

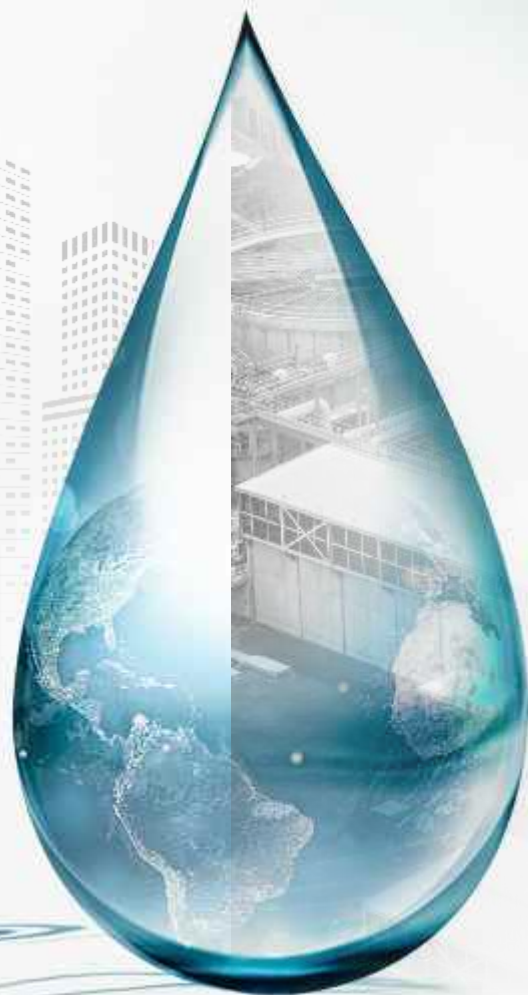


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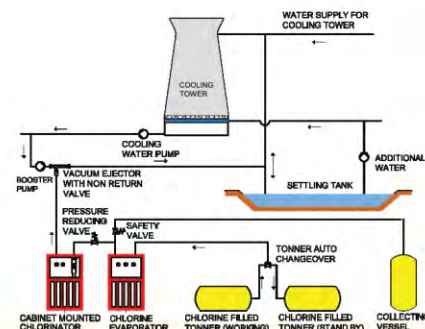
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Water Recycle, Reuse & Zero Liquid Discharge



Dear Readers,

We all agree to the fact that water is a valuable resource available in limited quantity and essential to the existence of the human race. Just like any other valuable resource it becomes mandatory that we use water carefully and most importantly recycle it and reuse it. Water reuse and recycling makes the non-potable wastewater useful, thus saving the economic and environmental costs related to establishing new water supplies.

There are a few facts about water that all of us need to keep in mind and its very important that we remember them, so that we have enough water, which would ensure we live a healthy life and have enough that we can pass to our next generation. Water is a finite source. According to the Food and Agriculture Organisation (FAO), "water is a finite resource: there are some 1,400 million cubic kilometres on earth and circulating through the hydrological cycle. Nearly all of this is salt water and most of the rest is frozen or is underground. Only one-hundredth of 1 percent of the world's water is readily available for human use." What this means is that usable water that is available for use by humans, is a small fraction, of the water that is available on this earth, and that we need to use it judiciously.

At a global level, about 359 billion cubic metres of wastewater is produced each year which is equivalent to the size of about 144 million Olympic-sized swimming pools. As per a report by the Central Pollution Control Board 'Status of sewage treatment in India' the estimated sewage generation from Class I cities and Class II towns (as per 2001 census) is 29,129 MLD and this is expected to be 33,212 MLD at present assuming 30% decadal growth in urban population. We can use this wastewater, to our advantage, if the same can be recycled. The reality however, is very different. As per UN water, globally, 80% of wastewater flows back into the ecosystem, without being treated or reused, contributing to a situation where around 1.8 billion people use a source of drinking water that is contaminated with faeces, putting them at risk of contracting cholera, dysentery, typhoid and polio. As per a study by Lancet, in 2019, pollution was responsible for 2.3 million premature deaths, in India. Out of this air pollution was responsible for 1.6 million deaths, and around five lakh deaths were caused due to water pollution.

We are the second most populated country, in the world, after China, and have about 17.1% of the world population but only have 4% of the world's water. That itself creates a mismatch where close to 17% of the world population has to make good with just 4% of the world's water. The pressures of increasing population and rapid industrialization have only increased the stress on water. As per government data, the average annual per capita water availability in the years 2001 and 2011 was assessed as 1,816 cubic meters and 1,545 cubic meters respectively which may further reduce to 1,486 cubic meters and 1,367 cubic meters in the years 2021 and by 2031 respectively.

Looking at our situation, it comes becomes clear that reduction in water usage, recycling and reusing of the waste water and adopting technologies such as Zero Liquid Discharge are the need of the hour and a necessity in case we want to pass on the valuable resource called Water to our future generations... It is time to think and Act...

thanks & regards,

Deepak Chaudhary

*Senior Manager – Content &
Business Development*



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A LOWDOWN ON SELECT EVENTS RELATED TO THE WATER

MEGHALAYA GOVERNMENT IMPLEMENTING PROJECTS WORTH RS 2,000 CRORE, CHIEF MINISTER SAYS

The Meghalaya government is implementing projects worth Rs 2,000 crore, Chief Minister Conrad K Sangma said on Thursday, September 1. Sangma and MoS Housing and Urban Affairs on Thursday laid the foundation for the prestigious - "Phase I" in presence of PHE Minister Renikton Lyngdoh Tongkhar and MLAs Marcuise Marak, Jim Sangma and Abdus Saleh at Williamnagar in East Garo Hills.

Williamnagar Urban Water Supply Project Phase-I was sanctioned at an estimated cost of Rs 121 Crores under AMRUT 2.0 in the funding pattern of 90:10. The Scheme was accorded sanction under AMRUT 2.0 by the Ministry of Housing and Urban Affairs, Government of India. This Scheme will cater to the water demand of the town up to the year 2050.

Under Phase - I of the project, construction of intake, laying of 500mm dia MS Gravity Main, construction of Treatment Plant, laying of MS Feeder Mains, construction of 8 (eight) out of 14 (fourteen) Elevated Service Reservoirs and laying of HDPE distribution pipes to 4 Wards of the Town, covering a total of 7229 households, are proposed.

The other components of the project viz construction of remaining 6 (six) ESRs, laying of new distribution system to remaining wards, construction of approach roads, drawal of the power line, construction of staff quarters in WTP & Control area, improvement of existing water supply scheme and installation of monitoring system (SCADA) will be implemented under Phase-II of the Project.

The present population of Williamnagar Urban Area, having 48 localities and office colonies, works out to be 56,412 people and 7,992 Households projected over 2011 census along with institutional and office population.



The prospective population considered for the next 15 years that is the year 2030 works out to be 96447 people and the ultimate population for the next 30 years 2045 is 142118 people.

The source of water named "Chibe" Stream was identified and dry weather discharge of this source was found adequate to meet the ultimate demand of the scheme i.e. 8,33,335.00 litres/day.

The capacity of the Treatment Plant is 15.00 Million litres per day. The Chief Minister expressed his gratitude to the MoS for laying the foundation during the 75th birth anniversary of the Late Purno A Sangma. "We remember him as a person who committed himself to work for the progress of the state and the country", the Chief Minister said.

He also thanked the Ministry for extending all support for sanctioning the project for the overall interest of the State and particularly for the people of Williamnagar town.

The Chief Minister also lauded the efforts of the PHE department, Minister and local MLA for taking the initiative to push for the project. He also took the opportunity to inform the gathering about different projects under the water supply scheme. He said that projects amounting to Rs 2000 crore are currently being implemented in the State.

He also informed that under Jal Jeevan proposals worth 3000 crore are under the advanced stage of consideration by the Government of India.

Talking about various initiatives taken for development in East Garo Hills, he said a project worth Rs 25 crore for improving internal road projects in Williamnagar is currently underway.

"Government has taken the initiative for change and Meghalaya has made rapid strides in many of the developmental indexes in the past 4.5 years", he added.

ATER NEWS

SECTOR FROM ACROSS THE COUNTRY



INDIAN OIL TO SPEND 2 LAKH CRORE TOWARDS ZERO EMISSIONS BY 2046

State-owned oil refining and marketing major Indian Oil Corporation (IOC) plans to invest 2 lakh crore in the coming years to achieve 'net zero' operational emissions by 2046.

The company aims to achieve two-thirds of emission reduction through energy efficiency, electrification and fuel replacement efforts. About a third of the total emission would be mitigated through options such as carbon capture utilisation and storage (CCUS), nature-based solutions and the purchase of carbon credits.

Further, IOC will pursue carbon reduction through hydrogen as a fuel, biofuels, renewable, carbon offsetting through ecosystem restoration and CCUS, says Shrikant Madhav Vaidya, chairman and managing director of Indian Oil.

Its greenhouse gas (GHG) emissions currently stand at around 21.5 million metric tonnes (MMT) of carbon dioxide equivalent (MMT CO₂e) per annum with the refining and petrochemical operations being the major source of emissions, close to 97% and another 2% from fuel transportation. The bulk of these emissions is due to direct fuel burning for deriving energy from heat, steam, electricity, and cooling, as required in operations. "We already have a well-crafted blueprint in place, with a multi-pronged approach to take us gradually towards the Net Zero destination," SM Vaidya says.

He says the IOC has formed an alliance with the 'National Mission for Clean Ganga' for reusing the effluent from the city sewage treatment plant for the operations in its Mathura refinery. This project will soon be implemented and would help conserve nearly 20 million litres of Yamuna water every day. This will be among a select few refineries in

the world to achieve such a green breakthrough and IOC is planning to replicate this model in other refineries gradually.

In 2020-21, IOC managed to reduce 3.36 MMT CO₂e of emissions through the use of natural gas instead of liquid fuels, pipelines transportation of crude and fuels, a renewable energy portfolio of 240 megawatt (MW), energy conservation projects in refineries, 8 lakh LEDs installed across the company and by increasing green cover in its premises.

IOC is undertaking measures such as energy efficiency, low carbon fuel switch, renewable energy, shift to grid power, nature-based solutions and CCUS as measures to reduce emissions. It is setting up 5-kilo tonnes per annum (KTPA) and another 2 KTPA of green hydrogen units at its refineries.

Along with the Oil and Natural Gas Corporation (ONGC), the company is setting up 1,500 tonnes per day of CCUS projects at the existing refineries. Another strategy will be to increase the adoption of natural gas in refineries in place of liquid fuels and meet the electricity requirements of expansion projects in refineries through renewable sources. It has collaborated with National Thermal Power Corporation (NTPC) to source 2.3 gigawatt (GW) of renewable power to run refinery expansion projects, says Vaidya.

Increasing greener fuels in the product mix for consumers is another strategy. Ethanol blending has crossed 10% as a 100-kilo litres per day (KLPD) of 2G Ethanol project has come up at Panipat. Another 128 KLPD of the 3G Ethanol plant is under construction at Panipat and Compressed Bio-Gas (CBG) plants of 6 TPD at Hingonia and 25 TPD plants are under construction at Gorakhpur. Further, IOC is developing waste plastic to fuel and to have 10,000 electric vehicle charging stations within three years.

PRIME MINISTER INAUGURATES MRPL PROJECTS WORTH INR 2,510 CRORE

Prime Minister Narendra Modi, who was on a two-day visit to Kerala



and Karnataka inaugurated two projects of Mangalore Refinery and Petrochemicals (MRPL) worth INR 2,510 crore in the first week of September. The Prime Minister inaugurated and laid the foundation stone of projects worth around INR 3,800 crore in Mangaluru, including MRPL's BS-VI upgradation project and sea water desalination plant, and also commissioned India's first indigenous aircraft carrier, INS Vikrant at the Cochin Shipyard in Kochi.

The sea water desalination plant, set up at a cost of around 680 crore, will help reduce dependency on fresh water and ensure regular supply of hydrocarbons and petrochemicals throughout the year. Having a capacity of 30 million litres per day (MLD), the plant converts seawater into water required for the refinery processes.

CM PRESIDES OVER PRAGTISHEEL HIMACHAL : SATHAPNA



KE 75 VARSH PROGRAMME AT HAROLI AC OF UNA DISTRICT

Chief Minister Jai Ram Thakur inaugurated 8 developmental projects of Jal Shakti Vibhag worth about Rs. 20 crore for Haroli assembly constituency of Una district today. He inaugurated Rs. 4.50 crore functional tap water connection scheme to left out households in Haroli, Rs. 4.65 crore multi village piped water supply scheme in Ispur Zone, Rs. 4.40 crore multi village piped water supply schemes in Barthri Zone, Rs. 2.10 crore multi villages piped water supply schemes in Dharampur, Rs. 2.07 WSS to village Palakwah, Rs. 69 lakh tubewell No. 30 at khad, Rs. 75 lakh lift irrigation scheme at Panjuana and Rs. 68 lakh water quality and monitoring training centre at Palkwah in tehsil Haroli.

