineral acid observed for VYTAL 3305 as compared to Non-Ferric Alum which further increase the output between regeneration in demineralized plant and reduced the chemical required for regeneration of resin.

Conclusion:

- 1) ~87-93% reduction in Turbidity achieved as compared 83-87% with Non-Ferric alum.
- 2) ~80 % less dosage consumption as compared to non-ferric alum.
- 3) Better floc formation and settling characteristics observed using VYTAL 3305.
- 4) Less sludge formation was observed which saved the water loss during

desludging of clarifier.

- 5) 10-15 % reduction in free mineral acid observed for VYTAL 3305 as compared to Non-Ferric Alum which further increase the output between regeneration in demineralized plant and reduced the chemical required for regeneration of resin (ref. Table 2).
- 6) Negligible impact on chloride. Hence very much beneficial to maintain cycle of concentration of cooling tower (ref. Table 1).
- 7) Ease in operation. VYTAL 3305 is a liquid product and 100% soluble in water therefore no sludge formation occurs during solution preparation whereas there is sludge formation during dissolution of non-ferric alum (solid form).

Thus, it can be concluded that treatment with Grasim's VYTAL 3305 and VYTAL 971 leads to significant improvement in turbidity reduction at much lower dosage for raw water treatment plant and giving huge intangible benefits at equivalent or somewhat lower treatment cost m3 of raw water.

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A BRIEF CASE STUDY ON WATER SUPPLY SCHEME AT KAMAKHYA AREA IN GUWAHATI, INDIA

By Abhijeet Das, Research Scholar, Department of Civil Engineering, C.V. Raman Global University

Abstract: Water is one of the basic necessities of every living being. Water supply system is a system of engineered hydraulic components which provide water supply. Water demand is increasing day by day. Water distribution network play vital role in preserving and providing desirable life quality to the public, of which reliability of supply is the major component. To solve this problem, there is need to up-gradation of existing water distribution network is necessary. This study is design of 24x7 water supply system at Kamakhya area (Assam-India). It includes also includes feasibility study; software based hydraulic design, operation and maintenance strategy and economic feasibility for the project.

Introduction: In Water distribution system, a hydraulic infrastructure consisting of elements such as pipes, tanks, reservoirs, pumps and valve etc. Pipe water system is one of the best systems to supply water safely, adequately and continuously.

Present water supply situation in Kamakhya area is challenging. Kamakhya area is facing acute water supply due to old water infrastructure. The existing water supply scheme has reached to its ultimate design capacity. The components of existing water supply scheme such as raw water intake structure, pumping system, water treatment process, storage and distribution system are inadequate to supply the increased water demand. The main objective of this

study is to increase upgrade the existing water supply scheme and it shall provide the measure for making infrastructure tackle present as well as future water requirement of the Kamakhya area. Also finding the cost and efficiency of system. India's population is increasing but will stabilise in the middle of this century. 1.3% increase is expected during 2000–2025 and 0.52% between 2025 and 2050. But urban population will increase by 50% by 2050 [1]. The water footprint of a consumer is defined as the total volume of freshwater consumed and polluted for the production of the goods and services used by the consumer. The water footprint of a group of consumers is equal to the sum of the water footprints of the individual consumers [2]. When the demand for fresh water exceeds the availability, desalination of water has to be depended. Nowadays, desalination has become a very affordable solution to cope with fresh water shortage typically in tropical as well as in offshore areas. Seawater desalination is being applied at 58% of installed capacity worldwide, followed by brackish water desalination accounting for 23% of installed capacity [3, 4]. Reverse osmosis (RO) is a process that uses semipermeable spiral wound membranes to separate and remove dissolved solids, organic, submicron colloidal matter, colour, nitrate and bacteria from water. Feed water is delivered under pressure through the semi-permeable membrane, where water permeates the minute pores of the membrane and is delivered as purified water called permeate water.



Fig. No.1 GIS Map of Guwahati city



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Study Area: Guwahati is the largest city in the Indian state of Assam and the largest metropolis in north-eastern India. A major riverine port city along with hills, and one of the fastest growing cities in India. Guwahati is situated on the south bank of the Brahmaputra. It is called the 'Gateway to North East India'. In the northern side, the city is bounded by mighty river Brahmaputra and in the southern side; the city is surrounded by hillocks which is the extension of Khasi hills. In the west and the south west there are the Rani Reserve Forest, with varying altitudes of 49.5 m to 55.5 m above mean sea level. The topography of the city is made up of both high land and low land. At present the city municipal corporation area consists of 60 wards covering an area of 216 sq. km.

In northern side the city is bounded by mighty river Brahmaputra and in the southern side, the city is surrounded by hillocks which is the extension of Khasi hills. In the west and south west there are Rani Resave Forest, plain with varying altitude of 49.5 m to 55.5 m above mean sea level. The topography of city is made up of both high land and low land. At present the city is business hub and largest city of Assam and North East. It is also biggest commercial, industrial, educational and health centre of the region.

Local Administration

Guwahati Municipal Corporation (GMC) is the local civil body. GMC is administratively divided into six zones. The city is divided in 60 electoral wards as shown in Figure 3. People of each ward elect a Comparators who represents that ward. The Municipal Corporation was established in the year 1971. The Corporation was duly constituted in 1974 in the first meeting of the elected councillors as per provision of Sec.45 of this Act. At present GMC administers an area of 216.79 sq. km. GMC provides basic amenities like drinking water, drainage facility, road, street lights, etc. and collects its revenue from the urban taxes.

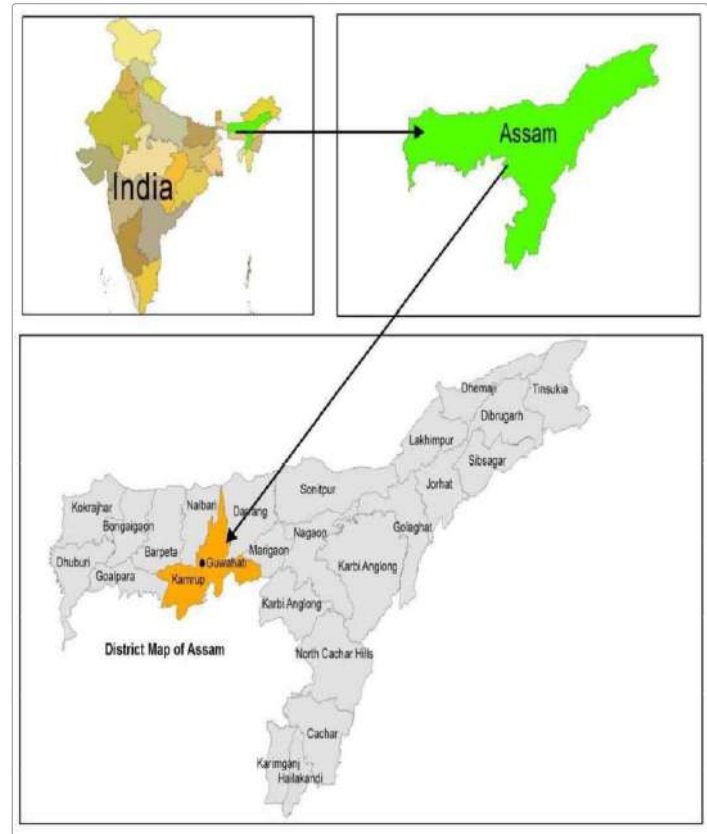


Fig. No.2 Location of Guwahati

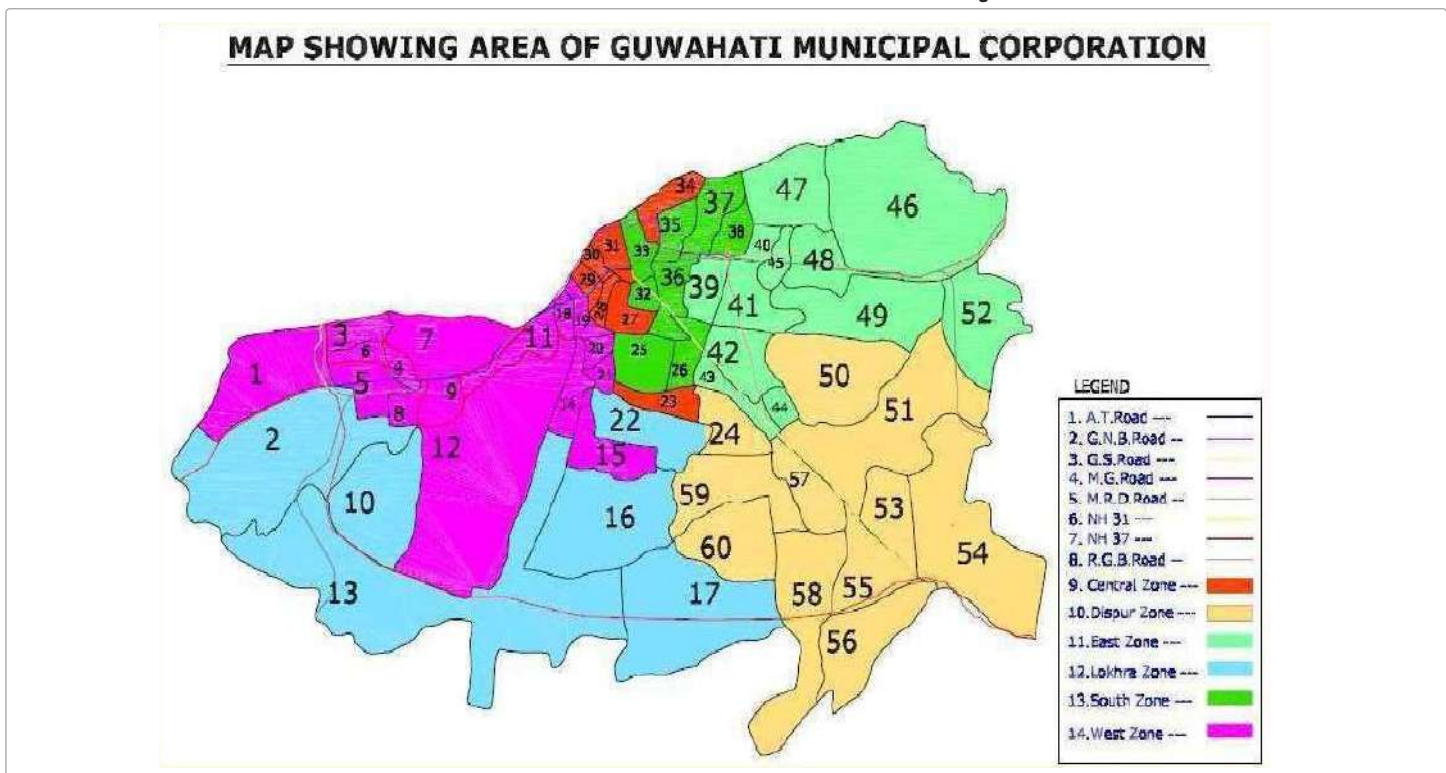


Fig. No. 3 Zone map of Guwahati municipal corporation

CASE STUDY

Design Period:

Looking towards the condition of existing system the implementation period is considered as 2021. The Design year for hydraulic analysis of Raw and Pure Water pumping Main is carried out for year 2052 as per demand calculated. It is envisaged that a sizeable quantum of Implementation of the Project would be achieved in early 2022. Hence the project horizons are decided as follows. Year 2022 (Present Stage) Year 2037 (Immediate stage) Year 2052 (Ultimate stage)

Existing water supply scheme:

The existing water supply to the Kamakhya area is managed by Guwahati Municipal Corporation (GMC). The water supply department is responsible for ensuring protected drinking water supply in the Kamakhya area. Presently water supply

situation in Kamakhya region is challenging. The existing water supply scheme was commissioned in the year 1990 and has reached to its ultimate stage i.e. 30 years old. The source of raw water for existing Kamakhya water supply scheme is Brahmaputra River.

Pump Barge:

Pump Barge is used as Intake structure to withdraw water from Brahmaputra River. Currently two stage pumping system is in working. Raw water pumping machinery is installed on barge and in the first stage water is pumped to sedimentation tank at distance near about 50 meters from the location of Pump barge. In second stage, the raw water from sedimentation tank is further pumped to Water treatment plant of capacity 4.50 MLD. The pure water is then pumped through pumping main to storage reservoirs near Bhubaneshwari Park.