While addressing a mammoth public meeting at Kangra ground at Haroli, the Chief Minister expressed his gratitude to Prime Minister Narendra Modi and Government of India for in-principal approval of Bulk Drug Pharma Park to the State. He said that this Park would be spread over an area of 1,405 acres at Pollian in Haroli and would prove a game changer for the people of the area. With an expected investment of around Rs. 50,000 crore, this project would provide direct employment to about 30,000 persons. He said that 90 percent of the project cost with the maximum limit of Rs. 1000 crore would be provided by the Government of India. He said that it was strange that some leaders of this constituency opposed this mega

project as they feared that this would harm their political prospects. Jai Ram Thakur said that it was indeed a matter of honour for our people as the State was celebrating 75 years of its existence. He said that the State Government was celebrating this event in a befitting manner by organizing 75 events throughout the State. Main objective of organizing these events was to showcase the developmental journey of the State during these 75 years, urging the people to actively participate in these events and be part of this glorious 75 years journey of the State.

Chief Minister said that the contribution of the present State Government to bring investment in the State was far more as compared to the investment attracted during the tenure of the former Industries Minister of the State. He said that it was for the first time that a mega Global Investors Meet was organized in Dharamshala in November, 2019 in which 703 MoUs with an investment of Rs. 96,721 crore were signed. He said that ground breaking of 240 projects amounting to Rs. 13,656 crore was held at Shimla and second such ground breaking ceremony was performed by the Prime Minister at Mandi on 27th December, 2021 on the occasion of completion of four years tenure of the state government in which 287 projects worth Rs. 28,197 crore were grounded. He said that all this was possible due to the investor friendly policies framed by the State Government to facilitate the investors.

YOGI GOVT WORKING ON UTILISING DRAINAGE WATER FOR IRRIGATION

The Uttar Pradesh government led by Chief Minister Yogi Adityanath is working on an innovative plan to utilise drainage water for irrigation. Yogi government's move is aimed at benefitting farmers and at the same time protecting the environment with better management of drainage water.

The state government is preparing the blueprint of this plan and soon the scheme will be on the ground. The engineers of Namami Gange have been instructed to complete the task.

Preparations are being made for the treatment of drainage water falling into the rivers through sewage treatment plants so that it is fit



for use for irrigation purposes. This will also protect the rivers from getting polluted.

Recycling effluent and using it for irrigation purposes, not only reduces the amount of wastewater being discharged into waterways, but also brings down the demand for treated potable water, thereby cutting the cost of irrigation significantly. Panel to monitor 848 drains flowing in the state.

A 5-member committee consisting of social activists and persons residing near drains will be formed to monitor 848 drains flowing in the state. The drains will be first blocked and then its water extracted for treatment in a plant.

The Namami Gange department would look after all the operations of Sewage Treatment Plants (STPs) operating across the state. New experiments will be done in the direction of water conservation and water conservation. The plan for monitoring Ganga through CCTV (Closed Circuit TV) will be ready this month. The Namami Gange projects in Uttar Pradesh have brought about unprecedented changes in the cleanliness of rivers.

Jal Shakti Minister Swatantra Dev Singh informed that as per the directions of Chief Minister Yogi Adityanath, the government is working on a war footing to make all the big and small rivers of the state, including the River Ganga pollution free and clean.

Instructions have been given to prepare a plan to stop drain water from falling into rivers and use it for irrigation. Along with making the rivers clean, it will also be useful for the farmers. The operation of all STPs connected with Ganga will also be monitored online.

KSB LIMITED REGISTERS 26.5 PER CENT SALES GROWTH!

KSB Limited, a leading pumps and valves manufacturer in India, recorded a growth of 26.5 per cent with a sales value of 8,661 Mio. INR on its half yearly sales (Jan to Jun 2022) vis-a-vis 2021 (Jan to Jun 2021).

As an experienced pump manufacturer, its product portfolio includes building and industrial technology, water transport,

wastewater treatment and power plant processes, agricultural applications, residential application. Owing to the innovative research and development, KSB can meet the most diverse requirements of customers. Benefit from many years of experience and technical expertise as a renowned pump manufacturer.

Commenting upon the business highlights, Mr. Farrokh Bhatena, Director- Sales and Marketing said, "This quarter we had significant order inflow from the Petrochemical segment. We have received noteworthy orders for pumps required for Flue Gas Desulphurisation from BHEL and also orders for BB3 pumps for domestic and export.

In July, 2022 we have received the order from NPCIL for 8 nos. Primary Coolant pumps for Kaiga 5 & 6 along with electric motors and spares for a value of approx. 5000 Mio. INR. This is a follow-up order over the development order NPCIL placed with us in 2018. This order reassures the trust of NPCIL in KSB.

The overall sales achieved for the quarter is 48 per cent higher than that of the corresponding Q2 2021 quarter."

Milind Khadilkar, Chief Financial Officer is delighted to inform that the growth in sales indicates an increased contribution from all other segments apart from Nuclear. On behalf of the Board of Directors and the management, Khadilkar has appreciated the Company's employees and workmen because, despite the cyber-attack, the factories, branches, and warehouse teams worked round the clock in 3 shifts to ensure continued sales.

Khadilkar further informed that to achieve the declared 'Strategy 2024', the Company has initiated major investments and infrastructure developments. He highlighted the investments planned for Solar business growth- development and manufacturing capacity and investments for Digitalization projects like Robotic Process Automation Phase 2, and Advanced Planning Solution for production planning at its EPD Plant.

HOWDEN EXPANDS INDIA OPERATIONS, OPENING DELHI OFFICE

Leading global provider of mission critical air and gas handling products, technologies and services, Howden, has opened a new office in Noida, Delhi, India. The new office comes in response to the growth in demand for air and gas handling equipment within India's fast growing economy. The move further positions Howden within its own market, offering access to products for India's high quality supply chain and facilitating access to expertise and technology across the Howden global business.

The business enables customers' vital processes which advance a more sustainable world, notably in sectors including: power generation, cement, steel, traction, waste water treatment, oil & gas, and ventilation for metro and mining. Its leadership position in compression solutions for hydrogen means Howden is supporting India's investment in renewable hydrogen development.

Howden's Executive Director & President of EMENA region, Fred Hearle, who opened the new office, commented: "This move is of





great importance to Howden's business in India. Having a presence in Delhi brings our expertise and technology closer to our customers, as well as enabling further investment in our facilities and the training and development of our team. We are committed to fully localising Howden products and services in India and creating new jobs and careers."

"The Howden team in India led by its Managing Director, Parvesh Mittal, has done an excellent job in managing the business through the pandemic to ensure the safety and wellbeing of our people and continuity of service to our customers in India and internationally. This new office in Delhi is another step in expanding our presence in a critical market for Howden and our customers." The investment follows over 40 years of operations in India, where the business has factories in Chennai and Hosur, an aftermarket team in Pune, and a joint venture with India's leading infrastructure company Larsen & Toubro in Faridabad. As a business with a strong reputation for client service, project execution and important aftermarket services, the office brings many of Howden's operations closer to its client base, offering full service support.

Howden focuses on helping customers increase the energy efficiency and effectiveness of their air and gas handling processes enabling them to make sustainable improvements in their environmental impact. Howden designs, manufactures and supplies products, solutions and services to customers around the world across highly diversified end-markets and geographies.

The business recently announced its target to be carbon Net Zero by 2035 through the purchase of renewable energy and carbon free energy; efficiency gains from energy conservation measures; and by renewable energy projects at its manufacturing facilities. The largest impact the business will have on global sustainability will be through its partnership with customers to supply equipment that will make a major impact on their carbon emissions and sustainability.

CENTRE OKAYS INR 229CR SHIMLA SEWER PROJECT

The central government has approved a Rs 229 crore sewage treatment project for Shimla. The project will be completed by the

year 2025 and cater the population of the hill town for the next 30 years. State had submitted a detailed project report to rejuvenate and lay the new sewerage network in the town to the Central Public Health and Environmental Engineering Organization (CPHEEO).

"CPHEEO has approved the project worth Rs 229 crore and it is being funded by World Bank under Program for Result (Pfor R)," said urban development minister Suresh Bhardwaj. He said that Shimla Jal Prabandhan Nigam Limited (SJPNL) has taken up the project to lay 230 kilometer fresh sewerage network.

"Shimla town is expanding. Our aim is to provide sewage linkage to those deprived of it," he said adding that the existing sewage line would also be upgraded by laying six inch diameter pipes. He said that the project has two components, laying fresh sewage linkage to the houses and upgrading the existing lines. This project will be completed by 2025 by SJPNL. He said that there are some households dependent upon septic tank for sewage disposal, and the scheme is intended to end this. Areas of Dhali and Mashobra will also be linked to the facility under this scheme, he added.

VIJAYAWADA MUNICIPAL CORPORATION SET TO REVIVE SEWAGE TREATMENT PLANTS

As part of its efforts to achieve a better rank in the next edition of Swachh Survekshan, the Vijayawada Municipal Corporation (VMC) has formulated an action plan to revive sewage treatment plants to reduce carbon emissions under its ambit.

According to VMC officials, the Union Ministry of Housing and Urban Affairs have identified 28 cities in the country under Swachh Bharat Mission. As a pilot project in the Sustainable City category, Vijayawada is among the five selected cities. Special funds will be released by the United Nations Industrial Development Organisation (UNIDO) in the respective cities.

On the other hand, the National Green Tribunal (NGT) has directed the VMC to maintain a biological oxygen demand limit to 10 mg/litre or less and chemical oxygen demand limit to 50 mg/litre in the water released from the sewage treatment plant (STP).



Keeping this in mind, the VMC has taken steps to modernize sewage treatment plants in eight parts of the city. The civic body officials have prepared plans to spend Rs 10 crore released by the UNIDO as the first installment and Rs 4.93 crore from the Corporation General Fund. Steps are being taken to revive the biogas production at sewage treatment plants in Ajit Singh Nagar (20 and 40 MLD), Jakkampudi (20 MLD), Ramalingeswara Nagar (20 MLD) to reduce carbon emissions and generation of electricity.

VMC chief engineer M Prabhakar Rao said that two STPs at Jakkampudi with 20 MLD capacity each were constructed with anaerobic sludge blanket reactor technology in 2017. Around Rs 3.48 crore was spent on upgrading facilities at the existing STPs in Jakkampudi.

Speaking about the plans to revive the STPs, he said that Rs 3.12 crore will be spent on 20 MLD STP at Ramalingeswara Nagar constructed in 2012 with anaerobic sludge blanket reactor technology. Around Rs 1.15 crore will be spent for reviving the 10 MLD STP constructed in 2004 with accidental aeration technology and another 10 MLD STP built with moving bed biofilm reactor (MBR) technology in 2019.

Similarly, Rs 3.24 crore will be spent on reviving the 20 and 40 MLD STPs in Ajith Singh Nagar constructed in 2011 and 2017. "After the completion of revival of the STPs in the city, carbon emissions from the industries will be reduced, besides water and air pollution," Prabhakar said.

AMRITSAR: 24X7 SURFACE-BASED WATER SUPPLY PROJECT TO BE COMPLETED BY 2024

The 24x7 surface-based water supply project will be completed by July 2024. Around 16 per cent work has been completed till the date.

A meeting was recently organised under the chairmanship of Mayor Karamjit Singh Rintu regarding the progress of the canal water project being implemented under the Punjab Municipal Infrastructure Development Company (PMIDC).



During the meeting, the officials of L&T Limited, a construction company, claimed that the canal water project was set to be completed by July 2024. The company has also been provided a 10-year contract for the operations and the maintenance of this project.

This project is expected to benefit the residents of the city for 30 years. The water from the water-treatment plant will be purified, and reach the households through pipelines. The city dwellers will receive around 440 million litres of water every day. For the same, as many as 51 new big overhead water tanks will be constructed in the city and 24 old water tanks will also be repaired. A new water pipeline will also be laid across 112 km in the city.

Construction to set up a water treatment plant on about 40 acres of land in Valla village, is currently underway. So far, 16 per cent work has been finished. The MC has signed a legal agreement regarding the project with the World Bank. A government company is to be formed to run the water supply and sewerage service, which will be headed by the Municipal Corporation.

At present, potable water is being supplied to the residents of the city through tube-wells. There are as many as 565 functional tube-wells in the city, which has led to ground water depletion in the region. Moreover, the residents are being supplied contaminated water, thanks to the existing infrastructure.

HYDERABAD ALL SET TO BECOME INDIA'S FIRST CITY TO FULLY TREAT ITS SEWAGE

If things go according to plan, Hyderabad will become the only city in the country to have 100 per cent sewage treatment facility by the end of next year. Work on the 31 Sewage Treatment Plants (STPs) in Greater Hyderabad and its outskirts are on at a brisk pace and are expected to be completed by next summer. In fact, some of them are expected to be ready by the end of this year. Apart from treating the generated sewage, the new STPs would also help protect water bodies including lakes, tanks and ponds in the city.