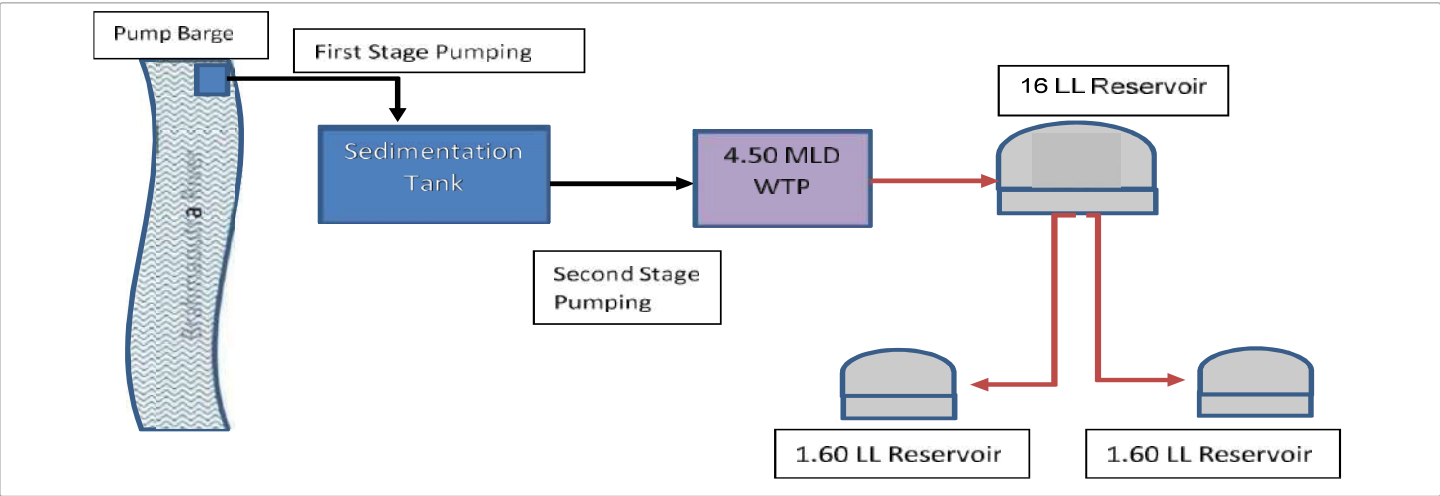


Fig No. 4 Schematic Arrangement of existing water supply

The main source of the Kamakhya water supply system is Brahmaputra River. To withdraw water from Brahmaputra River, pump barge is used as shown in figure below:

The water level in Brahmaputra River decreases during summer season the pump barge is lowered further into the river so as to get the required water depth for pumping. Currently two stage pumping system is in working. Raw water pumping machinery is installed on barge and in the first stage water is pumped to sedimentation tank through hose pipes of 200 mm diameter at a distance near about 50 meters from the location of Pump barge. In normal days two pumps of 50 HP and

60 HP are alternately used for 06 hours to pump raw water to sedimentation tank. Total 12 hours pumping is done in normal days. During Ambubachi festival period, all the pumps are in working for 24 hours to supply continuous water to meet the peak demand.

Sedimentation Tank: The raw water in first stage is pumped to sedimentation tank. Two tanks of sizes 7.40 m length x 6.40 m width x 8.0 m depth and 12.20 m length x 13.0 m width x 3.6 m depth with baffle walls at 3.5 m each. In second stage, water from sedimentation tank is pumped through two mild steel pipes of 200 mm diameter to existing water treatment plant (WTP) of 4.50 MLD capacity.



Fig No. 5 Existing Pump Barge

Table No. 1 Details of Existing Raw Water Pumping Machinery

Sr. No.	Pump Discharge (Cum/hr.)	Head (m)	Pump Rating (HP)	No. of Pumps	Working Hours	Year of Installation	Condition
1	180	200	214	2	6	2019	In working during normal day
2	180	200	215	2	6	2018	In working during normal day
3	180	200	215	1	6	2008	Under Maintenance

During Ambubachi period, alternate pumps are used for 24 hours for pumping for special festival.

Table No. 2 Details of Existing Raw Water Pumping Main

From	To	Diameter	Length	Number of line	Materials
Sedimentation Tank	4.50 MLD WTP	200mm	500m	02	Mild steel (MS) pipe

Water Treatment Plant: The capacity of existing water treatment plant is 4.50 MLD. The location of WTP is near the Bhubaneshwari Park on Kamakhya hill. WTP was commissioned in the year 1990



Fig No. 6 Picture of existing water treatment plant.

Storage Reservoir tank: There are three numbers of storage reservoirs near Bhubaneshwari Park of various capacity. One of 16 lakh litters and two each of 1.60 lakh litters



Fig No. 7 Reservoir

CASE STUDY

Distribution System: The water distribution network is 30 years old and is in very bad shape. With the increasing population and water demand, pipes are laid haphazardly. The existing water distribution network has DI and GI pipes of diameter

ranging from 50 mm to 300 mm. The house connection is of GI pipe. The length of water distribution network is approximately 5-6 kms.



Fig No. 8 Distribution System.



Fig No. 9 Distribution System

Need of Augmentation of Water Supply Scheme

The development of Guwahati Municipal Corporation is rapid. This is directly

Table No. 3 Existing pipe system

From	To	Diameter	Length
Brahmaputra River	Near Kamakhya Hill	500 m	3.6-4 MLD

affecting the amenities and facilities provided by the Municipal Corporation. One of the major problems faced by the citizens is lack of adequate water supply. At present Kamakhya area is getting only 3.60 to 4.0 MLD of water from its source

It is evident from above table for Kamakhya area 3.60 to 4.0 MLD supply is insufficient to cater to the current stage water demand i.e., year 2021. In order to

serve the demand of 6.15 MLD for intermediate stage (year 2037) demand during normal days and peak demand of 20.56 MLD (year 2037). Similarly, there is demand of 7.1 MLD (year 2052) and peak demand of 22.44 MLD during Ambuhachi period, an augmentation scheme is needed. The capacity of existing intake structure is not adequate for future demand. The WTP and all other components of water supply system are 30 years old. In view of rapid growth of population and increasing devotees of Kamakhya Devi, water supply is bound to get more stressed in near future if not augmented in sync with anticipated growth.

Population Growth:

Guwahati being an important city in the north-eastern region has witnessed fast population growth in the recent years. Due to rapid urbanization, the population of Guwahati city is increasing day by day. For Look East Policy of Govt. of India, emerging importance of Guwahati will be phenomenal. For all these reasons there is a tremendous pressure of population in Guwahati city. The population distributional pattern in Guwahati is not even. The undulating surface, rapid growth of population, different types of socio-economic activities have impact on distribution pattern of

Table No. 4 Adaptation of Future Populations.

Sr. No.	Year	Population		
		Residents	During Normal Days	During Ambubachi Period
1	2022	16326	36015	507372
2	2037	18835	41550	545897
3	2052	21730	47936	587347

Conclusions:

The future population of Guwahati city may increase to water demand in the year 2052, to satisfy the demand of water there need for augmentation of existing water treatment plant. The present plant having capacity of water treatment plant is 4MLD in future it will increased to 7 MLD. While augmentation the system area, cost, and efficient technology is needed. Efficient water distribution system is also need to avoid the water losses and other problems. The quality of water is remain same after augmentation.

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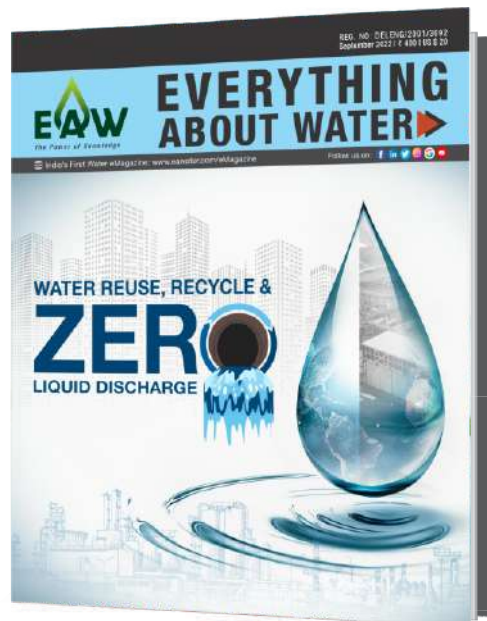
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SUSTAINABLE WASTEWATER MANAGEMENT PRACTICES TO CONTROL THE IMPACT OF THE \$50 BILLION INDIAN PHARMA INDUSTRY

By Vijender Reddy Muthyala, Co-founder & CEO, DrinkPrime



The Indian pharmaceutical industry, valued at \$50 billion, has been hailed a game-changer in the field of healthcare, providing affordable, life-saving medications to millions of people around the world. Ironically, '3000+ pharma companies and about 10,500 manufacturing units spread across the country contribute to the antimicrobial resistance (AMR) crisis that is estimated to result in a death toll of ²10 million people across the world by 2050!

The industry has been generating vast amounts of wastewater that has been contaminating groundwater with harmful chemicals and pollutants. The majority of the time, the catastrophic, environmental side effects of this industry are overlooked.

It's time the Indian pharmaceutical industry stepped up, addressed its water usage and prioritised efficient and sustainable wastewater management.

India's Booming Pharma Industry: A Looming Water Crisis?

According to a report by the National Institution for Transforming India (NITI Aayog), about 70% of the country's freshwater is contaminated. For a water-stressed country like India, with its dwindling sources of utilisable freshwater, this is alarming news.

And how is the Indian Pharma industry contributing to this issue? For starters, pharmaceutical manufacturing processes require large volumes of water for cooling, and cleaning of equipment, as a raw material in formulations and other processes. All these not only lead to high water usage but also wastewater generation in the industry.

Pharmaceutical wastewater that is generated during the production process contains a variety of substances, including active pharmaceutical ingredients, solvents, and other chemicals. These substances can be highly toxic and can have a significant impact on the environment and human health if not properly treated and disposed of.

Unfortunately, many pharma manufacturing units still discharge their wastewater directly into the groundwater without proper treatment, leading to groundwater contamination.

This has led to a huge problem for the country, particularly in terms of access to safe drinking water and the associated health risks. For India, this situation is particularly dire as the vast majority of the population depends on groundwater sources for drinking water.

But why is groundwater contamination such a significant problem? Because it can lead to a range of health problems for people who rely on these water sources. Some of the common health risks associated with contaminated water include gastrointestinal

diseases, typhoid, hepatitis A, and cholera. In rural areas, this problem is further exacerbated where access to safe drinking water is already limited. People living in these areas have no choice but to drink water that is infested with disease-causing pharma residues as the cost of treating water is beyond their means. This can cause detrimental health effects in the long-run.

Hyderabad's (Bulk Drug Capital of India) groundwater and surface water are known for being highly contaminated. According to a Telangana State Pollution Control Board report, Hyderabad's pharmaceutical sector is alone responsible for generating 33.1 lakh tonnes of waste during 2019-20. This is probably why the surrounding water ecosystem is riddled with high concentrations of hazardous, non-biodegradable compounds such as antidepressants, heavy metals, and antibiotics among many others-making it unsafe for irrigation and public health.

This is why the lack of an efficient wastewater treatment process is an issue that needs to be taken seriously. Especially when it is severely impacting the availability of water for other uses, such as agriculture and domestic consumption.

How Can We Tackle the Wastewater Problem?

The majority of pharmaceutical companies do not have effective treatment facilities in place, and the existing ones often fail to meet the regulatory requirements.

With wastewater polluting our rivers, lakes, and other water sources, the Indian pharmaceutical industry must take immediate steps to address the issue of wastewater management. Fortunately, the industry can employ strategies that are a mix of sustainable practices and efficient technologies.

High-tech reverse osmosis filtration systems: The industry should invest in more efficient water treatment technologies such as high-powered RO membranes. A well-functioning and properly designed RO filter can effectively remove around 99% of the contaminants from wastewater. Using multi-stage filters, RO removes all traces of drugs and medicines from water, leaving you with water in its purest form with all the required dissolved impurities, salts and organic compounds. Another effective way is to upgrade our existing treatment facilities and adopt new & cost-effective technologies for optimal filtration.

Establishing wastewater conservation and recycling process: The pharmaceutical industry should focus on wastewater reduction and adopting good water practices. How? By

implementing effective water conservation and water recycling/reusing measures. One of the most crucial benefits of wastewater recycling and reuse is its cost-effectiveness. Since water is a precious and expensive natural resource, the pharmaceutical industry can reduce the amount of freshwater they consume, resulting in lower operational costs.

Not only that, but the volume of wastewater being discarded will also see a significant decrease. This in turn would reduce the number of pollutants discharged into water bodies by which negative environmental impact can be greatly mitigated.

Utilising evaporation and distillation: One of the highly-efficient techniques to manage the amount of wastewater generated during manufacturing is distillation and evaporation. Unlike other filtration processes, evaporation is distinct because it involves removing the water from impurities rather than the other way around. After separating the contaminants from the wastewater, the result is clean water that can be recycled or safely discharged.

The basic distillation process goes something like this: the wastewater is heated to a high temperature causing the water to vaporise, leaving behind concentrated waste in the form of salts or solids. The remaining waste can be disposed off safely in a landfill along with other solid waste, preventing pollution of water bodies. Adopting these techniques can not only reduce the volume of wastewater before disposal but also lessen the strain on our valuable freshwater resources.

To price or not to price? A carbon tax on wastewater management in industries, especially pharma, could provide a financial incentive for them to lessen their carbon emissions and implement more sustainable wastewater treatment processes. While India does not have a formal industrial wastewater carbon taxation system in place, a tax on wastewater management could be a game-changer. Not only would it encourage industries to adopt environment-friendly practices but also reduce water pollution and prevent ecological damage.

Currently, the industry has very little incentive to adopt sustainable industrial practices, especially when they are not bearing the full cost of damage. These taxes could be incentives for the pharma industry to minimise risk to ensure that they do not end up paying an extra cost for environmental degradation - leading to cleaner water bodies, thriving aquatic life, and improved health.

The Way Forward

India is highly vulnerable to water-related risks with depleting freshwater and groundwater sources. And the pharma industry's wastewater containing hazardous pollutants is contaminating groundwater- degrading drinking water's quality and jeopardising our health.

The consequences of this pollution is alarming. The consumption of contaminated water can lead to serious health issues such as cancer, kidney damage, and even death in extreme cases. The most vulnerable populations are those who cannot afford alternative sources of clean water, making them particularly susceptible to the harmful effects of water pollution.

This is why wastewater treatment should become a critical part of the Pharma industry, especially with pharmaceutical residues infesting our aquatic environment. While the Indian government has taken steps to address the issue of industrial water management, more stringent policies have to be put in place.

Only by enforcing strict regulations related to water usage and discharge will industries practise proper wastewater management. Some ways the government could ensure compliance with environmental regulations are by monitoring industrial waste quality and conducting mandatory audits of wastewater treatment facilities.

One thing is clear: We shouldn't take our precious groundwater and freshwater sources for granted. Access to safe drinking water is a fundamental right and sustainable industrial water management practices are a necessity to ensure our water resources are used responsibly.

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ABOUT THE AUTHOR

Vijender (VJ) is the Co-founder and CEO of DrinkPrime, India's leading drinking water solution provider.

50% of India does not have access to safe drinking water and DrinkPrime is focused on solving this problem. Under his leadership, DrinkPrime has been recognised as a part of Fast Company's 'The 10 most innovative Asia-Pacific companies of 2021', Forbes Asia 100 To Watch list, Inc 42's Fast 42 2023 and YourStory and Trell's 500 Challenger Brands.

VJ has utilised his expertise in technology and product development to build India's first smart water purifier available on a subscription basis. Using the Internet of Things (IoT), DrinkPrime constantly monitors the water quality received by every subscriber to ensure they get clean and safe drinking water. This innovative approach has led to DrinkPrime being backed by Sequoia Surge, Omidyar Network, Alteria, UC Inclusive Credit, and Western Capital among other notable investors.

Before starting DrinkPrime, VJ was in the compiler research team at Advanced Micro Devices (AMD) where he worked on next gen AMD servers. He is a Master of Engineering graduate from the Indian Institute of Science (IISc) in Bengaluru.

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WASTE MANAGEMENT IN THE INDIAN PHARMA INDUSTRY - THE COMPULSIVE MEDLEY OF TRAPEZE, CTE AND CTO

By Dr S Sundaramoorthy, Dr S Saktheeswaran

The trapeze high is used by acrobatic performers in the circus to swing from one platform to opposite another and back with the very life at stake. The waste management in the Indian pharmaceutical industry is similar and swings by the trapeze between the pendulum of consent to establish (CTE) and consent to operate (CTO). There are no manuals, guidelines etc for effluent treatment plant (ETP) or air pollution control systems (APCS) of pharma industries by the pollution control administration (PCA) though mandated under the Water Act. Thus the ETP and APCS are guesswork by the industry at start and routinely stamped by the PCA as CTO. However, the effluent characteristics continually vary from ever changing market demands of medicine which sway between day to day needs from the nonsteroidal anti-inflammatory drugs (NSAIDs) like Ibuprofen to Critical Care injectables through solvent related Friedel-Crafts acylation / alkylation and result in spent solvents. The solvent recovery techniques are easily said than done. The APCS by counter current stripper is devoid of specific mathematical models and is compounded by thermal inversions. So much so, continual modifications in the ETP and APCS are warranted but requires a fresh CTE and CTO every time and becomes a perpetual "wheel". The R&D to establish a sustainable technology is impossible as the needed effluent and air samples are not there. Written in this background, this article is a contrast between the old solvent stripper technology ETP and the highly "adaptable" cavitation / thermal oxidation not manifesting despite this industry valued at an estimated US\$42 billion (Indian Rupees 300,000 crores) in 2021 (1) and world's third-largest pharmaceuticals producer (2). Tanneries have the Central Leather Research Institute (CLRI) but

there is no such in the pharma industry. The public concerns on pollution impacts are also intensifying. This compulsive medley cannot be expected to go on for long and the industry may let go of the trapeze and opt to migrate out. The country will be the loser, not the industry.

1. The "Sob Story" of the Pharma Bulk Drug Industry

Only a small group of pharmaceutical companies in the developing countries make the bulk drugs for developed countries for buyers to procure and repack to retail sales. The two entities are in a symbiotic existence, the companies needing the "Dollars" and the buyers needing the "bulk drugs". Though the buyers do support the pollution control by meeting the costs, the "labour pains" of delivering the drugs cannot be ameliorated by financing alone. It is further compounded by the continually varying formulations and the need for upgrades to the ETPs without any validated references and challenged by the local PCA on the one side and the complaints of odour from contiguous habitations. The validated treatment technologies for the effluents from newer formulations are just impossible as there are no effluents to do the lab scale R&D and has to be done in the ETPs themselves!!! The bunching of pharma industries for common effluent treatment plants (CETPs) with their "marine outfalls" for the "residuary effluents" has been tried but here again, the individual complexities combine and complicate the matters. This is the "sob story" of these industries which are lucrative in the cost obtained for the products but the production is more like "pseudo labour pains" forever.

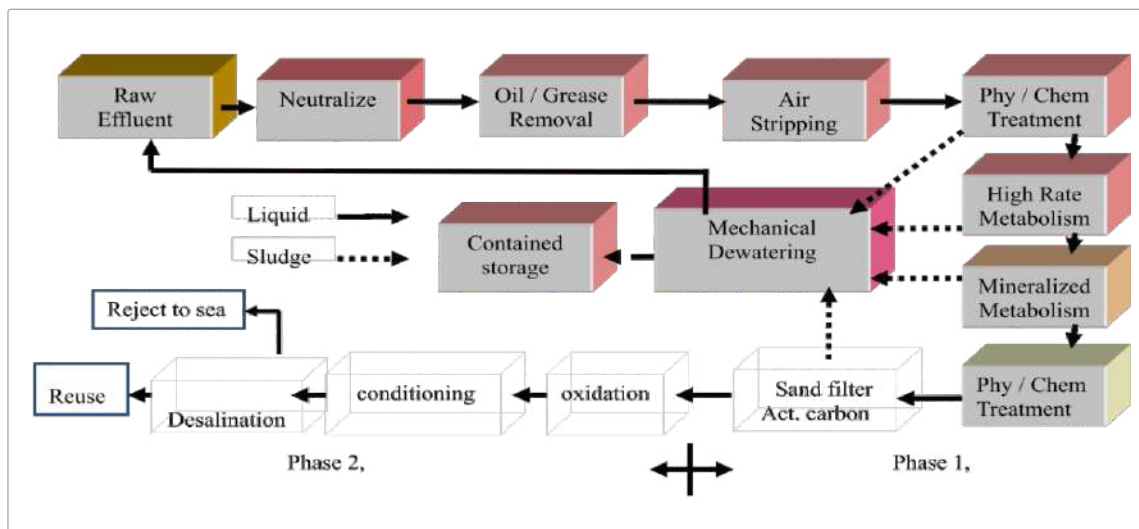


Fig.1. Treatment in the ETP. Solid waste from sludge precipitation is by on-site containment



Fig.2. Clockwise from top left. The multi-tier ETP with stripper tower at top, tertiary filtration, oxidation by chlorination, desalination by disc & tube membranes, thermal evaporator, crystallizer, colour removal in the sequence, the lead author with buyers's inspectors from overseas.

2. Case Study of an early Bulk Drugs Industry ETP of 2002

This is a recap of 2001-2003 in a coastal Tamilnadu. The raw effluent is generally dark brown with astringent odour. Typical raw effluent is BOD 4,000 mg/l, COD 8,000 mg/l and TDS 22,000 mg/l. The solvents were mainly trichloroethylene, isopropyl alcohol, hexane and acetone. The ETP sequence is in Fig.1 with the colour scheme in the boxes representing the improvement in colour of the raw effluent.

The oxidation referred to is by chlorination followed by dechlorination before desalination by disc & tube desalination and the rejects were blended with the CETP marine outfall but was discouraged later by pollution control authorities as it was not possible to detect which CETP member industry discharged untreated effluent surreptitiously. The key photo plates are shown in Fig. 2

units in a 5 floor industrial building with the equalization tank below ground level and the treatment starting at the sixth floor stripper tower and cascading down by gravity to the filters at ground level. The desalination unit, evaporator and crystallizer were offsite. The complexities of the above being "laborious", the challenge came from a totally innocuous logistics of lifting the raw effluent by a submersible pump to the stripper. These pumps require their vertical motor to be kept cooled by the surrounding raw effluent itself. This caused the raw effluent sediments settling down near the submersible pump itself and binding the impeller though it was an open

impeller in turn actually called for stopping the production some times. In hindsight, the immersible pump as in Fig.3 should have been used, but then it was not popular in those years and further imports were not liberalized at those times.

All the same, as of 2003, just to treat a 40 Kld of solvent laden pharma effluent, the industry had to go through all the hazzles of the unit operations as in Fig. 2 but then, in the interim till this 2023, there have been advances as cavitation technology and the thermal oxidizers but the industry is comfortable with the "sob stories" to focus on the "pharma-Dollars" and the PCA is not prevailing on such a



Fig.3. The Immersible Pump showing volute flow to the suction and the dry floor (3)

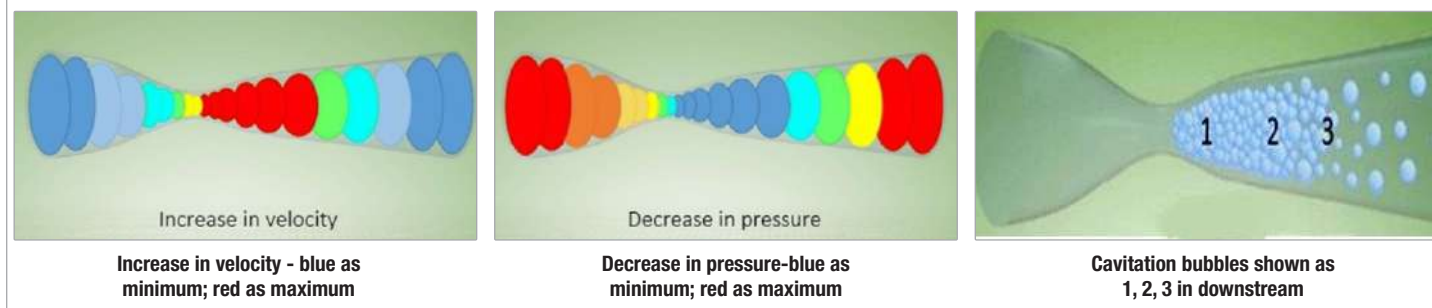


Fig.4. Illustration of Cavitation in Venturi Flow as the on-line sludge free technology.