"Am very proud of my@HMWSSBOnline team led by@MDHMWSSB Dana Kishore Garu & ED Satyanaryana Garu.



With 100% sewage treatment in #Hyderabad by next summer, our capital city will be a shining example for other Indian cities to emulate," Municipal Administration Minister KT Rama Rao tweeted on Sunday. On implementation of 31 STPs, Hyderabad city will stand in the first position among all metropolitan cities in the country for the treatment of sewage.

To improve the infrastructure for the treatment of sewage generated in GHMC limits, the State government had in 2021 sanctioned Rs 3,866.21 crore to establish 31 STPs in the first phase. These STPs will have the capacity to treat 1,260 million litres per day (MLD) of sewage through the hybrid annuity model.

The project is being taken up in three packages -- package-1 covers eight STPs with 402.5 MLD capacity with an outlay of Rs



1,230.21 crore and will be implemented in the north of Musi (Uppal, Kapra, Makajgiri, Alwal circles); Package-II covers six STPs (480.5 MLD costing Rs 1,355.13 crore in the south of Musi (Rajendranagar and LB Nagar circles) and another 17 STPs (376.5 MLD, Rs 1,280.87 crore covering Hussainsagar catchment areas of Kukatpally, Quthbullapur, Serilingampally circles).

As per the Hybrid Annuity Model (HAM), the State government would contribute Rs 1,546.49 crore (40 percent) of the cost while the remaining amount would be mobilised by the contracting agencies who would also be responsible for maintaining the STPs for 15 years.

Sources told Express that scaling up of sewage treatment facilities was taken up on the directions of Chief Minister K. Chandrasekhar Rao to meet the sewage treatment needs for the next 10 years. Presently, the city generates about 1,650 MLD of sewage water every day, and this would increase by 300 MLD over the next 10 years, according to a study conducted by Shah Consultants.

The existing 25 STPs have the capacity to treat 772 MLD, or 46.78 per cent of the total sewage water generated. The remaining 53.22 per cent of sewerage is left untreated in the river Musi and various other water bodies.

Incidentally, apart from the STPs, the State government plans

laying of lateral sewer mains, branch sewer mains, and trunk sewer mains for the collection of sewage and transport up to the STPs as part of its Comprehensive Sewerage Master Plan (CSMP).

According to Shah Consultants, the city and its surroundings would generate around 2,814 MLD of sewage by the year 2036 and this would go up to 3,715 MLD by 2051. The consultants recommended a total of 62 STPs (31 in GHMC limits and 31 more in ORR areas) to meet the sewage treatment requirements till 2051.

NATIONAL MISSION FOR CLEAN GANGA: 13 PROJECTS APPROVED FOR MAPPING & MANAGEMENT

Government has sanctioned 13 projects pertaining to geo-mapping, sewerage management, riverfront development among others for conservation of resources and management of infrastructure along the Ganga river system as part of National Mission for Clean Ganga.

At the 44th meeting of the Executive Committee organised by National Mission for Clean Ganga (NMCG), the government has sanctioned 13 projects pertaining to geo-mapping, sewerage management and wetland conservation among others that would cost an estimate of INR818 crore.

The 13 projects that were sanctioned included

- Geo-mapping in Uttarakhand, Uttar Pradesh and the NCT of Delhi
- Sewerage management in Uttarakhand, Uttar Pradesh, Bihar and West Bengal
- Riverfront development works in Uttarakhand, wetland conservation
- Arth Ganga
- Refurbishment of gates of Belia Circular Canal in Kolkata were approved

NGT IMPOSES ENVIRONMENTAL COMPENSATION OF RS 3,500 CR ON BENGAL OVER FAILURE IN WASTE TREATMENT

The National Green Tribunal has imposed an environmental compensation of Rs 3,500 crore on West Bengal for failure in the



treatment of solid and liquid waste. The green bench noted that the West Bengal government did not take much initiative in prioritising solid and sewage treatment plants in urban areas, news agency PTI reported.

The bench, headed by Justice Adarsh Kumar Goel, sought for remedial measures to be taken within six months. The order stated that for failure in liquid waste management processing, "liability of the state is to pay compensation of Rs 2,980 crores, rounded off to Rs 3,000 crore in view of continuing damage." For failure to process solid waste, the compensation to be paid is Rs 500 crore, the NGT added.

"Final amount of compensation under the two heads (solid and liquid waste) is assessed at Rs 3500 crore which may be deposited by the state of West Bengal in a separate ring-fenced account within two months," PTI quoted the September 1 order as informing.

The bench stated that the chief secretary may personally monitor the progress, at least once a month, while all district magistrates should oversee the status of compliance with environmental



norms, at least once in two weeks. "It is necessary to determine accountability for the past failures causing huge damage to the environment and public health and to meet cost of remediation," the NGT mentioned, as quoted by PTI.

The environmental body found that of the 2,758 million litres of sewage generation every day in urban local bodies in West Bengal, not more than 1,268 million litres is being treated. The work falls short of the project treatment capacity of 1505.85 million litres despite setting up several sewage treatment plants.

It said, "At Least three major cities and as many major towns as possible in the state and at least three Panchayats in every district may be notified on the website within two weeks as model cities/towns/villages which will be made fully compliant within the next six months."

The remaining cities, towns and village panchayats of the state may

be made fully compliant in respect of environmental norms within one year, the bench said in its directive to the state.

Environmentalist Subhas Dutta, who had been instrumental in bringing to the NGT's notice several pollution cases in the past, told PTI, "We are extremely happy with this order. Let the state earmark and spend some money for the people and posterity instead of spending money to buy votes."

He hoped for the state to prioritise the environmental aspects henceforth and advocated "judicial monitoring of the money to be spent. Otherwise, it may inflate the coffers of influential persons."

ADVENT INTERNATIONAL AND LANXESS ANNOUNCE CALUM MACLEAN AS CEO-DESIGNATE FOR THE ENVISAGED HIGH-PERFORMANCE ENGINEERING MATERIALS JOINT VENTURE

The British chemicals manager Calum MacLean is to become CEO of the envisaged joint venture for high-performance engineering



materials which Advent International ("Advent") and LANXESS AG ("LANXESS") are planning to form. Advent International, one of the largest and most experienced global private equity investors with a well-established track record in chemicals, and LANXESS, a global specialty chemical company, announced today that MacLean is designated to take over the position as the CEO for the envisaged company upon closing of the transaction.

MacLean brings extensive global CEO experience in petrochemicals, polymers and specialty chemicals from his time with INEOS and most recently as CEO of Synthomer. During his 17 years at INEOS, MacLean established and integrated two highly successful joint ventures in chemicals (Styrolution) and refining (Petrolneos), and therefore brings highly relevant experience in integrating and consolidating multinational blue chip chemical businesses. Due to his background, MacLean is the ideal candidate to lead the envisaged merger of equals following the 'best-of-both-worlds' principle and the ambition to preserve the rich heritage of both businesses. He is currently a non-executive board director of SABIC and has recently stepped down as a non-executive board director of Clariant.

Ronald Ayles, Managing Partner at Advent said, "We are very happy that Calum has accepted the designated CEO role in this strategic investment and are convinced that his highly relevant experience at

both INEOS and Synthomer will be invaluable during the integration and subsequent growth of the engineering materials business. We look forward to working with him and the future executive management team on this exciting venture.”

Matthias Zachert, CEO of LANXESS added, “Calum is a highly regarded executive with a strong reputation in both the chemical industry and financial markets, and I am convinced that he has the right expertise and skill base to lead the joint venture, once it will be established in the first half of next year. LANXESS and Advent will support Calum during the integration phase as the joint venture establishes itself as a strong global player in this highly attractive market, following merger clearances.”

The joint venture will benefit from the strong long-term partnership between Advent and LANXESS, as well as from their vast experience and common understanding of establishing and growing a highly innovative engineering materials business. The new company is expected to have sales of around EUR 3 billion and to be one of the leading suppliers to the attractive and growing automotive, electronics, electrical and consumer goods segments, with a particular focus on environmentally friendly and sustainable products. The highly complementary combination both in terms of regional footprint and product range will bring together well-invested assets, skilled employees with a strong cultural fit, and a comprehensive innovation pipeline, therefore creating a strong foundation for sustainable long-term growth.

Calum MacLean, the CEO-designate of the joint venture, said, “I am truly excited by the challenge and opportunity to lead the merger of equals of two highly successful and complementary businesses



with rich heritages from DSM and LANXESS. The combination will create a truly global engineering materials business and an exciting future for both employee teams and customers going forward.”

Once established, Advent will hold a minimum share of 60% in the new joint venture, with the balance being held by LANXESS. The transaction is subject to merger clearances and is expected to close in H1 2023. LANXESS and DSM are currently working on completing the respective carve-outs and preparing business integration for day 1. Calum MacLean has been appointed by

Advent International with full support of LANXESS.

ANU ADVANCE COMPOSITE PRODUCTS PVT. LTD. RECEIVED NSF/ANSI/CAN 61-2020 CERTIFICATION

India's leading manufacturer of water treatment products, Anu Advance Composite Product Pvt. Ltd. (AAPC) has received the coveted NSF/ANSI/CAN 61 - 2020 Standard Certificate for its product range of FRP Membrane Housing and FRP Pressure Vessels. The Hyderabad based company is marketing these products under the brand name of ALFA AEROSOL.

NSF certification is a seal of quality standards validated by The International Association of Plumbing and Mechanical Officials (IAPMO), the world's advanced inspection agency. The certification indicates that a product or service complies with predetermined standards of quality, safety, and sanitation. It also implies a constant evaluation and inspection of equipment, facilities and production procedures and their ability to meet the safety standards in day to day manufacturing process.

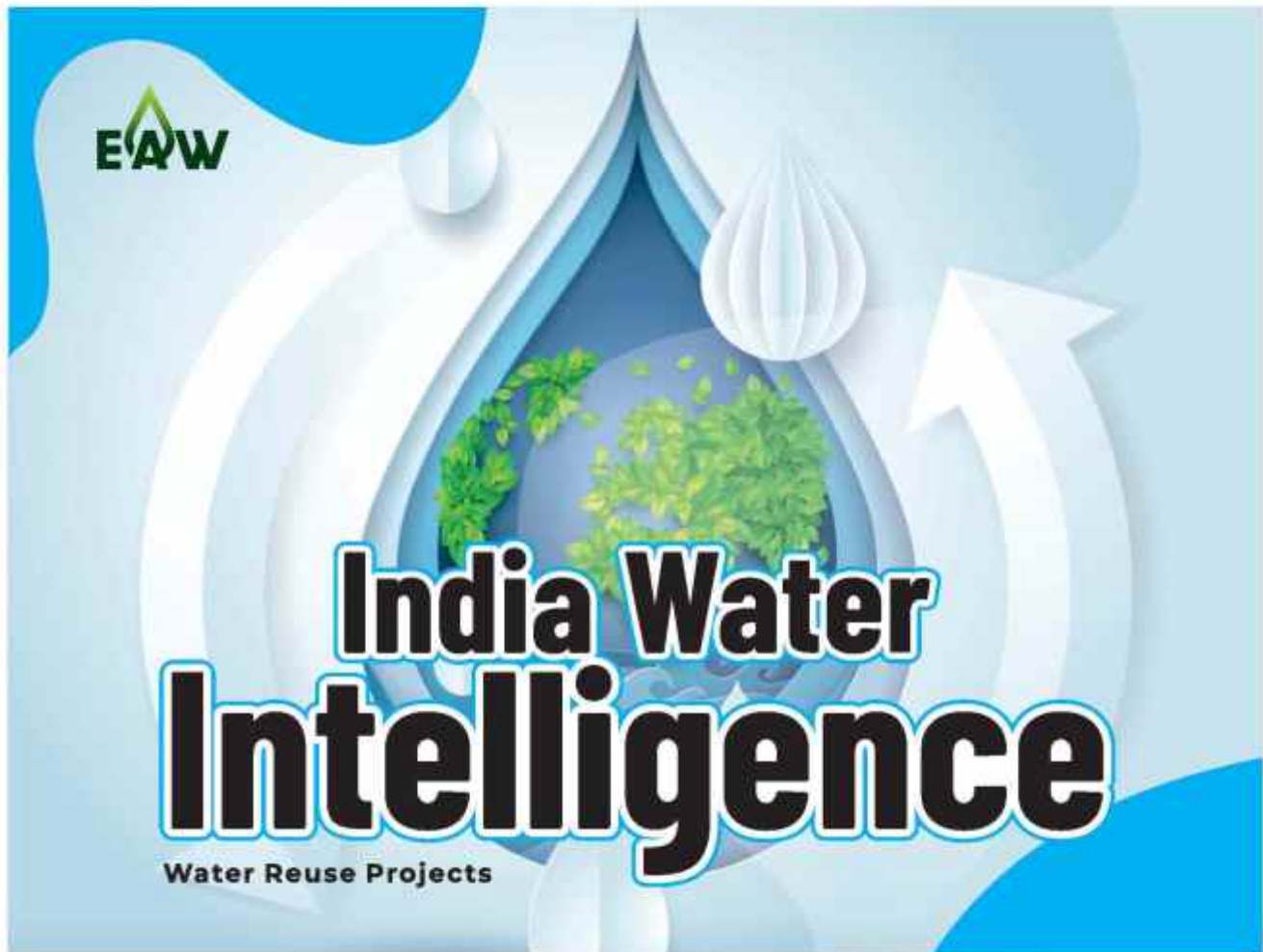
The FRP Vessels and FRP Housings are produced at the company factory spread across 32,000 square meters near Hyderabad. The modern manufacturing facility has technologically advanced systems using computer controlled filament winding, sanding, and side porting machines which provide precise and high quality production. The dedicated team of engineers are using leading edge manufacturing technology and software to continually innovate and develop products to meet specific design challenges. The ISO 9001:2015 certified company is providing high quality products at a competitive cost to India's leading water treatment plant manufacturers and allied industries across the country. With rich experience of over 20 years in business and highest customer trust, it is amongst the most reliable suppliers in India with proven performance to cater the growing demand of water treatment Industry.