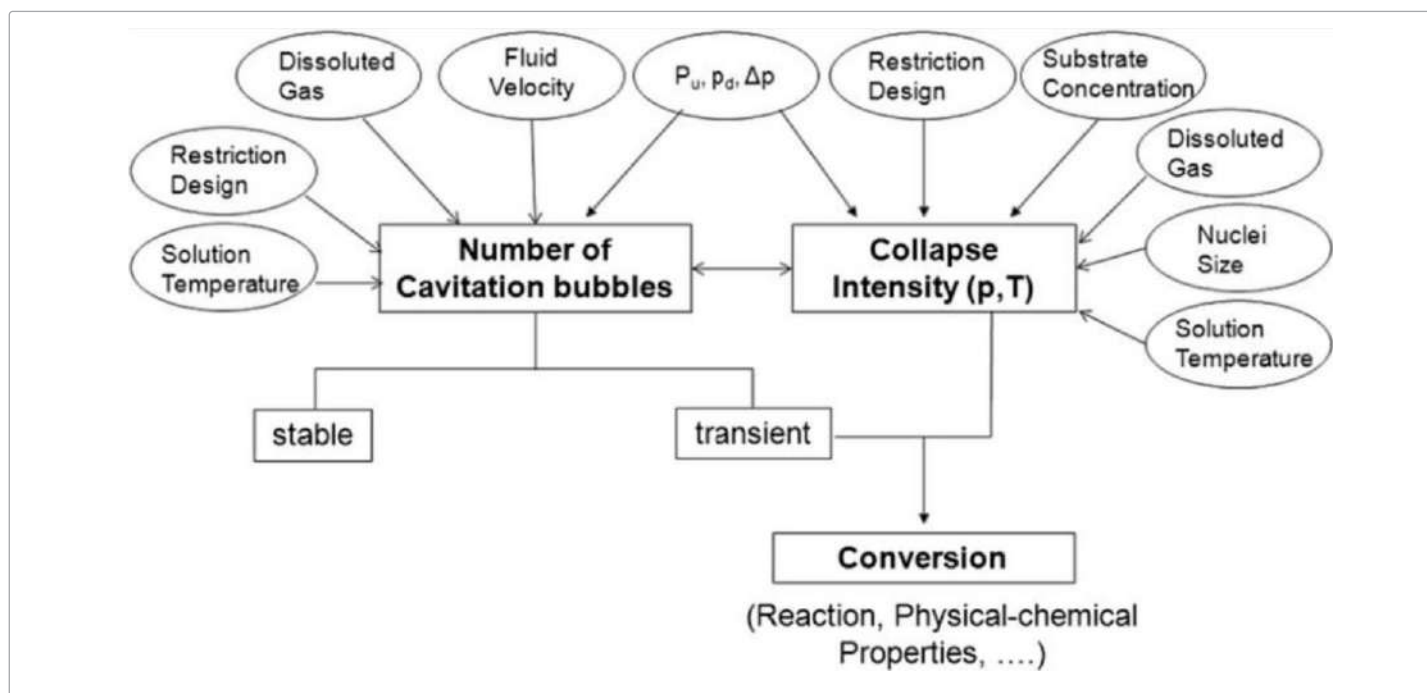


Fig. 5. The Parameters and Variables being Industry and Effluent Specific in Cavitation Technology.

change.

3. The Cavitation Technology

Cavitation is a phenomenon where the static pressure of a liquid reduces to below the vapour pressure, resulting in the formation of small sized vapor-filled cavities in the body of the liquid and when these are subjected to higher pressure, they collapse into constituent gases. In pharmaceutical solvent laden effluents, these break free the carbon and hydrogen and thus the solvent is destabilized as in Fig.4. This is claimed to demonstrate the suitability & efficiency against contaminants (biodegradable, recalcitrant, organic and inorganic) at very low operation costs, simple equipments and no reactants required.

What looks simple is not always easy and this is shown in Fig.5 which brings out the partaking parameters and hence, validation for each application and this is where the in-house R&D is needed.

4. The Thermal Oxidizer Technology

A thermal oxidizer addresses the issue of waste gases such as ammonia, hydrocarbons (C_xH_yO_z), volatile organic compounds (VOC), Hydrogen Sulphide (H₂S), hydrocarbon and volatile emissions with combustion to carbon dioxide (CO₂) and water (H₂O) for exhausting into the air. For a simpler depiction, the concept, velocity and temperature through the system is shown in Fig. 6

Though it may appear to be a very high temperature regime nearing 2000 deg F, in reality, it is only a resident temperature in the oxidizer and the pre-heating of the feed gases are just about 500 deg F. These systems are claimed as among the most efficient technologies for the treatment of volatile organic compounds (VOCs) gas emissions and a process that transforms polluting compounds into products with reduced environmental impact through the following reaction: of VOCs plus Oxygen plus energy into carbon dioxide plus water plus waste heat and the combustion reaction takes place under appropriate conditions of temperature, turbulence and

time. Depending on each process needs, the activation energy necessary to carry out the reaction and the generated heat can be recovered by means of heat exchange units with VOC removal efficiencies nearing almost 99 % with very low maintenance and quick startup and regenerative systems (7), (8).

5. The Paradox of these Pharma ETPs and CETPs

This is best illustrated by the country's oldest Jeedimetla CETP (JETL) at Hyderabad catering to mainly pharmaceutical and chemical industries with a design of 5 million liters daily (MLD) of which 3.5 MLD is domestic sewage and 1.5 MLD is the industrial effluents which are together reported to follow the Physico-Chemical Treatment for removal of suspended solids and the sludge centrifuged and stored in secured landfill (9). The clarified effluent is given biological treatment and the sludge converted into compost. The final treated effluent is sent by a 26 kilo meter pipeline to the city sewage treatment plant (STP) of 260 MLD and disposed into a river course. The high value dissolved solids stream of 0.4 MLD is stated to be put through an evaporator and spray dryer. This issue of using dilution as a method of attaining discharge standards is legally not sustainable under pollution control directives and it needed recourse to the highest court of the country to intercede. The vision is stated to be the ZLD. This however will be for the said 1.5 MLD. Unless technologies as the cavitation or thermal oxidation are pursued, it will only be following the earlier said ETP and all the uncertainties becoming another "carrot before the horse" oddity of sorts, due to the very fluctuating characteristics of the effluent. Even if the JETL pursues these new technologies, the paper work appears to be a daunting task given the existing legislation and procedures of consent to establish (CTE) and consent to operate (CTO) as under.

6. The CTE, CTO and the Water Act Trapeze

For any ETP or CETP to take shape, there is the CTE format which needs to be filled up and got approved. This CTE asks for the details of the proposed ETP /CETP and the consumables to be used. This implies, the promoter designing the said ETP / CETP

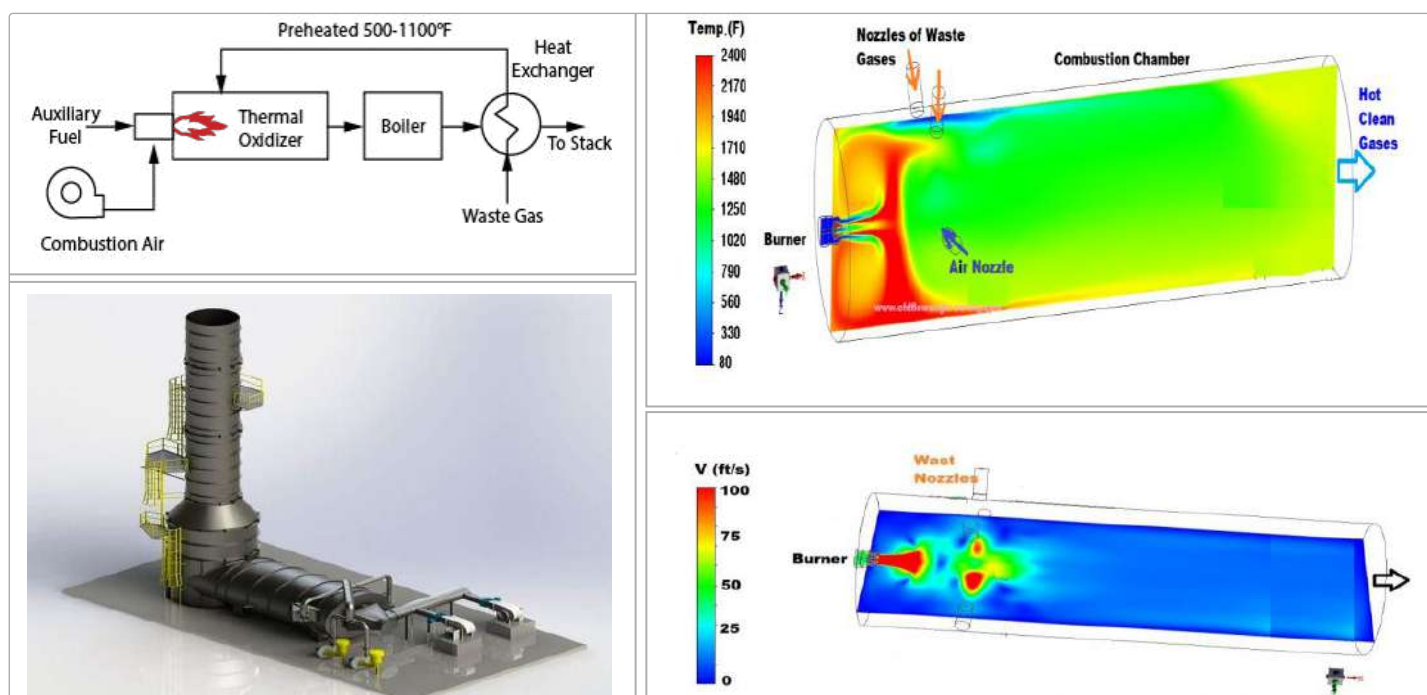


Fig. 5. The Parameters and Variables being Industry and Effluent Specific in Cavitation Technology.

and cull out these details. Leaving it at that, the pollution control administration (PCA) merely puts its stamp and approves it without any changes to the technology and unit sizings. The CTO is similar to ensure the said treatment units are constructed as in the CTE. Thus, the PCA becomes an alibi and thereafter, if the ETP / CETP is unable to produce the designed degree of treatment, strictly speaking the PCA cannot hold the ETP / CETP alone as failing. But then, the familiar “undue influence” by the PCA can prevail on any number of infrastructure say for example a remote inadequate Lumens on the aeration tank. This undue influence (Indian Contract Act) is described as an action by a person deemed to be in a position to dominate the will of another. The fact remains that the PCA's entitlement is supreme and the industry's subservience is ultimate.

This, despite the proviso of section 16 (f) of the water act which lays down the functions of the PCA as “collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control and prepare manuals, codes or guides relating to treatment and disposal of sewage and trade effluents and disseminate information connected therewith” and which by itself is in intra-conflict. To bring it out in simpler terms, suppose the PCA has released the said manuals, codes or guides, etc and suppose the industry has built the ETP / CETP accordingly and suppose further it does not function, it is the PCA which becomes responsible, but, in reality, the PCA can circumvent it by recourse to ever so many intangibles such as the operation and maintenance for instance and on top of it invoking the undue influence and the industry ends up on flat feet. The agonizing part is even if the industry voluntarily can venture to upgrade the system, the CTE has to be re-applied before attempting such upgrade. Thus, the industry is in pursuit to survive lured by the “pharma Dollars” much like the gymnast on the Trapeze in a circus.

7. Some Realistic Insights

7-1. India plays a key role in global pharmaceutical production and a pivotal role in bringing affordable medicine to millions of people worldwide. However, in Hyderabad

and other production hubs around the country, this is argued as coming at an unacceptably high price for the people living in the vicinity of the industries.(10), (11) In the town of Bonthapalle, villagers are reported to avoid eating food grown in their own area and due to highly contaminated water, wells dug far from the town and complain about the constant damage by pollution (13) and at Gaddapotharam village, the groundwater is shown as coloured and the residents are stated as forced to buy water even for secondary domestic purposes as in Fig.7 (10), the pictures foreboding possibly the famous sword of Damocles.

7-3. The Central Pollution Control Board (CPCB) report on 20 large & medium scale pharmaceutical industries in Central Zone revealed that except one or two, the majority are not monitoring the fugitive & source emissions of volatile organic carbons (VOCs) and not even developed the mechanism for them (12). And also puts forth the interlocking of production process with pollution control devices has not been done in almost all the plants and is very much required so that case of non functioning of the pollution control equipment like scrubbers ,solvent recovery process, Incinerator etc. the main production process could stop automatically. (12). This is “amusing” as the CPCB, read, PCA itself defaults on sec 16 (f) of the Water Act in the first place.

7-4. The Environment (Protection) Amendment Rules, 2019, which sets limits on residues of 121 antibiotics in the treated effluents discharged by drug production units (14) claims credit for its foresight in curtailing the anti microbial resistance (AMR) but then, are we really equipped to test these individually is a moot point and it ends up in the good old bio-assay test protocol.

7-5. Currently, India's largest selling drug products are antibiotics, but the fastest-growing are diabetes, cardiovascular, and central nervous system medicines.(15). However, the cost of a reliable diabetic blood sugar test strip continues to rule the roost at about Rupees 20 per strip and takes away a solid Rupees 2400 per month for a retired pensioner senior citizen couple, which is, so to say, cruel, leave alone the daily pricking of the fingers. There are safer saliva based strips and bodily worn

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patches which have never been attempted to affordability despite the industry valued at US\$42 billion (Indian Rupees 300,000 crores) in just one year in 2021.

7-6. The Indian pharmaceutical industry has the advantage of scale & reach in global pharmaceutical space and needs to move up the value chain by scaling up its R&D and innovation, thus helping itself to advance from 'Make in India' to 'Discover and Make in India' (16)

7-7. A pictorial view of these vs the draft standards of 2020 is presented by Shivananda Shetty and Mugundan Ramachandran (17) under the aegis of the Pharmaceutical Supply Chain Initiatives (PSCI) and reproduced in Fig.8 which further illustrates the "quests" with no validated answers.

Pointers

1. The often debated theories of management are like scientific management, administrative management, bureaucratic management, human relations theory, need hierarchy theory, systems management, contingency management, etc. but then the most convenient of all when confronted with the prospect of a change in waste management is procrastination citing the "sob stories". This however cannot go on forever as cautioned by the famous Murphy Law which postulates that "A perpetual holiday is a good working definition of hell".

2. This is all the more imperative in air pollution from volatile organic compounds (VOCs). The PCA is not coming forward with manuals, guidelines etc though mandated under the water act and the industry has to help itself to endear to the people by extricating from the notions of a hilarious (mis)conception of pollute, create health issues and get markets for medicines and instead aim to exist as the "Immaculate Conception"

3. The greatest malady is in the endless wheel of the CTE and CTO because even if R&D of a new technology is to be explored, there are no samples and even if an interventional R&D is to be taken up in the operating systems, this compels "spinning the CTE and CTO wheel" with no Rumpelstiltskin (18) to help out and left with only the straw and not the gold.

4. The Water Act has to be amended to permit the industry to divert about, say, 5 % of raw effluent for the R&D loop to try out newer technologies of treatment and blend the resulting product of the R&D with the existing raw effluent downstream of the R&D

unit.

5. It seems the age-old axiom of "self help is the best help" is the only way out for the pharma waste management in solvents, effluents and VOC related challenges and at least now bring into existence their own R&D center like the CLRI of the tannery sector.

6. After all, creating health issues and making medicines to cure them cannot be "Dharma"

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Fig. 7. The reported coloured ground water of Gaddapotharam village (10) and potential revolt by the villagers someday, depicted by the proverbial Damocles sword (circled)

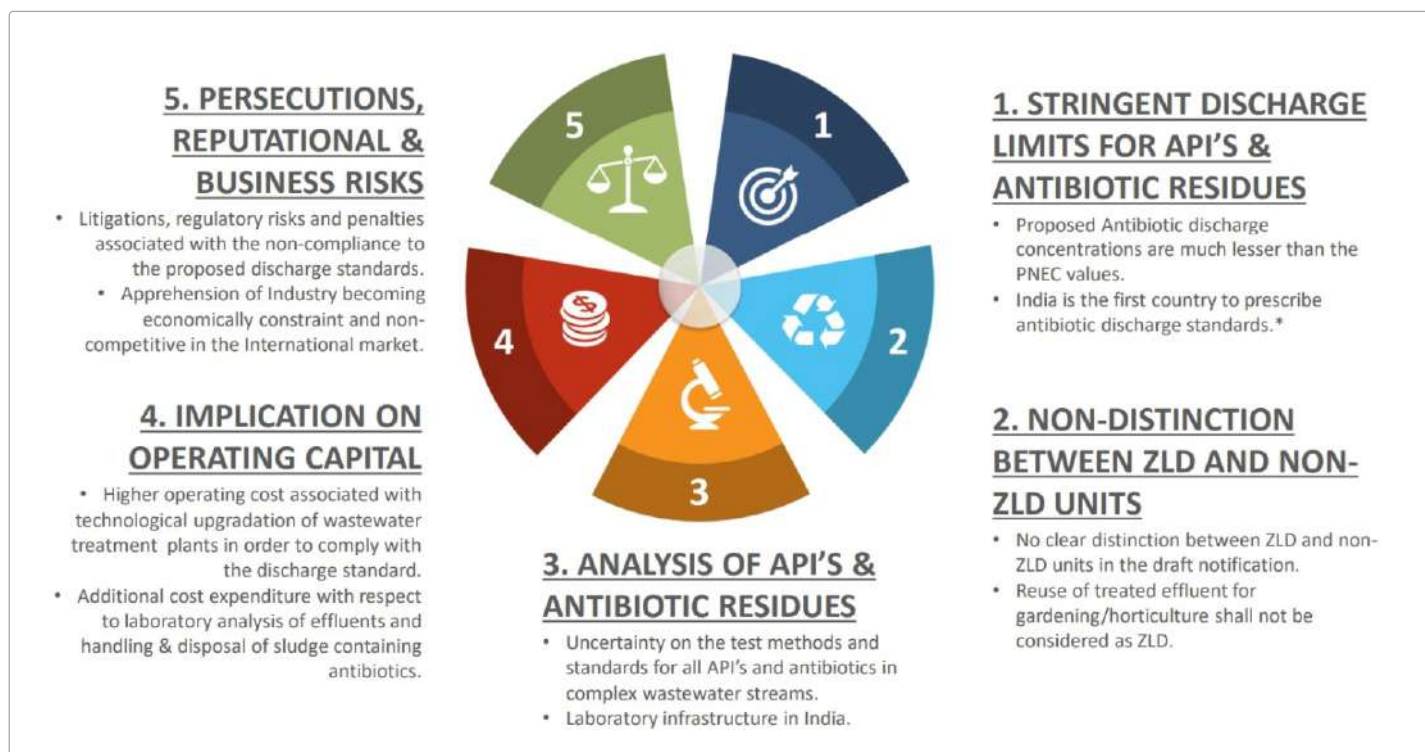


Fig.8. Key Challenges and Ramification for the Indian Pharma Industry (17)

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WATER MANAGEMENT SOLUTIONS FOR THE PHARMACEUTICAL INDUSTRY

By Rajul Parikh, Director, Alfaa UV



Rising concerns about water scarcity are becoming a serious problem in increasing locations, especially in those vulnerable to drought and water shortages. Industries like pharmaceutical that depend on high-quality process water for use in manufacturing may be severely affected by a declining water supply. Industrial businesses are increasingly putting water treatment measures into practise in order to reduce risks associated with potential water shortages and increase their water security.

One of the most important and essential requirements in the pharmaceutical sector is water. The pharmaceutical manufacturing facility uses a number of water treatment techniques, such as distillation, reverse osmosis, UV disinfection, evaporation, and aerobic/anaerobic treatment, amongst others. To meet regulatory standards or prevent the problem of water scarcity, these techniques treat, recycle, reuse, or release water into the environment.

Treating water before using it in the manufacturing of pharmaceuticals is essential. The typical source of water used to serve the pharmaceutical sector is underground water and water from nearby water treatment facilities. While clean water from water supply facilities frequently falls short of the manufacturing quality assurance standards, underground water sources are often characterized by high levels of dissolved materials, primarily manganese, calcium, and magnesium, and may need a greater degree of treatment pharmaceutical businesses must treat their input water sources to get rid of any contaminants or pathogens that

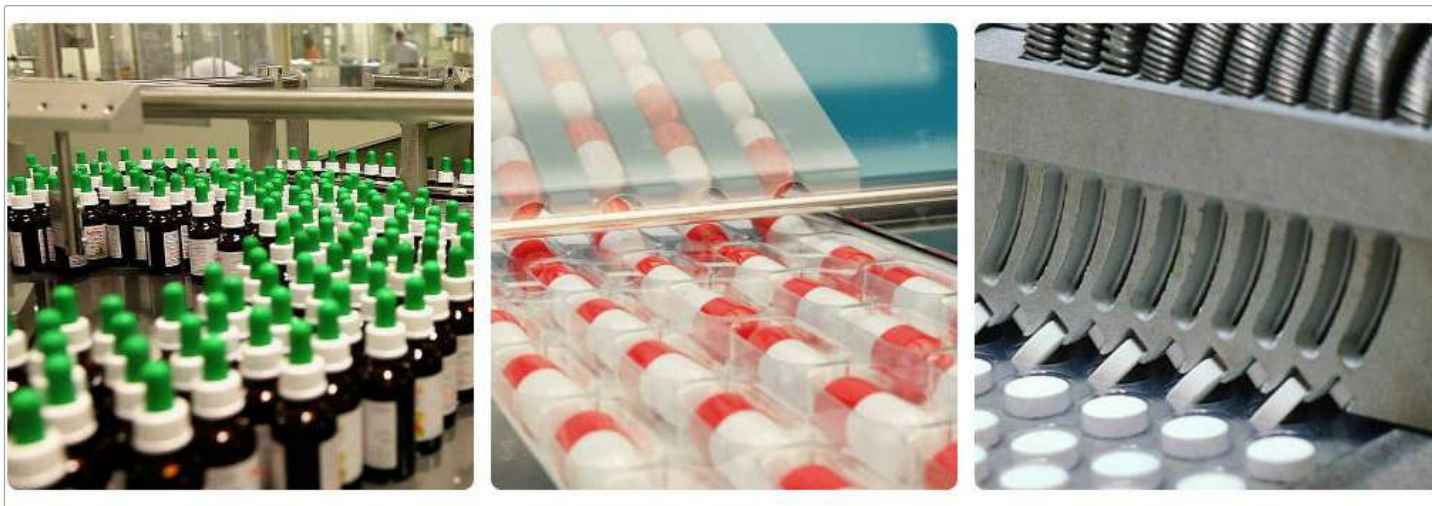
could lower the quality of their products.

In the pharmaceutical sector, purified water is used and applied in a wide range of ways at all stages of the manufacturing process. Let's look at a few instances of how water is used in the industry.

For some medicines, water could be a critical component. Ordinary water, including drinking water, contains traces of pollutants and toxins, hence cannot be used as a medicinal ingredient. For this use, purified and disinfected water must be supplied by a pharmaceutical water treatment system.

Boiler water treatment and cooling water treatment are two of the primary industrial water treatment procedures. Lack of adequate water treatment might cause bacteria and sediments in the boiler housing and pipes to interact. When left untreated, scale or corrosion in steam boilers can result in weak and unsafe machinery. Scale deposits can also mean that more fuel is needed to heat the same amount of water due to a loss in efficiency. Poorly filtered, unclean water can support the growth of bacteria like Legionella, endangering public health. A sizeable part of an industrial site's waste water may be reusable with the right treatment. A cooling water system may develop scale, corrode, and stink, and it may become a home for harmful microorganisms without efficient water treatment. As a result, operations become unreliable and dangerous, efficiency is decreased, and plant life is shortened. Various water treatment technologies can be used to raise or improve the quality of water.





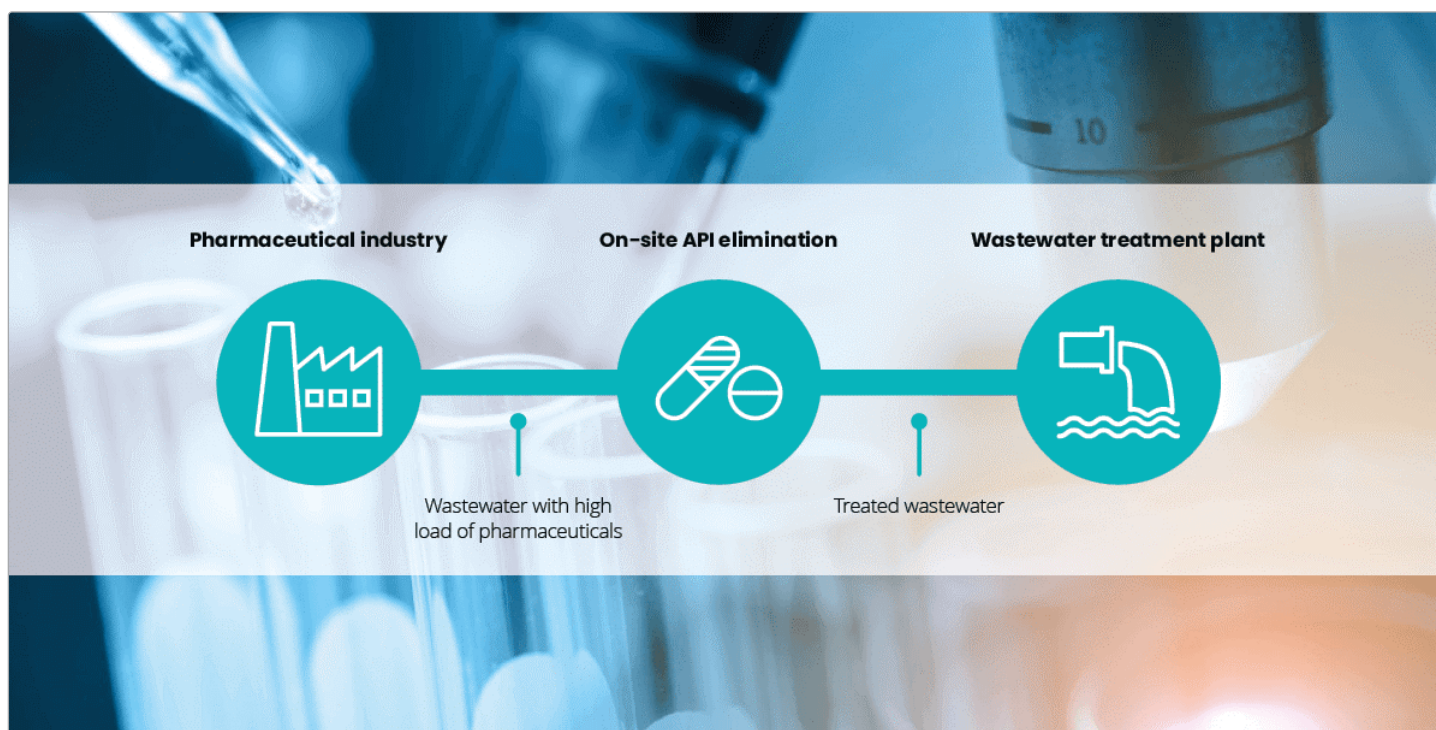
Water Treatment Solutions for the Pharma Industry

Pharmaceutical industries, which employ water as an ingredient or a process catalyst, place a high priority on the usage of purified and high-quality water. Pharmaceutical businesses also rely on filtered water to save money and achieve their environmental aims. The following are a few of the popular water treatment options. For efficient outcomes, these solutions can be applied singly or in combination.