Mohammed Abdul Rahman, Director, AAPC commented, “Water contamination issues and subsequent human and industrial losses has become a big challenge in today's world. We are very pleased to receive the most desired NSF Certificates that reinforces our commitment of producing best quality products meeting all safety standards. From the very beginning, we are very conscious about meeting the quality parameters in all products that we manufacture and market but the NSF seal will help us in proving that we are a safe, high-quality producer. This seal signifies that the company has undergone the inspection and earned the approval of the authorities. This will help the company enhancing the trust of our customer as well as provide us an advantage over the competitions.”



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ZERO LIQUID DISCHARGE, POLICY SCENERIO AND INDIAN TEXTILE INDUSTRIES

By

Manoj Nainani, Executive Director, Egis India

Over the years, growth of population, expansion of industry and infrastructures has resulted in accelerated depletion of the natural water supplies and created water stress regions around the world.

Further, to preserve natural resources from overburdening and pollution; stringent environmental regulations are being enforced. This requires additional technology interventions prior to waste water discharge and to undertake water management practices.

Zero Liquid Discharge (ZLD) is a comparatively recent development in waste water treatment that totally eliminates requirement of waste water discharge to the environment. Apart from this benefit, a ZLD process also makes effective use of wastewater treatment, recycling, and reuse, thereby contributing to water conservation through reduced intake of fresh water. ZLD desalination is a high-recovery process that

permits to recuperate about 75%–90% of the total water amount from the wastewater.

Evaporation and crystallization technologies are essential steps in any ZLD application. However, these are expensive and energy intensive technologies. Further, prior to implementation of high end technologies, high recovery pre-treatment processes are required to be implemented to recover and reuse maximum possible wastewater.

Although ZLD is a costly process, it paves the way for economic benefits by recovering salts and other chemical compounds. ZLD has been proven effective in reducing discharge, recovering and recycling of treated water within premises. In addition to ZLD, the recovery and reuse of salt reduces the amount of sludge.

Major driving factors in support of ZLD are listed herein:

1. Fresh water scarcity

2. Water economics
3. Environmental regulations

Different methods, which can be employed to achieve ZLD:

1. Thermal process (evaporation)
2. Reverse osmosis: RO (membrane technology)
3. Electrodialysis
4. Forward osmosis
5. Membrane distillation
6. Nanofiltration

Whilst thermal evaporation technologies; such as multistage flash distillation (MSF), and single and multiple effect evaporation coupled to mechanical vapor compression (SEE/MEE-MVC) are already relatively well-established processes in the desalination industry, membrane-based systems including membrane distillation (MD), forward osmosis (FO), reverse osmosis (RO), nanofiltration (NF), and electrodialysis/electrodialysis reversal (ED/EDR) have recently emerged as attractive alternatives for high-salinity wastewater applications.

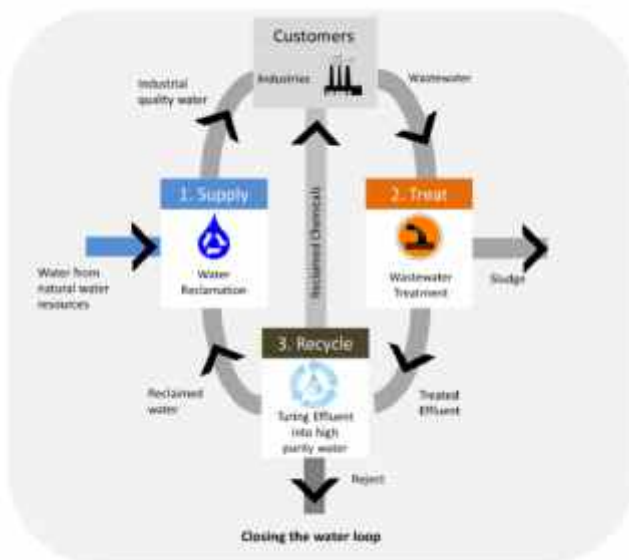
A systematically design ZLD is made up of the following components:

- Pretreatment (physicochemical and Biological)
- RO (membrane processes)
- Evaporator and crystallizer (thermal processes)

Challenges for implementation of Zero Liquid Discharge in different industrial segments

1. High CAPEX and OPEX
2. Management of highly toxic waste generated as by product of treatment process.
3. Space requirement
4. Impact on cost of final product

The adoption of ZLD requires extensive research and advance process design as the wastewater generated is different for industries and processes. Financially viability of implementation of ZLD is a prime concern. Large scale industries with considerable water usage can install effluent treatment plant to achieve ZLD; and those that cannot afford; they may tie up with common effluent treatment plan (CETP).



Policy scenario for ZLD in India and case study for Textile industry India accounts for 2.45% share of land area and 4% share of water resources in the world; however, the country has 16% of the global population. The population in the country is likely to cross the 1.5 billion mark by 2050. The Government of India has estimated the demand for water to increase from 710 BCM (Billion Cubic Meters) in 2010 to almost 1180 BCM in 2050; industrial and domestic water consumption is projected to rise almost 2.5 times during this period.

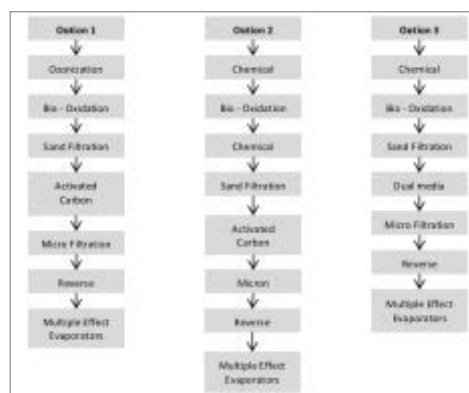
In India, Zero Liquid Discharge (ZLD) guidelines were introduced in 2015 for four industrial sectors in India i.e., Textile, Tanneries, Distilleries and Pulp & Paper. Till last few years, the whole ZLD issue in textile was limited to Tirupur and the Bulk drug manufacturers in Andhra Pradesh, and now focus on Zero Liquid Discharge had come to the forefront following the launch of the "Namami Gange" program.

A draft national mandate was notified in 2015 for all textile industries having effluent discharge greater than 25 KLD and CETP based ZLD facility for textile clusters irrespective of the effluent discharge quantity. Further, MoEFCC on 10th October 2016 released a new notification, which stated that the textile units under the MSME category are supposed to meet the discharge standard notified by the ministry, while the standalone large scale units are expected to do the same. However, those in environmentally sensitive or critical areas may also be mandated to achieve ZLD by CPCB or SPCBs / PCCs with the prior approval of CPCB. The notification also supersedes the previous notification for ZLD for the textile units in the Ganga Basin states. Textile industry and Zero Liquid Discharge

The textile industry is one of the most important sectors for the Indian economy, accounting for almost 2% of the national GDP and approx. 12% of the total manufacturing export earnings in the country. The textile wet processing sector is largely dependent on water and hence its long term viability hinges heavily on sustainable water management. The reducing per capita water availability, degrading ground and surface water quality has adversely impacted the sector and increased its vulnerability to operational risks. Furthermore, the sector uses wide variety of dyes which can potentially pollute the river streams into which the effluent flows in thus creating environmental challenges. As per case study conducted regarding ZLD

in textile study, adoption of ZLD mainly impacts a part of the textile value-chain which is focused on dyeing and coloring; increasing their cost by 6-10%. Textile industry in India has had experience in Zero liquid Discharge systems since 2008 when Tamil Nadu high court mandated Zero Liquid Discharge systems for dyeing and wet processing industry in Tirupur. It showed that almost 92-95% water recycle is possible in textile industry with recovery of salts which can be again used for dyeing process. Some of the factories over here are using ZLD system for almost 5 to 10 years and they have gathered enough expertise to optimize and reduce the operating cost by a certain extent. Due to the high use of dyes the effluent from textile industry contains pigments, ions due to salts used in dyes. Therefore the recommended configuration for textile effluent is Pretreatment with Biological treatment and adsorption, chemical precipitation to remove ions followed by reverse osmosis which recovers 80% of water. The remaining 20% is sent to Multi-Effect Evaporator (MEE) or combination of Mechanical Vapour Recompression Evaporator (MVR) and MEE for further separation.

The various technology options for zero liquid discharge in textile are as follows: As per the case study conducted, the water cost in Tirupur was Rs. 70/KL. Therefore, if factories recover 100% of water then the effective resource saving should be Rs. 70/KL. Although due to the limitation of technology actual recovery ranges from



80% to 95%. Therefore factories have to buy the makeup water which brings down the value of water saved to almost Rs. 40 – 60/KL

Salt used is mostly global salt which costs about Rs. 10/KL. Depending upon the use 95 to 98% pure salt can be recovered. In some cases concentrated brine solution is recovered and used for dyeing process. The

combined value of recovery for brine and salt ranges from Rs. 15 – 60/KL

It is evident the value of resources recovered through ZLD process is not enough to cover the total cost of the project. After taking account value of various resources recovered the cost of water comes down to Rs. 30 – 70/KL in case of Central Effluent Treatment Plant (CETPs) and Rs. 120 – 130/KL in case of Independent Effluent Treatment Plant (IETPs). Although this might be the case in country like India where industrial water is insufficiently priced which provides the false picture of the tangible savings incurred due to ZLD systems.

ABOUT THE AUTHOR

Manoj Nainani

has been with Egis since October 2015 and holds the position of Executive Director - Infrastructure (Water, Ports & Energy) and he is also IOSIS partner and holding position in Management team of Egis India. He is in charge of Pradhan Mantri Awaas Yojana (PMAY), DRIP, AMRUT (Water Project) which are largest projects of Egis in India.

An Accomplished C-Suite Executive with strong background in Sales, Business Development, Project Management, Client Servicing, and Operations mainly across Infrastructure and Engineering industry segment with more than 28 years' experience.

A business leader who has effectively contributed to enhancing organizational processes through initiatives geared towards lowering risk, heightening productivity & improving internal controls. He has an analytical bent of mind and creative approach to work. He has a proven track record of stamping success in uncertainties & challenges across profit & loss management, operations planning & management, business acquisition/Delivery, partnerships, team building and leadership. He has held various senior positions in Essel Infra projects and SPML, before joining Egis.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.



FLOURISH GREENERY: EXPLOIT TWW (TREATED WASTE WATER)!

By

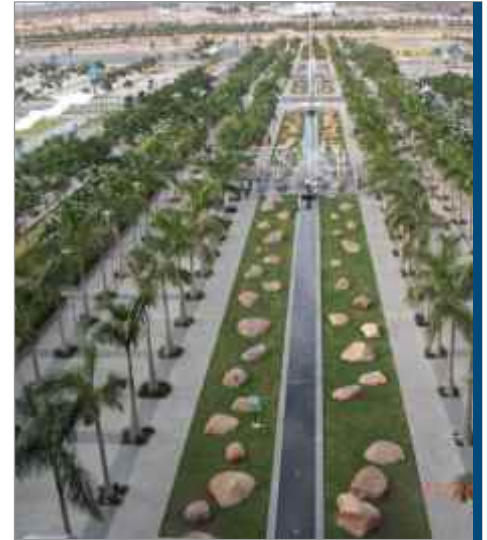
Dilip Yewalekar and Manisha Kinge, Jain Irrigation Systems Ltd, Jalgaon India

INTRODUCTION

Till the end of 19th Century, the Central/State Government, Environment and Pollution Control Board were not so active and serious in controlling, monitoring, and implementing laws and regulations on pollution and the environment for industries, municipalities, and corporations, in India to dispose of & treat liquid and solid waste in a systematic way without creating additional waste in a scientific. There was not much awareness / public domain available on the use of TWW water for landscape, green belt, and agriculture. It is a common trend followed by many industries, municipal councils & corporations, effluent water is simply being disposed of without treatment into a subsidiary of streams or rivers without further thought and caring about the side effects of polluting down streams. The most live example is the Holly River, Ganga & Yamuna called 'Victim Rivers' by man-made pollution as a live learning example!