To remove pollutants suspended in water, distillation uses the volatility (difference in vapor pressures) of the water. The water is heated to a boil in a specially designed multi-column distillation facility, and the fumes are then condensed to provide sterile water, which is commonly used for the manufacture of injectibles.

Known as one of the most effective methods for removing dissolved salts and minerals and reducing TDS levels, reverse osmosis (RO) is extensively used in the pharmaceutical industry and other fields where water is a vital resource and raw material. In reverse osmosis (RO), a high-pressure pump pushes water through a semi-permeable membrane that traps microorganisms in the water while allowing the "clean" water to pass, eliminating dissolved pollutants.

UV disinfection is a rapid, effective and inexpensive way to disinfect water for use in pharmaceutical manufacturing processes which require pathogen free water. During this process, UV sterilizers are used to expose the water to UV rays of specific wavelengths, which kill pathogens present in the water such as bacteria, viruses, algae, moulds, etc, and prevent them from replicating. One of the main applications of UV disinfection, aside from the manufacture of medical products, is Cleaning in



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Place (CIP), a method used in the pharmaceutical industry to clean the vessels, apparatus, pipelines, filters, and other accessories used in routine manufacturing activities. Not only does UV help pharmaceutical businesses to adhere to Good Manufacturing Practice requirements (GMP), but also ensures the safety of liquid orals and extends shelf life of such products.

Wastewater treatment in the Pharmaceutical Industry

About 99.99% of the water in pharmaceutical wastewater is in the form of dissolved particles, while the remaining 0.01% is made up of other substances. In general, pharmaceutical wastewater contains chemicals and solvents from quality control, pharmaceutical drugs (API and Excipients) from production, oil and grease from utility and maintenance.

Pharmaceutical wastewater contaminants are a major source of water contamination, so it is required to treat the wastewater and purify it to a prescribed level, especially in the case of reuse. Oil and grease, pH, suspended particles, biological oxygen demand/chemical oxygen demand levels and microorganisms are the key components of pharmaceutical plant waste streams that regulators are often concerned with. Technologies that minimize Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Total Dissolved Solids (TDS) and pathogens in the pharmaceutical effluent include preliminary treatment,

aeration, neutralization, flocculation and coagulation, biological degradation, and UV disinfection. The required quality of the treated water is next tested, and then reused or discharged.

Extending the idea of water reuse, the adoption of zero liquid discharge is a significant trend in the pharmaceutical industry. No water is permitted to exit the plant under the ZLD principle. Plants use cutting-edge technology to clean, recycle, and reuse every drop of wastewater, including membrane filtering and thermal evaporation/crystallization.

Pre-treatment requirements were the main emphasis of water treatment in the past. While pre-treatment continues to be a crucial component, more businesses are taking greater responsibility for cleaning their wastewater streams. Water treatment tactics have grown to incorporate the entire design, rather than only focusing on the front end of the plant.

For the pharmaceutical sector, Alfaa UV offers a wide variety of water treatment products. In order to satisfy your application needs, we offer tailored solutions. With the use of Alfaa UV's solutions, numerous pharmaceutical procedures can use water that complies with FDA regulations. Industry-leading companies like Cipla, Dr. Reddys Laboratories Ltd., amongst numerous other large and small pharmaceutical companies use Alfaa UV water treatment solutions.



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OXYGEN FLOW AND OZONE PRODUCTION - BE YOUR OWN JUDGE

There is a famous saying: Do not reinvent the wheel. With the advent of COVID -19 and the acute shortage of oxygen plants available, many oxygen manufacturers have mushroomed. With very limited knowledge of oxygen manufacturing, they manufacture systems to meet the demand today. Prices have doubled and it's time for all to make hay while the sun shines. The ultimate losers are the end users. Here are some facts that need to be understood in the manufacturing of oxygen plants (in particular reference to feed gas to produce ozone)

Oxygen produced by a PSA oxygen concentrator produces oxygen at about 90 – 93 % purity. It means it will contain at least 90% oxygen content. Air contains only 19-21% oxygen. Obviously when you use oxygen to produce ozone, you will produce a high concentration ozone

Not all the oxygen you feed into the ozone generator is converted to oxygen. Available technology allows only a maximum of 12-12% concentration of ozone with oxygen. Very few ozone generators available in India can produce ozone even at 10% concentration consistently Few ozone systems available in Europe can produce ozone up to 13% concentration consistently

Therefore, when you receive an offer for an ozone system, you can easily find out if the oxygen recommended will ever produce the proposed ozone weight.

Ozone is always measured in terms of concentration. The weight (grams per hour) is only calculated by multiplying the concentration by the flow of oxygen (in M3) . This will give ozone weight in grams per hour

Take a look at this table : ozone concentration will always be measured in g/Nm3 . All ozone measurements equipment provides this figure and the ozone weight is derived by multiplying the ozone concentration with the oxygen flow (in M3/hr)

6% ozone concentration: $1482 \times 6/100 = 88.92 \text{ g O}_3/\text{Nm}^3 \text{ of O}_2$

7% ozone concentration: $1482 \times 7/100 = 104 \text{ g O}_3/\text{Nm}^3 \text{ of O}_2$

8% ozone concentration: $1482 \times 8/100 = 118 \text{ g O}_3/\text{Nm}^3 \text{ of O}_2$

9% ozone concentration: $1482 \times 9/100 = 133 \text{ g O}_3/\text{Nm}^3 \text{ of O}_2$

10% ozone concentration: $1482 \times 10/100 = 148 \text{ g O}_3/\text{Nm}^3 \text{ of O}_2$

11% ozone concentration: $1482 \times 11/100 = 163 \text{ g O}_3/\text{Nm}^3 \text{ of O}_2$

12% ozone concentration: $1482 \times 12/100 = 178 \text{ g O}_3/\text{Nm}^3 \text{ of O}_2$

Factor 1482 is the molecular weight of oxygen in grams

Ozone concentration	5 LPM (0.3 M3/hr)	10 LPM (0.6 M3/hr)	15 LPM 0.9 M3/HR	20 LPM 1.2 m3/HR
6% (88)	26 g/hr ozone	52g/hr ozone	78g/hr ozone	104g/hr ozone
7% (104)	31 g/hr	62g/hr	93g/hr	124g/hr
8% (119)	36 g/hr	72g/hr	108g/hr	144g/hr
10% (148)	44 g/hr	88 g/hr	132g/hr	176g/hr
Oxygen Concentrators required	1 NO	2 NOS	3 NOS	4 NOS

The following table gives you the ozone production at ozone concentration of 6,7,8, and 10 % concentration vis a vis the oxygen feed .

Some Facts on Oxygen and ozone production

- 1) Local oxygen machines produced by either ozone manufacturers or small timer oxygen manufacture do not produce the kind of purity or dew point required for ozone production
- 2) Low dew point feed gas will affect the reliability of the ozone dielectrics causing them to fail requiring frequent maintenance shut down. It's better to source oxygen plants from reputed and time-tested manufacturers. Oxygen required for medical use does not require stringent dew point control unlike that required for ozone production. Not many oxygen manufacturers in India can design system that consistently produce oxygen at -65 Deg dewpoint required for ozone production
- 3) No local machines in India can consistently produce above 10% ozone concentration
- 4) Most of the systems available can produce ozone only between 6-8% concentration
- 5) If any manufacturer tells you that his equipment can produce 100 grams ozone with just 2 oxygen concentrators (10 LPM) it is not feasible and you need to take the statement with a pinch of salt
- 6) If any manufacturer tells you that his equipment can produce 50 grams ozone per hour with one oxygen concentrator (5 LPM) , it also has to be questioned as with 5 LPM oxygen you can never produce more than 30-36 grams of ozone per hour (7-8% concentration)

Very often application failure results due to low ozone dose , because the ozone generator just does not produce the required ozone as it is undersized or it is recommended with not enough oxygen feed gas in order to save on capital costs to beat competition .

ISSUED IN PUBLIC INTEREST BY:

V.BARATHARAJ

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MAJOR EVENTS IN THE HISTORY OF WATER TREATMENT

2000 BC – In Greece and India, writings dated back to 2000BC suggest water treatment methods such as boiling and straining.

1500 BC – The Egyptians discovered the principle of coagulation. They used alum for suspended particle settlement.

500 BC – Hippocrates invented the practice of sieving water, and obtained the first bag filter, which was called the 'Hippocratic sleeve'. The main purpose of the bag was to trap sediments that caused bad tastes or odours.

300-200 BC – Rome built its first aqueducts. Archimedes invented his water screw.

500 – 1500 AD – Water supply was disrupted due to destruction of many aqueducts due to war. No major project related to canals or water treatment was done. Lack of scientific innovations in the Dark ages also delayed the solutions.

1627 – Sir Francis Bacon started experimenting with seawater desalination. He attempted to remove salt particles by means of an unsophisticated form of sand filtration.

1676 – Van Leeuwenhoek first observed water micro organisms.

1700 – The first water filters for domestic application were applied. These were made of wool, sponge and charcoal.

1804 – The first actual municipal water treatment plant designed by Robert Thom, was built in Scotland.

1854 – Discovery was made that linked Cholera epidemic and contaminated water.

1890 – America started building large sand filters to protect public health.

1903 – Water softening was invented as a technique for water desalination.

1914 – Drinking water standards were implemented for drinking water supplies in public traffic, based on coliform growth. It would take until the 1940s before drinking water standards applied to municipal drinking water. In 1972, the Clean Water Act was passed in the United States. In 1974 the Safe Drinking Water Act (SDWA) was formulated. The general principle in the developed world now was that every person had the right to safe drinking water.

1970 – Public health concerns shifted to anthropogenic water pollution such as pesticide residues and industrial sludge and organic chemicals. Techniques such as aeration, flocculation, and active carbon adsorption were applied.

1980 – Membrane development for reverse osmosis was added to the list. Risk assessments were enabled after 1990.

SOURCES

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Quotes on UNION BUDGET 2023-24



TARIQ SIDDIQUI
*Chief Strategist,
TS Advisory Services*

India is on the cusp of growth and following the trail for \$5 trillion economy in next two years requires extraordinary plan and investment. The economic growth depends on social, physical and commercial infrastructure development and above all, availability of clean water takes precedence in all.

The Union Finance Minister while presenting the Budget for 2023-24, has announced a few measures and scheme relevant to water sector. The flagship scheme of Jal Jeevan Mission, which is to be concluded next year as per initial planning, has been given and enhanced budget of INR 70,000 Crore (\$854 million), an increase of INR 10,000 Crore (\$122 million) from the last year allocation. This scheme is transforming rural water supply situation and in over three year's period since its launch, it has already added 78.3 million additional households with functional tap water connections. The task to connect the remaining 83 million rural households in a year time seems very challenging, and we expect that the period of Jal Jeevan Mission needs to be increased to achieve the objective of providing direct water supply in every household in the country.

The Finance Minister also announced a central assistance of INR 5,300 Crore (\$64.6 million) to the drought prone central region of Karnataka to be given to Upper Bhadra Project for creating infrastructure for sustainable micro irrigation and filling up of surface tanks for drinking water purposes. This investment will help easing of water scarcity challenges which Karnataka is facing for a long time.

Another scheme to improve socio-economic conditions of the particularly vulnerable tribal groups (PVTGs) under the Pradhan Mantri PVTG Development Mission will have an allocation of INR 15,000 Crore (\$183.1 million) that will be made available to implement the mission in next three years under the Development Action Plan for the scheduled tribes. Apart from building other basic facilities, clean drinking water and sanitation will also be part of the scheme, helping poor tribal population to have access to clean drinking water and organised sanitation facilities.

However, the total budget allotment has been slashed across multiple sectors and schemes of the central government, there is no particular allocation announced for wastewater treatment and reuse facilities which was widely expected. There should have been targeted plan and investment to reduce water distribution losses in India, which is a big challenge in water sustainability.

The technology adoption in water sector is quite inadequate compared to other developing nations. India having the second largest population and wide spread water stress and unsustainable water usage, we need to have specific plan to invest in technological solutions in water management and wastewater recycling and reclamation projects, while making targeted efforts in reducing water consumptions in agriculture and industrial productions.

With water scarcity looming large over urban India and big challenge of untreated wastewater being discharged into water sources, there has to be concrete framework, robust planning and adequate financial support to tide over the challenges water sector in India is facing and will face in coming years.

Quotes on UNION BUDGET 2023-24



MOHAMMED NASER AZEEZ

*Managing Director,
Aquality Water Solutions Pvt. Ltd.*

Water is the harbinger of economic and social growth of a country. India having such a large human and livestock population is facing a difficult challenge in making provision for clean drinking water for human, commercial and agriculture needs.

The water industry in India were expecting that the Finance Minister will focus on water and wastewater infrastructure development with some new initiatives and good financial allocation given the situation of water stress and increasing water source pollution in the country. There need to be a focussed approach for making water available for people, industries and agriculture so that our efforts towards creating a robust economy will not be hampered.

We at Aquality Water Solutions Pvt. Ltd. welcome the increased allocation for Jal Jeevan Mission projects to the tune of INR 70,000 Crore, an increase of over 16.6% from the last year's allocation. There is still a huge task of making provision of tap water facilities created for 83 million (43% of total) rural households in the country within the remaining period of just over one year as per the Mission's timeline. The development under this mission has so far been successful in making drinking water delivery to an additional 78.3 million rural households since its launch in August 2019. The progress so far has been effective in making clean drinking water provision for 110.6 million (57% of the total households) in the country. The increased investment will certainly help in making better progress of the mission which is being monitored at the highest level.

I have witnessed the severe water stress situations in Karnataka and am happy that the union government has considered it and allocating big amount of INR 5,300 Crore to develop Upper Bhadra Project to provide sustainable micro irrigation and filling up of surface tanks for drinking water for the people in the drought prone central region of Karnataka.

Launching the Pradhan Mantri PVTG Development Mission for improving socio-economic conditions of the particularly vulnerable tribal groups (PVTGs) by providing clean drinking water and sanitation, health etc. With an allocation of INR 15,000 Crore for a period of three years will support the creation of livelihood facilities for the vast tribal population in India.

We are expecting that the Finance Minister will subsequently allocate more resources towards the development of water and wastewater infrastructure while increasing stimulus for technological intervention in water management as both these will be important aspects towards better water sustainability.

Quotes on UNION BUDGET 2023-24



ABDUL RAHMAN MOHAMMED

CEO,

Sahara Industry

The Hon'ble Finance Minister, Smt. Nirmala Sitharaman while presenting the union budget for 2023-24, has announced few new schemes that will also support water sector growth. Although the budget is silent on several key aspects of water sector like wastewater treatment and building sewage treatment and reuse system as the increasing challenges of water contamination due to unrestricted release of both municipal and industrial wastewater into rivers, ponds and other water bodies across the country. Also adopting modern technology for the management of water and wastewater, recycling and reclamation and huge volume of potable water lost in distribution lines should have been considered.

Over the past few years, the government has been taking various initiatives, especially the rural water supply schemes under the ambitious Jal Jeevan Mission (JJM), which started in August 2019 after the Hon'ble Prime Minister announced it in his Independence Day address. We have seen the development of rural water infrastructure in the country and for the current fiscal; the FM has announced a budget increase for JJM projects to Rs.70,000 Crore against the last year allocation of Rs,60,000 Crore. This mission is indeed a game changer for rural households who are getting clean drinking water facilities at their homes. Since its launch, this rural water supply scheme is being implemented on a mission mode and it has already covered almost 57% of the total households (193.63 million) and the new allocation will expedite the projects undergoing to connect the remaining 43% households.

Karnataka has been facing a difficult challenge of water scarcity for many years and inter-state dispute on water is not yet resolved. The Finance Minister has announced the central assistance of Rs. 5,300 Crore to Karnataka for augmenting water supply through Upper Bhadra Project to provide sustainable micro irrigation and filling up of surface tanks for drinking water purposes. This is going to help in easing the water scarcity situation in the drought prone central region of Karnataka.

The Aspirational Blocks Programme covering 500 blocks is launched for providing essential government services across multiple domains such as health, nutrition, education, agriculture, water resources, financial inclusion, skill development, and basic infrastructure. This will help in building and retrofitting water infrastructure for resource augmentation that will support in making drinking water facility available for the people.

Rs. 15,000 Crore allocation for three years to improve socio-economic conditions of the particularly vulnerable tribal groups (PVTGs) under the Pradhan Mantri PVTG Development Mission will also help in creating and improving clean drinking water and sanitation infrastructure in the tribal areas apart from other basic facilities like education, health and road connectivity.

We are hopeful that all these projects and dedicated investment will help increasing the market size of water and wastewater treatment equipment, membranes, chemicals and other ancillaries.



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The laptop screen displays the cover of the 'Everything About Water' magazine. The cover has a blue background with a white water drop icon and the text 'EVERYTHING ABOUT WATER' in large, bold, white letters. Below this, it says 'INDUSTRIAL WATER MANAGEMENT' in a similar font. At the bottom, there is a photograph of an industrial water treatment facility with large circular tanks and pipes. The text 'INDUSTRY SPOTLIGHT' is visible above the photo, followed by a list of topics: 'Lab & Field Instruments, Filters & Filter Components, Activated Carbon, RO Systems, Submersible Pumps'.

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TENDERS

OWNERSHIP:

Authority : State Government

Location : Rajasthan - India

Tender Value : ₹ 4,860,000.00

Closing Date: 27-4-2023

Ref No: 57745580

Drain construction work for Rainwater Harvesting from Military Area Fencing Line to Budh Vihar Park.

* Civil Works

OWNERSHIP:

Authority : State Government

Location : Madhya Pradesh - India

Tender Value : N.A

Closing Date: 11-4-2023

Ref No: 57739517

Balance works of Survey, Review the Designs, Redesign where necessary and Build Sewage Collection and Conveyance System, Sewage Treatment and Disposal System of Barwani Nagar Palika

1 Balance works of Survey, Review the Designs, Redesign where necessary and Build Sewage Collection and Conveyance System, Sewage Treatment and Disposal System of Sendhwa Nagar Palika,

OWNERSHIP:

Authority : State Government

Location : Madhya Pradesh - India

Tender Value : N.A

Closing Date: 11-4-2023

Ref No: 57746444

Balance works of Survey, Review the Designs, Redesign where necessary and Build Sewage Collection and Conveyance System, Sewage Treatment and Disposal System of Barwani Nagar Palika, District of Madhya Pradesh

OWNERSHIP:

Authority : State Government

Location : Madhya Pradesh - India

Tender Value : N.A

Closing Date: 11-4-2023

Ref No: 57758552

Balance works of survey, review the designs, redesign where necessary and build Sewage collection and conveyance system, Sewage Treatment and disposal system of sendhwa nagar palika, district

barwani, of madhya pradesh

OWNERSHIP:

Authority : State Government

Location : Rajasthan - India

Tender Value : ₹ 553,000,000.00

Closing Date: 3-4-2023

Ref No: 57736879

Construction of STPs and reuse of treated water, sewer network in hospital at Ajmer, Jodhpur, Udaipur and Jhalawar with 10 years of operation and maintenance of entire system.

OWNERSHIP:

Authority : State Government

Location : Rajasthan - India

Tender Value : ₹ 553,000,000.00

Closing Date: 3-4-2023

Ref No: 57762858

Construction of STPs and reuse of treated water, sewer network in hospital at with 10 years of operation and maintenance of entire system.

OWNERSHIP:

Authority : State Government

Location : Multi State - India

Tender Value : ₹ 47,194,723.00

Closing Date: 27-3-2023

Ref No: 57723365

Provision of STP of 200 KLD.

OWNERSHIP:

Authority : State Government

Location : Gujarat - India

Tender Value : ₹ 377,474,752.00

Closing Date: 3-4-2023

Ref No: 57736017

survey design And Construction Of WTP @ Khambhara Hw And Lakhapar Hw , Rcc U/G Sump, Pump House At Various Places & Civil Works & Providing, Supplying, Lowering, Laying & Jointing Pipeline & Supply, Installation, Testing & Commissioning Of Pumping Machinery With Operation & Maintenance Of All Type Machineries For 5 Yrs. Under Anjar Regional Water Supply Scheme Taluka -anjar Of District Kutch.

OWNERSHIP:

Authority : Central Government/Public Sector

Location : Tamil Nadu - India

Tender Value : ₹ 6,998,441.00

Closing Date: 27-3-2023

Ref No: 57736677

Annual Cleaning and Maintenance of Existing sewer lines, storm water drains, water pipe lines and repairs of drains (SW-I), and Operation & maintenance of effluent Treatment Plant at Locoworks/Perambur (SW, II).

OWNERSHIP:

Authority : State Government

Location : Delhi - India

Tender Value : N.A

Closing Date: 27-3-2023

Ref No: 57762245

Upgradation and capacity Augmentation of Keshopur STP Phase-I from 12 MGD to 18 MGD along with 11 years comprehensive operation and maintenance.

OWNERSHIP:

Authority : State Government

Location : Delhi - India

Tender Value : N.A

Closing Date: 27-3-2023

Ref No: 57763421

Augmentation/up-gradation of existing STPs under Pkg- 5 of liquid stream.

OWNERSHIP:

Authority : Central Government/Public Sector

Location : Punjab - India

Tender Value : ₹ 47,194,723.00

Closing Date: 27-3-2023

Ref No: 57770101

Provision of STP of 200 KLD.

OWNERSHIP:

Authority : Corporations/Associations/ Others

Location : Jammu-kashmir - India

Tender Value : ₹ 1,000,000.00

Closing Date: 24-3-2023

Ref No: 57739503

Maintenance/ damaged works (i any) including pety works 10 be executed at sie as per the necessity! demand/ emergent nature for up-keeping restoration/ protection of water conduc-l tor and project raod of chep-1 (stage contract) 3rd call.

OWNERSHIP:

Authority : State Government

Location : West Bengal - India

Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57739508

Construction of arsenic-cum-iron removal Plant (airp) for hamidpur piped water supply scheme at kaliachak-ii block under malda arsenic area w/s division, p.h.e.dte. in the district of .(2nd call).

OWNERSHIP:

Authority : State Government

Location : West Bengal - India

Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57739515

Construction of arsenic-cum-iron removal Plant (airp) for kadamtala piped water supply scheme at



TENDERS

kaliachak-ii block under arsenic area w/s division, p.h.e.dte. in the district of .(2 nd call).

OWNERSHIP:

Authority : State Government
Location : West Bengal - India
Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57739519

Construction of arsenic-cum-iron removal Plant (airp) for khaschandpur piped water supply scheme at kaliachak-i under arsenic area w/s division, p.h.e.dte. in the district of .(2nd call)

OWNERSHIP:

Authority : State Government
Location : West Bengal - India
Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57739524

Construction of arsenic-cum-iron removal Plant (airp) for mobarakpur piped water supply scheme at kaliachak-ii block under arsenic area w/s division, p.h.e.dte. in the district of .(2nd call)

OWNERSHIP:

Authority : State Government
Location : West Bengal - India
Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57739528

Construction of arsenic-cum-iron removal Plant (airp) for mosimpur piped water supply scheme at kaliachak-i block under arsenic area w/s division, p.h.e.dte. in the district of .(2nd call)

OWNERSHIP:

Authority : State Government
Location : West Bengal - India

Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57739535

Construction of arsenic-cum-iron removal Plant (airp) for alipur piped water supply scheme at kaliachak-i block under arsenic area w/s division, p.h.e.dte. in the district of .(2nd call)

OWNERSHIP:

Authority : State Government
Location : Jammu-kashmir - India
Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57763834

Construction, Testing and Commissioning of Rapid Sand Filtration Treatment Plants (Pre-Settling Tank, Flash Mixer, Clari-flocculator, filter House, Clear Water Chamber, electro-mechanical works etc.) of PHE Division FBI TAN

OWNERSHIP:

Authority : State Government
Location : Jammu-kashmir - India
Tender Value : N.A.