Recently, many countries have taken initiative to implement wastewater treatment and reuse it for landscape, gardens &

agricultural purposes. Glasgow, 10th Nov 2021-The UNEP, and India signed an agreement on climate change and committed to achieving the target of SDG 6.3. Since 1980, India has initiated the treatment of wastewater and re-use for irrigation of lawns, gardens, landscapes, and forestry at Chennai Municipal Corporation. Many research institutes e.g. Indian Agricultural Research Institute, Karnal, University of Agricultural Science, Dharwad, have carried out research work on the use of TWW for agriculture purposes. Now State/Central Governments are tightening norms and making it mandatory to implement Waste Water Treatment and reuse TWW (Treated Waste Water) for Landscapes, Gardens, Green belts, and agriculture. The sad thing is, still many industries have a hesitant mind set toward using TWW instead of fresh water and are following the conventional/crude methods of irrigation to maintain greenery. I saw a message on the hoardings/wall while traveling to Delhi, Mumbai, and Hyderabad, 'Harit Mumbai, Harit Delhi (keep city green).....!' There is no meaning in it without using TWW. The said article fosters the



industrialist, municipal councils, and corporations to consider to use of TWW to maintain greenery around and highlighted the basic orientation.

LANDSCAPE!

Landscape, first recorded in 1598, was borrowed as a painter's term from the Dutch during the 16th Century when Dutch artists were on the verge of becoming masters of the landscape genre. The Dutch word landscape had earlier meant simply region. Landscaping involves the planting of ornamental trees, shrubs, vines, ground cover turf, lawn, perennial flowers, annual flowers, bulbs, and other materials for a decorative and aesthetic look.

The aim of landscape is not made to achieve yield or generate commercial income. The overall purpose of the landscape is to add beautifications to the property as well as to protect & maintain the environment and natural flora & fauna, to solve the problem of waste water disposal.

IRRIGATION FOR LANDSCAPE, GREEN BELT.

High resources and budgets are being directed for the establishment of good landscapes and gardens at residential, municipalities, factories, corporate, commercial complexes, airports, high-way etc. Although by concept, it looks very simple to understand, it is a very vast and important subject, and lack of awareness has resulted in a crude way of landscaping, unorganized irrigation, and management. Misconceptions and doubts are still rising in the mind of many people about using TWW for a landscape like bad odor, change in



colors, emission of foul smell, toxicity in plants, and unhygienic. If you look at Plant physiology, all plants act as a chemical processing factory where poor-quality water gets processed and used by the plant for metabolic activities. Take the example of coconut plants which are cultivated around the coastal area using seawater but we don't find salty sea water in coconut.

WHAT IS A LANDSCAPE IRRIGATION SYSTEM?

The landscape irrigation system is a combination of the different irrigation systems as suitable for various crop covering and requirements.

- Dripper System.
- Integral Dripline System.
- Sprayer – Micro Jet/ Micro/Mini Sprinkler System.
- Pop Up Sprinkler System.
- Fogging/Bubbler System.

DRIPPER IRRIGATION SYSTEM

In this system, drippers are fixed on blind polytube at designed spacing near to crop root zone and are generally suitable for trees, pot plants, gallery plants, terrace gardening, roadside trees, and fence trees.

INTEGRAL DRIPLINE IRRIGATION SYSTEM

Drippers are inserted in the tubing at certain intervals during the process of manufacturing in the factory. It forms a continuous wetting strip in the soil and is suitable for irrigation of closely spaced /row plants, shrubs, flowers bed, vegetables, and ornamental plants. It can be placed underground and not visible on the surface.

MICRO JET SYSTEM

It is a tiny fountain, that sprays water at low pressure in fine droplets and in different patterns- half circle, full circle, square & rectangular, butterfly, strips and looks very attractive. It is suitable for front flower beds, shrubs, and islands of bamboo, ornamental flowers & cactus.

MICRO SPRINKLER SYSTEM

It sprinkles water in fine drops in a circle and looks very attractive. It is suitable for lawns, flower beds, shrubs, and nurseries and is also used for cooling terraces or balconies during summer.

POP UP SPRINKLER

It is one type of sprinkler, installed on the ground surface (flushing) surface and cannot be seen by normal eyes. While working nozzles come out (pop up) and spray water around and look beautiful. It is suitable for the front lawn, playground, marriage lawns, and party lawn.

FOGGING/MISTING

It creates a beautiful effect of artificial cloud, mist/fog without wetness. It also helps to cool down the temperature during summer. Droplet size is less than 100 microns. Nowadays it is also used for cooling purposes during marriage functions at the entrance of doors, and windows. Perfumes are added to spread the fragrance.

PRINCIPLE COMPONENTS OF LANDSCAPE IRRIGATION SYSTEM.

Principle components are Control Head Unit (Filtration Unit), Piping Distribution network, Emitting Devices (Drippers, sprayers, micro jets, micro/min sprinkler, pop-up sprinklers), and control units.

CONTROL HEAD UNIT

It consists of a filtration system, a control unit, and pressurizing mechanism (pump unit). Based on the presence of the physical impurities in TWW, the filtration system is being selected as additional security to while using TWW. Backwashing/Cleaning can be done manually as well as automatic option with the logical program.

In general three types of filtration system are used. Viz.

- Hydrocyclone
- Sand / Media filter.
- Screen / Disc filter

a. HYDRO CYCLONE FILTER

It is the first primary filter unit used in a series of filtration groups, used to separate fine silt, solid heavier particles present in raw water before going onward. It works on the principle of centrifugal force and a vortex of water is created to settle down heavier particles into the settling tank.

b. SAND / MEDIA FILTER

It is the second filter unit in a series of filtration groups, silica media of size 0.7 mm - 1 mm is used and it works on the principle of



multi-dimensional flow, thereby algae, fine particles, silt, and suspended particles separate to 100 microns rapidly. Back washing/cleaning can be done manually as well as an automatic option with a logical program.

c. DISC FILTER

It is a 3-dimensional flow filter. Plastic cross-grooved discs are arranged together to form filtration mesh, used to separate remaining particles passed after the sand filter. It can be cleaned manually as well as an automation option with a logical program.

d. SCREEN FILTER

It is a 2-dimensional flow filter. It can be made of plastic or metal with stainless steel screen of 100microns, used to separate left-out particles from the earlier filter. It is the last filter in series of filtration unit. It can be cleaned manually or automatically with a logical program.

CONTROLLER

It is a microprocessor controller where input data can be processed to get desired work done and desired out-put. It takes control over the operation and no need of extra man power to operate entire system. It just follows instructions as per the program and does the work sincerely in time with messages & alarm.

PIPING DISTRIBUTION NETWORK

A piping distribution network can be formed from the TWW storage tank to the field as per the design requirement of the irrigation

system. It can be of Pvc / HDPE depending upon the quality of water. It is recommended to use HDPE pipes for irrigation purposes with TWW. The size and pressure rating of the piping network is determined by water flow capacity and frictional head losses by hydraulic engineering theory.

TWW STANDARD NORMS (PPCB)

The user should have prior information on TWW supply and its quality as per Table 1 for reference to ensure the formulation and adoption of an appropriate greenery management strategy.

TABLE 1. TWW QUALITY NORMS (REF: PPCB-PUNJAB POLLUTION CONTROL BOARD)

Sr	PARAMETERS	TWW STANDARD NORMS
1	Temperature	Not more than 50C.
2	pH	5 - 9
3	BoD	<= 10 ppm
4	COD	<= 50 ppm
5	TSS	<= 20 ppm
6	Sulphates	<= 200 ppm
7	TKN	<= 50 ppm
8	Faecal coliform	<= 100 MPN/100 ml
9	Total Phosphorus	<= 2 ppm
10	Ammonical Nitrogen	<= 20 ppm
11	SAR	<=3.5 ppm
12	EC	<=2000 micro siemens/cm
13	RSC	<= 2.5 meq/l

Emitters in the form of drippers, sprayers, micro jet, micro sprinklers, pop-upsprinklers, misters, and foggers are selected as per the crop requirement, quality of water, aesthetic aspects, available resources, topography, power available, and facilities.

BENEFITS OF TWW USED FOR IRRIGATION OF GREENERY.

1. Since ETP/Water (TWW) is being used for greenery, means pollution and disposal problems get solved to a great extent.
2. Because of greenery, the natural cooling effect is generated, and there by energy conservation in using air conditioners can be reduced by 5-20%.
3. Countless enjoyment is given to the owner and residents.
4. Attractive and aesthetic views are pleasing to users.
5. Plantation conveys warmth, protection, and comfort.
6. Players & viewers can enjoy games like football, volleyball, and cricket.
7. Maintaining freshness and a pleasant environment.
8. Time and money put into establishing a nice landscape pay dividend while selling.

CONCLUSION

Greenery protects our environment from global warming and pollution. And the true fact is that without irrigation (water) greenery is not possible. TWW is the best way to maintain greenery while helping to minimize pollution, the environment, and global warming..



ABOUT THE AUTHOR

Dilip Yewalekar is the Senior Vice President of Jain Irrigation Systems Ltd. He has over 36 years of experience. He has done M.Tech- Civil- Structural Engg, PG Diploma in Piping Engg, AMIE, UK, ASAE, USA. He is a Google scholar, Member of ICID.



He also has Fellowship of World Bank and Mashav, Israel and is a Faculty at Govt College of Engg, Jalgaon. He is also a faculty at Micro Irrigation Course of ICID & CWC, Govt of India. He has been awarded the EEF Global Water Leadership Award – Global Water foundations. Strategic Leader in Micro Irrigation – ABSA Award, Professional Excellence Individual Award – Aqua foundations and Best Innovative Article in Sabujeema International Magazine. He has 70+ papers/publications at national/international conference/magazines/books to his name.

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Manisha Kinge is an M.Tech-Agri Engg. She is the Manager –Design & Projects (Dom/Export), at Jain Irrigation. She is also the Faculty: Micro Irrigation Course of ICID & CWC, Govt of India. She has an overall experience of 16+ years in Water Management – Irrigation, Agriculture - Planning, Designing, Execution, Management & marketing in India and Abroad. She has 20+ papers/publications at national/international conference/magazines/books to her name.



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WASTEWATER REUSE SYSTEM AS PART OF THE SMART CITY CONCEPT

By
Ran Kedem, Partner And Business Development Director, Reali Technologies Ltd.

SMART CITY CONCEPT – BACKGROUND

The smart city concept integrates information and communication technology (ICT), and various physical devices connected to the IoT (Internet of things) network to optimize the efficiency of city operations and services and connect to citizens.

Smart city technology allows city departments and management as well as related entities to interact directly with both community and city infrastructure and to monitor what is happening in the city and how the city is evolving. ICT is used to enhance quality, performance and interactivity of urban services, to reduce costs and resource consumption and to increase contact between citizens and government.

A smart city is a technologically modern urban area that uses smart technology to collect specific data to improve the operations across the city.

Major part of the smart city solution is the

Water & Wastewater networks. In this article we will present the smart wastewater (Smart wastewater network – SWWN) concept.

SMART SEWER (WASTEWATER) CONCEPT – BACKGROUND

A wastewater system generally comprises

- Wastewater source
- Collection and transport system,
- Treatment of wastewater plant
- Transport system of treated wastewater for disposal or reuse

If in the past it was common to look at each of the sewer components as standalone, in smart network the approach is to look and manage all the sewer components as one integrated system.

This new approach has significant advantages a Wastewater sources and the volume of wastewater affect the entire system from the collection and transport network and up to the composition of the wastewater and the nature of the treatment facility required to produce effluent able to meet environmental discharge or recycled



water quality requirements.

INFORMATION MANAGEMENT

In smart wastewater system the information management is becoming increasingly important and a feature of regulatory control programmes. Increasingly, information needs to be communicated transparently within the utility as well as to relevant authorities, users, and other stakeholders.

Data aggregation and data availability in real time is crucial to manage better crisis events by having Real-time warnings for exceptional events. With advanced ICT system the ability to Manage & Control remotely all system components. The real time Information enables improved service, quick reaction time to malfunctions and contributes for better and safer management of the system in both, routine, and crisis events.