Closing Date: 22-3-2023

Ref No: 57763836

Construction, Testing and Commissioning of Rapid Sand Filtration Treatment Plants (Pre-Settling Tank, Flash Mixer, Clari-flocculator, filter House, Clear Water Chamber, electro-mechanical works etc.) of PHE Division URI

OWNERSHIP:

Authority : State Government
Location : Uttar Pradesh - India
Tender Value : 228,500,000.00

Closing Date: 21-3-2023

Ref No: 57773384



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EVENT CALENDAR



FEBRUARY 2023

Water & Wastewater Equipment, Treatment & Transport (WWETT Show)

Mon, 20 - Thu, 23 Feb 2023
Indianapolis, USA
www.wwettshow.com/en/home.html

Water Expo

Thu, 09 - Sat, 11 Feb 2023
Kochi, India
www.waterindia.net

Water Today's Water Expo

Thu, 23 - Sat, 25 Feb 2023
Chennai, India
www.watertoday.org/

InterAqua 2023

1 February, 2023 to 3 February, 2023
Tokyo Big Sight, Japan
www.interaqua.jp/eng/index.html

Water & Solid Waste Expo 2023

16-18 February 2023
Pragati Maidan, New Delhi, India
watersolidwaste.com

World Water-Tech Innovation Summit 2023

21 February, 2023 to 23 February, 2023
London, United Kingdom
worldwatertechinnovation.com/

MARCH 2023

India Smart Utility Week (ISUW) 2023

Wed, 01 - Sat, 04 Mar 2023
Lalit Hotel, New Delhi
<http://www.isuw.in>

Watertech China

Thu, 09 - Sat, 11 Mar 2023
Guangzhou, China
<http://expo.watertechgd.com>

New England Water Well Expo

Fri, 10 - Sat, 11 Mar 2023
Marlborough, USA
www.newwassociation.org

Netherlands Aqua Trade Fair

Tue, 21 - Thu, 23 Mar 2023

Gorinchem, Netherlands
expotobi.com/aqua-nederland-vakbeurs

Oman Sustainability Week (OSW)

Sun, 12 - Thu, 16 Mar 2023
Muscat, Oman
www.omansustainabilityweek.com/

Watercon Conference

Mon, 20 - Thu, 23 Mar 2023
Springfield, USA
www.isawwa.org/mpage/Microsite_Registration

Water Korea

Tue, 21 - Thu, 23 Mar 2023
Goyang-si, South Korea
<http://waterkorea.kr>

Water Philippines Expo & Conference

Wed, 22 - Fri, 24 Mar 2023
Pasay, Philippines
www.waterphilippinesexpo.com/

Waptema Water Expo

March 3 - 5, 2023
Netaji Subhash Place, Pitampura, New Delhi
waptema.in/

Water India

Mon, 27 - 29 Mar 2023
New Delhi, India
www.waterindia.com/

KRWA Conference & Exhibition

Tue, 28 - Thu, 30 Mar 2023
USA
www.krwa.net

Canadian Underwater Conference and Exhibition (CUCE)

Sun, 26 - Tue, 28 Mar 2023
Halifax, Canada
www.underwaterconference.ca

APRIL 2023

Smart Water Systems

Mon, 17 - Tue, 18 Apr 2023
London, UK
www.smartwater.com/

CIFA Water Infrastructure Summit

April 11-14, 2023

Washington, D.C., USA
www.cifanet.org/summit

Water Expo

14-16 April 2023
DC Ground, Yerwada, Pune, India
tradeshows.tradeindia.com/watere-xpo-pune

WQA Convention and Exposition

18 April, 2023 to 20 April, 2023
Las Vegas, United States
www.wqa.org/convention/

Texas Water

Tue, 11 - Fri, 14 Apr 2023
Houston, USA
www.txwater.org

IE Expo China

April 19-21, 2023
Shanghai, China
www.ie-expo.com

SDARWS Rural Water Expo

April 26-27, 2023
Rapid City, SD, USA
<https://www.sdarws.com/expo.html>

Beijing International Irrigation Technology Expo

April 26-28, 2023
CNCC, Beijing, China
expotobi.com/irrigation-technology-expo

MAY 2023

World Utilities Congress

May 08-10, 2023
ADNEC, Abu Dhabi, UAE
www.worldutilitiescongress.com

AZ Water Conference & Exhibition

Tue, 09 - Thu, 11 May 2023
Phoenix, USA
www.azwater.org

Ozwater 2022

10 May, 2023 to 12 May, 2023
Brisbane Convention & Exhibition Centre
Australia
www.ozwater.org/

Watrex Expo

Mon, 15 - Wed, 17 May 2023
Cairo, Egypt

waterexpo.com

Trenchless Asia

17 May, 2023 to 18 May, 2023
Kuala Lumpur Convention Centre, Malaysia
www.trenchlessasia.com/

Water and Plumb Skills Expo

18 May 2023 - 19 May 2023
Pragati Maidan, New Delhi, Delhi
www.plumbskillsexpo.com

Water Expo- Bangaluru

18 May 2023- 20 May 2023
BIEC, Bangalore, India
waterindia.net

Water Management Show

May 11-13, 2023
ICCB, Dhaka, Bangladesh
10times.com/water-management-show

E-World Energy & Water Exhibition

May 23-25, 2023
E-World Energy & Water Exhibition
www.e-world-essen.com

JUNE 2023

Watertech Africa

01 - 03 Jun 2023
Kenyatta International Convention Centre, Nairobi, Kenya
expogr.com/watertech

Aquatech China

05 - 07 Jun 2023
National Convention & Exhibition Center, Shanghai, China
www.aquatechtrade.com/china

World Environment Expo

05 - 07 Jun 2023
Pragati Maidan, New Delhi, India
worldenvironment.in

Algeria Electricity & Water Expo

05 - 07 Jun 2023
Algiers, Algeria
expotobi.com/algeria-electricity-water-expo

Power & Water Nigeria Exhibition & Conference

20 - 22 Jun 2023
Lagos, Nigeria
pnwnigeria.com

EVENT CALENDAR



African Smart Cities Summit
28 Jun 2023
Gallagher Convention Centre,
Johannesburg, South Africa
10times.com/asc-summit

JULY 2023

European Water And Wastewater Management Conference And Exhibition
04 - 05 Jul 2023
The Point at Lancashire County Cricket Club, Manchester, UK
ewwmconference.com

IFAT Africa
05 - 07 Jul 2023
Gallagher Convention Centre,
Johannesburg, South Africa
www.ifat-africa.com

INDO WATER
05 - 07 Jul 2023
Jakarta Convention Center, Jakarta, Indonesia
indowater.com

West Africa Water Expo
11 - 13 Jul 2023
Landmark Centre, Lagos, Nigeria
elanexpo.net/waweexpo

Delhi Water Expo
13 - 15 Jul 2023
Pragati Maidan, New Delhi, India
www.waterex.biz

Milwaukee Air and Water Show
22 - 23 Jul 2023
Milwaukee Lakefront, Milwaukee, USA
mkeairwatershow.com

AUGUST 2023

18th EverythingAboutWater Expo 2023
Thu, 03 - Sat, 05 Aug 2023
Pragati Maidan, New Delhi
www.eawaterexpo.com

The Water Expo
Wed, 23 - Thu, 24 Aug 2023
Miami, USA
www.thewaterexpo.com/

SEPTEMBER 2023

Water Indonesia
Wed, 13 - Sat, 16 Sep 2023
Jakarta, Indonesia
www.waterindonesiaexpo.com/

THAI WATER
Wed, 30 Aug - Fri, 01 Sep 2023
Bangkok, Thailand
www.thai-water.com

SR Onshore Wind Conference
Wed, 06 Sep 2023
Glasgow, UK
www.scottishrenewables.com

Gat Wat
Wed, 06 - Thu, 07 Sep 2023
Cologne, Germany
www.gat-wat.de

WasteEcoExpo
Tue, 12 Sep 2023
Krasnogorsk, Russia
en.waste-tech.ru

Taiwan International Water Week
Wed, 20 - Fri, 22 Sep 2023
Taipei, Taiwan
www.taiwanintlwaterweek.com

WCW Conference & Exhibition
Mon, 25 - Thu, 28 Sep 2023
Saskatoon, Canada
www.wcwwa.ca/page/AnnualConf

OCTOBER 2023

Wetex
Mon, 02 - Wed, 04 Oct 2023
Dubai, UAE
www.wetex.ae

IFAT India
Wed, 18 - Fri, 20 Oct 2023
Mumbai, India
www.ifat-india.com

Pak Water & Energy Expo
Wed, 25 - Fri, 27 Oct 2023
Lahore, Pakistan
pakwaterexpo.com

AWT Convention and Exposition
Wed, 04 - Sat, 07 Oct 2023
Grand Rapids, USA
www.awt.org/events/annual-convention

Envitech
Tue, 10 - Fri, 13 Oct 2023
Brno, Czech Republic
<http://envitech.co.in>

VietWater
Wed, 11 - Fri, 13 Oct 2023
Ho Chi Minh, Vietnam
www.vietwater.com/en

Water In Industry
Tue, 31 Oct 2023
Moscow, Russia
www.aquatechtrade.com/news/industrial-water

NOVEMBER 2023

Water Loss Forum
01 - 03 Nov 2023
Lutfi Kirdar International Convention & Exhibition Center, Istanbul, Turkey
www.waterlossforum.org

Aquatech Amsterdam
06 - 09 Nov 2023
RAI, Amsterdam, Netherlands
www.aquatechtrade.com/amsterdam/

The International Water Conference
12 - 16 Nov 2023
San Antonio Marriott Rivercenter, San Antonio, USA
iwconf.org

Smart City Expo - Dubai
14 - 15 Nov 2023
The Ritz-Carlton, Dubai, UAE
10times.com/smart-cities-nh

WETEX and Dubai Solar Show
15 - 17 Nov 2023
Dubai World Trade Centre, Dubai, UAE
www.wetex.ae

Myanwater
16 - 18 Nov 2023
Myanmar Expo, Yangon, Myanmar
myanwater.com

Sand Water Rv Expo
17 - 18 Nov 2023
Lake Havasu State Park, Lake Havasu, USA
sandandwaterexpo.com

Cairo Water Week
29 Oct - 02 Nov 2023
Cairo, Egypt

DECEMBER 2023

Water Bangladesh International Expo
07 - 09 Dec 2023
International Convention City Bashundhara (ICCB), Dhaka, Bangladesh
www.water-exhibition.com

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best practices and showcase next generation technologies and products in smart energy and smart cities domains. ISUW 2023 will include plenaries, interactive workshops, keynotes, technical sessions, technical paper presentations and master classes from tutors from the USA and Canada. Bi-lateral Smart Grid workshops with EU, USA, Sweden, Germany, France are also expected to be a part of the upcoming edition. 7th edition of ISGF Innovation Awards 2023 will be organised as part of ISUW 2023 on 03 March 2023.

Date: 01-04 March 2023

Venue: Lalit Hotel, New Delhi

Website: <http://www.isuw.in/>

India SMART UTILITY Week 2023
01 - 04 March 2023
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SPRING Water Summit

SPRING project (funded by the Government of India and the EU Commission under Horizon 2020) is convening actors from the Indian, EU and Nordic water sector to join in a multilateral summit on March 9-10, 2023 in New Delhi. The summit enables direct interaction with high-level stakeholders in the Indian water sector including high-quality B2B meetings between EU/Nordic and Indian companies.



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 The European Union Horizon 2020 research and innovation programme under Grant Agreement No. 821425
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Date: 09-10 March 2023
Venue: New Delhi, India
Website: <https://inwf.in/summit/>

Water India Expo

Water India expo strives for a sustainable future with clean water for India, making every drop count. Offering Solutions in Clean Water Management for Urban and Rural Water requirements the show brings together Government Missions, Municipalities and Industrial Bodies that are making efforts to conserve this natural resource by storing, reusing, recycling and reducing wastage. The expo is a one-of-a-kind international forum bringing the latest technologies to life and redefining the water sector.



Set to be bigger and even better, the Water India expo 2023, co-located with the Smart Cities India expo, offers unparalleled business opportunities to both domestic as well as international players from the water industry, to offer solutions that have the potential to revolutionise the water space and define better water management services for the citizens.



Date: 27-29 March 2023
Venue: Pragati Maidan, New Delhi, India
Website: www.waterindia.com



18th EverythingAboutWater Expo 2023

18th EverythingAboutWater Expo 2023 is one of the most unique & comprehensive annual events in India showcasing the latest technologies & solutions in the water sector. Also, recognized as South Asia's largest water event during recent times, this is a perfect gateway for stakeholders from across the globe to penetrate into the vast & dynamic ecosystem of the Indian Water & Waste management industry to share business opportunities, network & explore innovative water solutions.

The 18th EverythingAboutWater Expo 2023 will offer unparalleled business opportunities to both national as well as international players from the water industry to learn, explore the future trends in the Indian water market

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Venue: Pragati Maidan,
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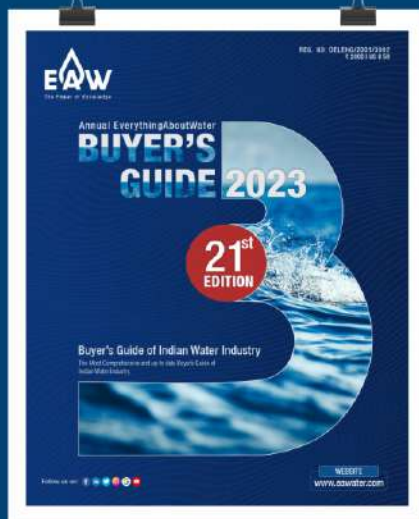
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