Unfortunately, it is also one of the biggest challenges water utilities are facing today. According to recent market surveys among 500 water utilities executives, the main Data challenge that they are facing is (61%) is the ease of access to data, furthermore the main barriers in adapting digital transformation (integrating IIOT data) are: costs, technology complexity and security.

In this article we will present the most advanced smart Water & wastewater IIOT system existing today. This system was developed exactly to overcome those challenges providing, Smart & simple, affordable, and highly secured holistic solution that makes all data (aggregated) available and easily accessible in real time.



SMART WASTEWATER REUSE CONCEPT – IIOT SOLUTION

WHY DO WE NEED SMART SEWER SYSTEM?

Water and sewer utilities are facing a significant challenge; the infrastructure and Data management of their facilities, network and process became increasingly complex, while the demands for real-time, efficient, and safe operation of facilities and networks, both in routine and during crisis events, became more stringent and necessary. Also, the demands from costumers from one hand and regulators from the other hand is increasing all the time.

SMART SYSTEM WILL REDUCE OPERATIONAL COMMON RISKS:

- Risk of ignorance - Not knowing in Real time what is going on
- Risk of ignoring - Ignoring existing and future problems
- Risk of late response - Late response to ongoing problems and crisis events

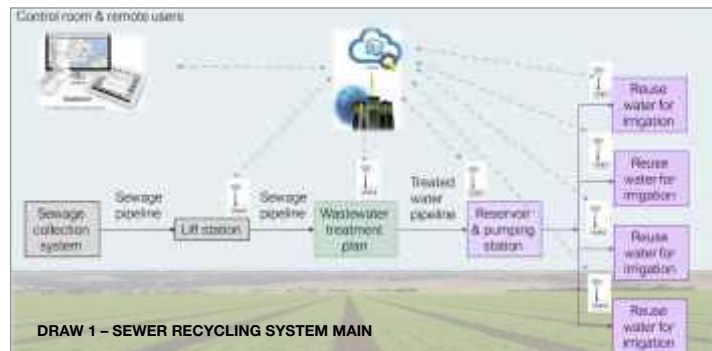
and at the same time will increase efficiency by improving collaboration, coordination and data sharing in the organization and reducing respond time. Reducing risks + increasing efficiency = improving the safety, customer satisfaction & the bottom line of the utility

THE MAIN CHALLENGES OF SMART SEWER SYSTEM ARE:

- The system is spread on a large area from the collection area and up to the reuse/disposal area of the treated water. This area is changing in most cases from urban area to a rural area, with long distance between the different site and facilities and in many cases with a challenging topography change between the different sites.
- The system is made of many different components providing a huge amount of data (flow, discharge, water level, water quality...) which are all relevant for safe and efficient operation.
- A large variety of facilities from underground manhole to pump stations, reservoirs, and up to complicated Wastewater treatment plan.
- A large variety of equipment (Sensors, PLC, analyzers, pumps, valves...), manufactured by different manufacturer and using different communication protocols.
- In the system combined real time devices for monitoring and control together with data loggers for monitoring which is not real time.
- Large number of users from different disciplines (Technicians, operators, local managers, senior managers, professional experts...) located in different places (on site level, utility level, municipality level...), who needs different data in different

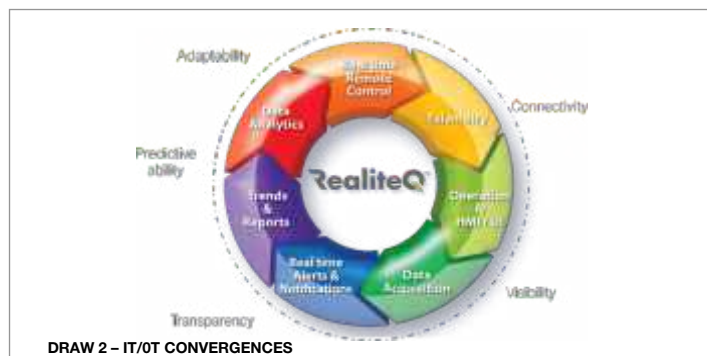
BASED ON THE ABOVE CHALLENGES THE MAIN KPI OF THE SMART SEWER SYSTEM ARE:

- Centralized system for the entire network from the collection stage up to the end use of the recycling water (**See Draw 1**).



DRAW 1 – SEWER RECYCLING SYSTEM MAIN

- Comprehensive, real-time remote control & data management system from the infrastructure level through the ICT & SCADA level up to the Cyber security & data analytics level.
- Combined system for real time and data loggers while connecting all the relevant devices in the different facilities to the system.
- IT/OT convergence - integrates information technology (IT) with operational technology (OT) used to monitor events, processes, and devices, makes real time operational adjustments at the network's sites, machines, and offers significant benefits in cost, quality, speed, reliability, and safety (**see draw 2**)



DRAW 2 – IT/OT CONVERGENCES

- Optimization of coordination and collaboration between the different departments in the water utility. Making the relevant data available and accessible in teal time to all the relevant personal in the utility with no limits of the amount of the data and the location of the users.

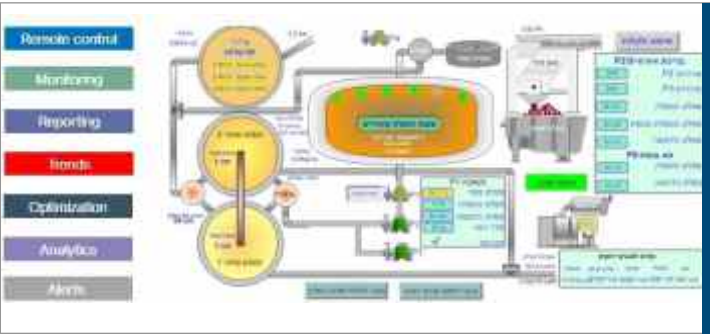


Real time "Asset health" information (**See draw 3**) to the operational and senior management team as, you can't manage efficiently what you can't see!

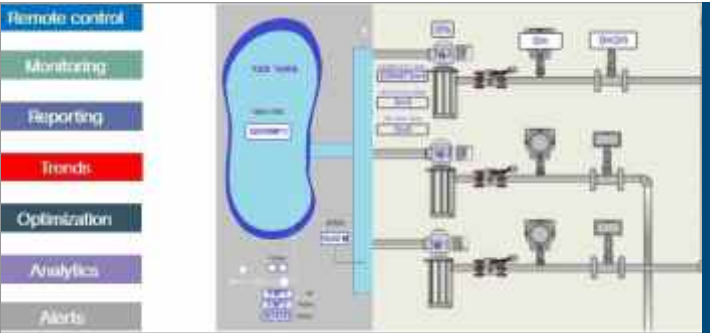
MAIN SMART SEWER RECYCLING SYSTEM FACILITIES AND REQUIRED DATA:

1. WASTEWATER TREATMENT PLAN

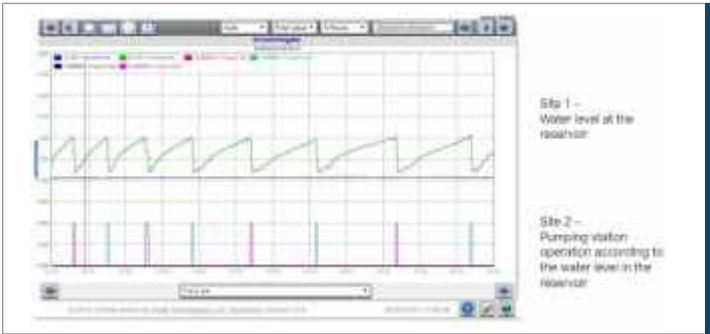
The system monitors and controls all the process of treating the wastewater, from the entry point to the plant and up to the point where the treated water (as well as the waste) leave the plant.



2. RESERVOIR AND PUMPING SYSTEM

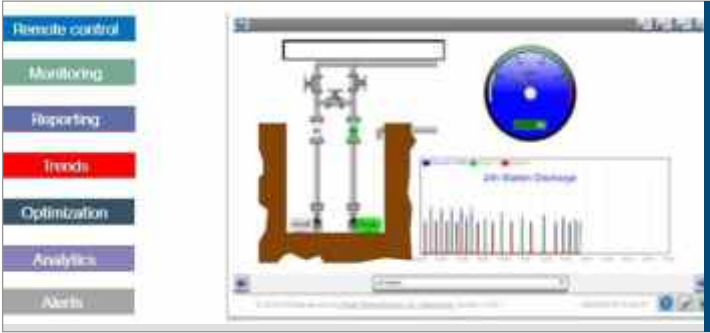


Direct communication and Data sharing between the reservoir and the Pumping station (some time they can be in the same site but in other case they can be in separated sites as well. In this case, direct communication system and data sharing can prevent overflow events at the reservoir and manage critical events.



3. LIFT STATION

In the lift station it is common to monitor and control the operation, maintenance, collections, and more... Usually control local PLC (if exist) and sensors as required providing real-time and historian data, trends, reports, notifications, and alerts.



4. TRANSMISSION LINES

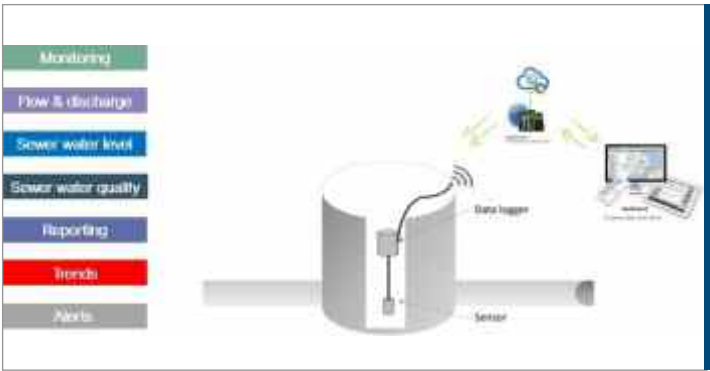
Along the transmission line you are usually are usually monitoring the flow and the pressure and you may also control valves if required, this way you can remotely close valves in crisis event and



minimize the damage and the water loss.

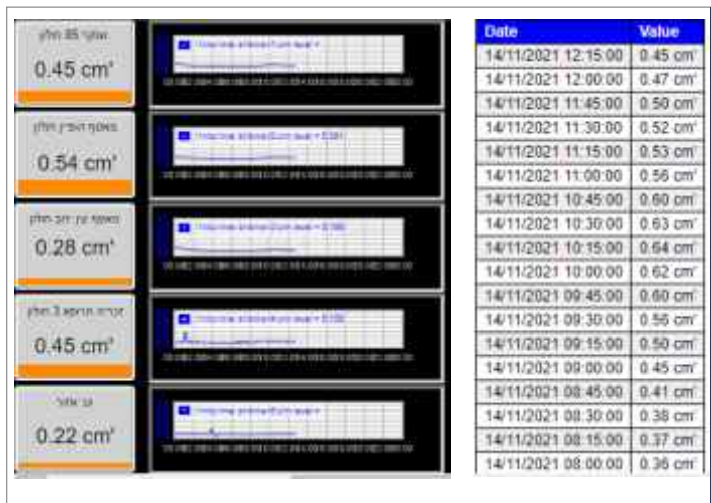
5. MANHOLE MONITORING

In sewer manhole there are several parameters which are usually monitored to follow the sewer water level and gets alert/notification when the level is going up to prevent sewer overflow events (combined sewer overflow – CSO or sanitary sewer overflow - SSO). It is also common to monitor the flow/discharge and in some case



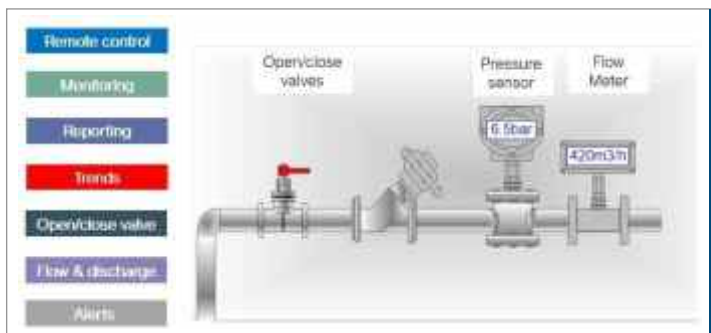
also the sewer water quality.

For example, below presented the real-time sewer water level in several manholes (left side), and the trend (change in the sewer water level in time) in black or in table on the right side.

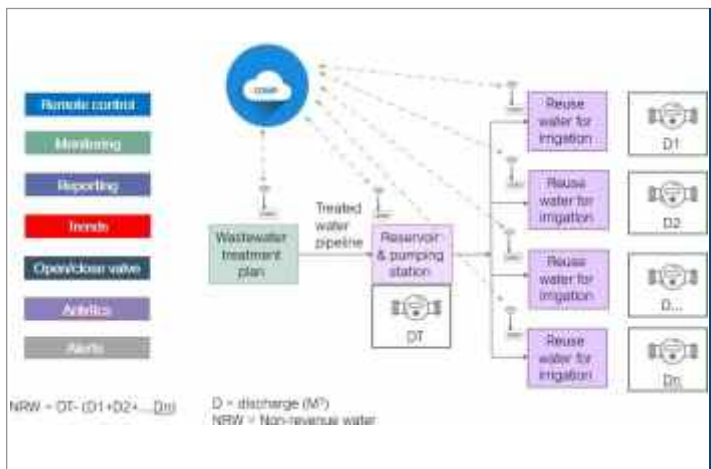


6. RECYCLED WATER FOR IRRIGATION ENTRANCE POINT

When dealing with wastewater recycling system for irrigation it is important to connect to the centralizes system also the entrance point to the irrigated area. This way you can know exactly the amount of recycling water provided to the end user (for billing), but also to manage the entire distribution of the treated water to avoid overflow at the reservoir and overloaded on the treated plans.



Monitoring the entire system from the collection system through the treatment plant and up to the end user also allow to identify very easily non-revenue water (NRW) events.



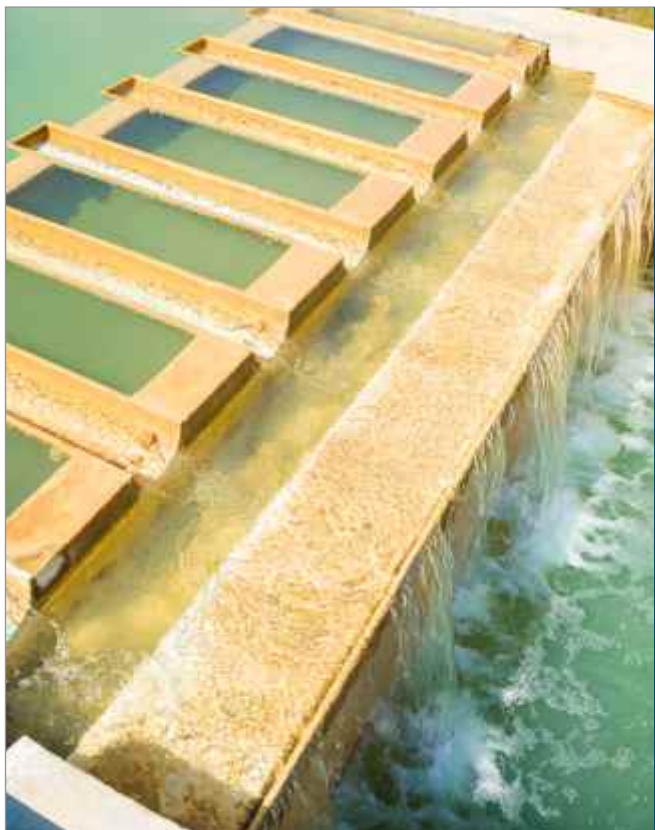
ABOUT THE AUTHOR

Ran Kedem is the Partner at Reali Technologies Ltd. After more than 30 years of executive management experience in Global Business development in the field of water and environmental technologies: - Ran joined as a partner to Reali Technologies an Israeli innovative & groundbreaking company in the field of Internet of Things (IoT), SCADA and cloud computing. Ran served as an officer at the technology unit in the IDF. Ran has two academic degrees: MBA, and B.Sc. in Water and soil sciences.

Prior to Reali technology Ran was part of the founding team at Miya, a global leading company in NRW (Non-Revenue water) redaction projects and water efficiency in water utilities (sold for hundreds of millions USD). Prior to Miya, Ran served as a Division Director at Netafim, a global leader in smart irrigation technology.

Ran is a member of the Steering Committee "International Standards for Water in the Smart City".

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.





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WASTEWATER REUSE: SOLUTION FOR WATER SCARCITY

By

Mohammed Naser Azeez, Managing Director, Aquality Water Solutions Pvt. Ltd.

Water is essential for life. It is the most abundant compound found in all living organisms and the basis of existence of the planet. Yet, around 80% of the world's untreated waste water is discarded into the water bodies, rivers, lakes, ponds, and oceans creating drinking water pollution that ultimately becomes harmful to public health. The researchers are surprised that in decades, what they could not imagine, the new contaminants are now increasingly found in water that were previously unidentified, from micro-plastics and nano-plastics to pharmaceuticals in water as well as the recent SARS-CoV-2 virus due to contamination from the untreated wastewater.

In India, over 600 million people face acute water shortages, and the demand for domestic water is continuously rising due to increased awareness about hygiene with pandemic. Estimated almost 200,000 people lose their lives in a year in India due to lack of access to safe water. More than 12% of the country's population (or approximately 168 million) are already living the "Day Zero" scenario, a day with no access to clean water within or near their

homes. The COVID-19 pandemic has aggravated the water crisis by increasing the demand for domestic water by 20-25 percent, as hygiene awareness has grown and households are practicing cleaning and hand washing more regularly.

WASTEWATER TO RESOURCE

The use of treated wastewater is among the strategies that can be employed to address the water stress. This also make economic sense for using treated water to plug the increasing demand-supply gap by following the examples from successful global models in order to cover India's USD 257 billion gap in water infrastructure funding through leveraging on public private partnerships (PPPs) in wastewater recycling and reuse projects.

There is an ardent need of specific policy reforms, including the introduction of central schemes to incentivize sewage treatment plants and common effluent treatment plants on PPP basis with modern treatment and technological solutions.

As water reuse becomes a critical part of



water security, water utilities and municipal bodies in India are under constant pressure to incorporate cost-effective methods in their daily operations. The major hurdle in wastewater reuse plan is the mindset and infrastructure resources required for the purpose. The treatment solution for making wastewater treated for reuse, the traditional processing method, mainly membrane bioreactor technology (MBR) is complex and expensive to operate. A newer solution that combines two simple yet extremely powerful technologies now offers utilities a low-cost and reliable alternative for indirect potable reuse.

TECHNOLOGY FOR REUSE SOLUTION

With the innovative technology changing lives everywhere, the treatment methods for wastewater has also undergone sea changes. The modern solution combines the granular sludge technology with tertiary filtration using pile cloth media to produce reuse-quality effluent with significant cost savings and operational benefits.

Aerobic granular sludge is simply a batch process that harnesses the unique properties of the microbial community found in all wastewater systems by creating optimum conditions for dense aerobic granules to form. Each of these granules contains an aerobic, anoxic, and anaerobic zone. Basically, each granule is a miniature biological nutrient removal wastewater plant, so there is no need for multiple tanks or zones to carry out each process step.

Aerobic granular sludge technology allows wastewater treatment plant to achieve enhanced biological nutrient removal in a compact environment with simple



operational procedures. Based on the unique characteristics of granular biomass, including settling rates over 15x greater than conventional activated sludge, the solution uses an optimized batch cycle structure that combines biological treatment and clarification in a single reactor. There are three main phases of the cycle to meet advanced wastewater treatment objectives (Fill/Draw, React, and Settling). The duration of the phases is based upon the specific waste characteristics, the flow rate, and the effluent objectives.

Pile cloth media filtration technology has been around for decades, used mainly for tertiary wastewater treatment, a final stage of the treatment process to filter effluent before it leaves the plant. However, the technology is now poised to provide extensive benefits as an advanced primary treatment technology. It stacks up well against other methods, which include chemically enhanced solutions that present additional operating costs and ultra fine screens that remove fewer solids. As a replacement for primary clarifiers, or with placement ahead of an extended aeration plant or sequencing batch reactors (SBRs), the robust pile cloth media technology can significantly reduce the treatment footprint while driving energy savings and boosting energy production.

With the pile cloth media filter, treatment is accomplished through the use of cloth filtration media, capable of reducing total phosphorus to less than 0.1 mg/l and less than 5 mg/l of BOD and TSS. Benefits include vertically oriented cloth media disks, which reduce the required footprint, and lightweight, removable segments for ease of maintenance.

The most significant benefit of this combined solution is its low operating cost compared to MBR technology. Energy consumption is roughly 10 percent of what is consumed with an MBR, due to the elimination of all aeration energy required for membrane air scour and other unit processes, including mechanical mixing and mixed liquor recirculation. The MBR membranes are typically replaced almost every three years, while expensive chemicals are used in the interim in order to maintain low trans-membrane pressures and prevent excessive pumping costs.

Daily operations are also much simpler because there are no moving parts within the reactor. By comparison, maintaining an MBR is complex and operator-intensive because

the membranes require much more frequent monitoring and cleaning.

While initial capital costs for an MBR and aerobic systems' alternative solution may be similar, the additional up-front expense for an MBR if the utility is required to meet more aggressive biological nutrient removal targets may be increased considerably. In that case, selector zones (anoxic, aerobic, and/or anaerobic) must be built in addition to the membrane basins.

The number of membranes in an MBR must accommodate expected peak flows. For a plant with a 4-to-1 peaking factor, four times as many membranes need to be in place as you would need to treat average flow. With advance aerobic technology, given the flexibility of the cycle structure where cycles can be shortened to treat higher flows, this is accomplished without significantly increasing the size of the reactors. In the same plant with a 4-to-1 peaking factor, for instance, the aerobic granular sludge reactors may only require a much more modest increase in size.

FUTURE ORIENTED ACTIONS

Conventional activated sludge treatment for wastewater is becoming a challenging process over the years with changing environmental norms. The process not only require significant amounts of energy, which drives up operating expenses, but municipalities and water utilities are under pressure to follow green practices. With energy cost mounting and safe disposal becoming a challenge, there a greater push for focused approach with energy efficiency. The aerobic granular sludge technology can help overcome these issues as well as other emerging constraints.

In India, a large number of water and wastewater treatment systems are grappling with aging infrastructure that needs an upgrade to accommodate the growing volume of wastewater and expanding customer base. The benefits of cutting energy costs, improved sustainability, and the ability to treat more within a smaller footprint requires urgent attention from the authorities. Implementing sustainable treatment solution is also suitable for adoption of green technology that will meet the quality requirement of treated for reuse purposes.

At Aquality Water Solutions Pvt. Ltd., we believe that innovation holds the key to

growth and sustainability of any business and nation's economy. With fresh water becoming a scarce resource and water stress is threatening lives across the globe; the most pungent solution will be to reuse as much wastewater as possible starting from non-potable purposes initially. As a responsible water treatment solution provider, it is our integrated approach to common goals that sets us apart. Cooperation over competition, sustainability over profitability, livelihood over employment, solutions over sales, value creation over marketing are some of our priorities in the long term and same holds true for water industry as well. As an entrepreneurial firm in an era of extreme competitiveness, we move ahead by creating value rather than pursuing business. This strategic choice is reflected in our approach at every step.

In the current socio economic scenario where water scarcity and contamination along with environment degradation has become the biggest concern, focused efforts are required locally to achieve the benefits at a greater scale. Multiple approaches are needed — increase use of treated water for irrigation, improved access of reclaimed water to industries, increased groundwater recharge, adoption of water conservation strategies and making wastewater treatment plants functional to treat the maximum generated while increase the reuse for all no-potable purposes and switching to crops that are less water intensive.

ABOUT THE AUTHOR

M o h a m m e d Naser Azeez, a first generation entrepreneur in water sector has played a major role in formulating growth strategies

that has helped several companies to become water positive with proper treatment and reuse facilities. His efforts in making a difference has made Aquality Water Solutions a strong mission driven organization with the sole intention of providing clean drinking water facility to the people and industries.



To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.

SHOULD WASTE WATER BE REGARDED AS A 'WASTE' ANYMORE ?

By

Dr. Mayur J. Kapadia, former Additional General Manager & Head, Quality Control Division, GNFC Ltd., Bharuch, Gujarat.

Water - the sole lifeline of people and a precious gift of nature –is becoming increasingly scarce. In the face of climate change, our freshwater resources are at threat. One tenth of the world's population lacks access to clean and safe water. The population growth, increased human activities and degradation of natural environments have put challenge to provision of safe and sufficient water to the mankind.

Wastewater is often seen as a burden to be disposed of. However, a major part of the solution to challenge of fresh water availability lies in managing the wastewater. Therefore, the days of considering the waste water a 'waste' have gone away because Water is too precious to be used just once.

Rather than considering the wastewaters a burden, it is now viewed as a source of water,

energy and nutrients. Wastewater contains many resources like organic matter, phosphorus, nitrogen, heavy metals, thermal energy, etc. Waste water is, thus, a resource with economic value, not a liability anymore. With water demand growing in every sector from agriculture to industry, it is judicious to use wastewater after proper treatment to tide over water crisis and generate huge environmental and economic benefits for mankind.

Water Reuse (also commonly known as 'water recycling' or 'water reclamation') reclaims water from a variety of sources, then treats and finally reuses it for beneficial purposes such as agriculture and irrigation, potable water supplies, groundwater replenishment, industrial processes, and environmental restoration. Water reuse can provide alternatives to existing water supplies and be used to enhance water



security, sustainability, and resilience.

Waste water sources :

- Municipal wastewater
- Industry process water
- Cooling water blow-down
- Boiler bleed-off
- Industrial effluent
- Stormwater
- Agriculture runoff and return flows
- Water resulting from natural resource extraction activities

These sources of water should be adequately treated to meet “fit-for-purpose specifications” for a particular next use i.e., quality needed to ensure public health, environmental protection, and / or specific user needs.

WHY WASTE WATER SHOULD NOT BE WASTED ?

- Aversion of water scarcity - Salt water (sea water) is plentiful, but fresh water is scarce. Recycling of wastewater, through scientifically advanced resource recovery systems, can put clean water back into circulation, thereby reducing scarcity.

- Fertilizer - It is also possible to convert biosolids into safe, pathogen-free, nutrient-rich, Class A quality chemical and biological fertilizers.

- Green spaces - Wastewater resources can be used for creating public parks, where residents can enjoy rare, green space. The water and nutrients stay in the city, providing new benefits in their recycled form.



- **Energy** - Advanced technical treatment of waste water can increase the production of biogas in digesters at wastewater treatment plants. Proper waste water treatment can, thereby, become a source of alternative energy.

- **Diversion of waste** - When treated as “waste”, wastewater biosolids are too often dumped in landfills. Landfill takes up valuable space and sends greenhouse gases into the atmosphere. Sound and advanced treatment can recycle the waste for higher and better uses, reducing the need to create more landfills.

- **Soil fertility** - Recycled wastewater contains valuable nutrients and organic matter which can keep soil healthy and enhance fertility.

- **Prevention of soil erosion**—Use of nutrient rich waste water can lead to healthy plants and soils, which are able to retain more moisture, thereby reducing the soil degradation and erosion.

- **Value addition** - There are wastewater management solutions available today that offer production of valuable products with real market value.

- **Aquifer recharge** – Treated waste water can enhance recharge of artificial lands and aquifers.

- **Lowering fresh water cost** – The reduction in consumption of fresh water can eventually lead to lowering down of cost towards fresh water consumption treatment.

- **Fewer transboundary conflicts** – The conflict and war for surface water among districts, states and countries could substantially reduce as dependence on fresh water will come down by waste water recycling.

SHIFTING OF WASTE TO RESOURCE:

Water reuse can be done in 2 ways - **PLANNED** or **UNPLANNED**.

Planned water reuse : Systems designed with the goal of beneficially reusing a recycled water supply. Examples of planned reuse include agricultural and landscape irrigation, industrial process water, potable water supplies, and groundwater management.

Unplanned water reuse : Situations in which a source of water is substantially composed of previously-used water. The drawl of drinking water by communities from rivers, which receive treated wastewater discharges from communities upstream, is an example of unplanned water reuse.

Depending upon the type of contamination in waste water and “fit-for-purpose specifications” for treated water, the waste water reclamation can be accomplished by employing unit operations like clarification, removal of chemical contaminants, activated sludge process, chlorine dioxide treatment, direct membrane filtration, ultrafiltration, reverse osmosis, and ozone disinfection.

Adequately and properly treated waste



water can find use in below listed main areas:

- Irrigation for agriculture
- Landscaping such as parks, rights-of-ways, and golf courses
- Municipal water supply
- Industrial process water requirements
- Toilet flushing
- Dust control
- Surface cleaning of roads
- Concrete mixing and other construction processes
- Recharging of lakes, aquifers
- Environmental restoration
- Fire fighting

Chennai, India has become more circular and resilient towards water reclamation responding to the need for more water amid rapid industrial and population growth. It mandated rainwater harvesting and became the first city in India to reuse 10% of collected wastewater, with plans to achieve a reuse rate of 75%. As part of this effort, its Water Supply and Sewerage Board sells treated wastewater to industrial users. It had been the only utility in India with two large-scale desalination plants that considered to sell most of the biosolids created by the process as manure for agricultural land.

Panipat refinery and petrochemical complex of the Indian Oil Corporation has also complied with a zero liquid discharge requirement.

Gujarat has drafted a Policy for Reuse of Treated Waste Water which aims for full reuse of treated wastewater by 2030. The key objectives of policy include (i) minimum 80% coverage and collection of sewage in all municipal towns, (ii) attain a level of 100%



treatment of collected sewage, (iii) reuse at least 25% of fresh-water consumption from treated waste water within prescribed time limit, (iv) reuse 70% & 100% treated waste water by 2025& 2030 respectively.

Above cited are only a few cases. In fact, the reuse of treated waste water has been adopted by many municipal plants, industries and governments.

RISKS ASSOCIATED WITH WASTE WATER RECYCLING

While considering enormous benefits of waste water recycling, the risks associated with it should also be sincerely considered. Proactive actions to mitigate risks will only render water reclamation a healthy proposal for governments, industries and society.

HARM TO ENVIRONMENT : If not treated and handled properly, reuse of waste water can harm the ecology and environment.

HARM TO PUBLIC HEALTH : Reuse of sewage could cause harm to public health since pathogens of sewage can lead to spread of disease in community, if adequate disinfection of sewage is not ensured.

ACCUMULATION OF POLLUTANTS IN SOIL AND CROPS : Use of treated waste water for irrigation pose a threat about accumulation of metal pollutants in farms



and the crop.

GROUND WATER CONTAMINATION : Reclamation of wastes for irrigation and recharge of wells could lead to contamination of ground water streams.

SUITABILITY OF WASTE FOR THE SOIL, SEASON AND CROP : While waste water reclamation for irrigation is quite

overwhelming, it is necessary to understand the season, type of crop grown and soil characteristics prior to implement water reuse in soil under question.

MONITORING : Thorough and regular monitoring of waste water recycling program bears a high thrust, since minor skip from monitoring could lead to heavy cost.

WAY FORWARD

The waste water reclamation is, of course, gaining due recognition and being increasingly practiced. For further progress in the matter, the following points need to be taken into consideration :

Waste water being affordable and sustainable source of water, energy, nutrients and other recoverable materials, the **Governments need to exploit the enormous opportunities** in wastewater.

There are **many treatment processes and operational systems** that use wastewater in municipal activities, sustainable agriculture, energy production and industrial development. Correct treatment process should be deployed and research should be provided a boost to lead to more cost economical treatment.

Benefits far outweigh the costs of better wastewater management. The positive impacts on water quality and supply by increasing wastewater recycling and safe reuse will drive progress in environmental sustainability and economic development.

Wastewater can be vital for farmers. Wastewater is a valuable source of both water and nutrient content for crops, contributing to water and food security and livelihood improvements.

Wastewater can be used in '**industrial symbioses**'. Industry is a major water consumer and wastewater discharger. Many businesses are now using some of their 'process water' for cooling or heating, and using rainwater for toilet flushing, irrigation or vehicle washing.

CONCLUSION

Victor Hugo, A French Novelist, in his acclaimed novel Les Misérables, referred to the sewage system as "the conscience of the city," - a place where secrets don't exist.

After some 200 years later today, the researchers have used innovative technologies, scientists have deployed various analytical techniques and artificial intelligence have employed varied technological tools to study the contents of our waste waters to disclose all of their secrets. Due to unfurling of all the secrets and characteristics, it has become possible to treat the waste waters to make them 100 % safe for the "fit-for-purpose" specifications. In view of limited availability of fresh water, increasing water requirements and promise that waste waters hold for recycling, it is time to make full use of waste waters for domestic and industrial use. Waste water, therefore, has not remained a 'waste', but acclaimed state of a useful 'resource'.

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THE UNIVERSAL RISE OF ZERO LIQUID DISCHARGE FOR WASTEWATER MANAGEMENT: TECHNOLOGIES AND FUTURE DIRECTIONS

By

Dr. Pooja Nikhanj, Microbiologist, Punjab Agricultural University

Freshwater scarcity, one of the most critical global challenges of our time, poses a major threat to economic growth, water security, and ecosystem health. The challenge of providing adequate and safe drinking water is further complicated by climate change and the pressures of economic development and industrialization. The public and industrial sectors consume substantial amounts of freshwater while producing vast quantities of wastewater. If inadequately treated, wastewater discharge into the aquatic environment causes severe pollution that adversely impacts aquatic ecosystems and public health. Recovery and recycling of wastewater has become a growing trend in the past decade due to rising water demand. Wastewater reuse not only minimizes the volume and environmental risk of discharged wastewater, but also alleviates the pressure on ecosystems resulting from freshwater

withdrawal. Through reuse, wastewater is no longer considered a “pure waste” that potentially harms the environment, but rather an additional resource that can be harnessed to achieve water sustainability. Zero liquid discharge (ZLD) is an ambitious wastewater management strategy that eliminates any liquid waste leaving the plant or facility boundary, with the majority of water being recovered for reuse. ZLD obviates the risk of pollution associated with wastewater discharge and maximizes water usage efficiency, thereby striking a balance between exploitation of freshwater resources and preservation of aquatic environments. Achieving ZLD, however, is generally characterized by intensive use of energy and high cost. As a result, ZLD has long been considered not viable and has been applied only in limited cases. In recent years, greater recognition of the dual



challenges of water scarcity and pollution of aquatic environments has revived global interest in ZLD. More stringent regulations, rising expenses for wastewater disposal, and increasing value of freshwater are driving ZLD to become a beneficial or even a necessary option for wastewater management. The global market for ZLD is estimated to reach an annual investment of at least \$100–200 million, spreading rapidly from developed countries in North America and Europe to emerging economies such as China and India. Although ZLD holds great promise to reduce water pollution and augment water supply, its viability is determined by a balance among the benefits associated with ZLD, energy consumption, and capital/operation costs. Therefore, it is imperative to understand the drivers and benefits that make ZLD a realistic option. Incorporating new technologies, such as emerging membrane-based processes, provides opportunities to reduce the associated energy.

ZERO LIQUID DISCHARGE OR NOT TO BE?

The demand for Zero Liquid Discharge often comes with the company policy or in order to cope with unstable water supply. Zero Liquid Discharge aims at the maximum possible reuse of wastewater – but is it also economical? With a fraction of the costs, already large quantities of wastewater can be recycled. The last few percent water recovery increase the costs for such a system considerably. This is also because the treatment residues, the brine, need to be disposed of expensively. As a result, the reclaimed water may get more expensive than fresh water. With an alternative solution



with a combination of elimination and separation process steps, a better balance between ecology and economy can be achieved: The industrial wastewater can be treated to a level that still allows the concentrate to be discharged cheaply in the sewers. Typically the clean majority of the treated water can be used for internal processes.

CONVENTIONAL ZLD SYSTEMS

THERMAL ZLD SYSTEMS

Early ZLD systems were typically based on a series of thermal processes. In such systems, the feed wastewater undergoes a pretreatment step that reduces scaling potential, and is then concentrated sequentially by two core elements; a brine concentrator and a brine crystallizer (or an evaporation pond). The distillates generated by the brine concentrator and crystallizer units are reused as clean product water, whereas the solids produced are either stored (in evaporation ponds), further processed for landfill disposal, or reused as valuable byproducts. Despite their limitations, brine crystallizers or evaporation ponds are still indispensable for ZLD processes. Therefore, the focus of ZLD technology has been on reducing the volume of concentrated brine entering the brine crystallizers or evaporation ponds.

REVERSE OSMOSIS

RO, a well-established, pressure-driven desalination technology with excellent energy efficiency compared to thermal desalination, has been incorporated into ZLD operation to lower energy consumption.

Unlike thermal processes, RO does not require product water to undergo phase transition to achieve separation, thereby eliminating irreversible losses associated with evaporation and condensation in thermal processes. The energy consumed by the RO stage in seawater desalination at 50% recovery is as low as ~2 kWh/m³ of product water, which is significantly lower than that by brine concentrators and crystallizers. A smaller amount of energy is required when treating feedwater with lower salinity than seawater (e.g., brackish water RO, BWRO). In addition, the modular nature of membrane-based technologies provides further versatility in adapting RO into wastewater treatment facilities. As a result, RO can be used to pre concentrate the feed water prior to the more energy-intensive thermal processes, increasing both energy and cost efficiencies of ZLD systems.

EMERGING MEMBRANE-BASED ZLD TECHNOLOGIES

Three membrane-based processes

- ED (Electrodialysis)
- FO (Forward osmosis) and
- MD (Membrane distillation)

Emerge as alternative ZLD technologies to brine concentrators to further concentrate the wastewater after the RO stage. The produced brine from these processes serves as a feed to the crystallizer or evaporation pond. A schematic illustration of ZLD systems incorporating these technologies is shown in Figure below. Some of these technologies (i.e., thermolytic FO and MD) are hybrids of both thermal- and membrane-based processes. While the energy input to these processes is thermal, membranes are



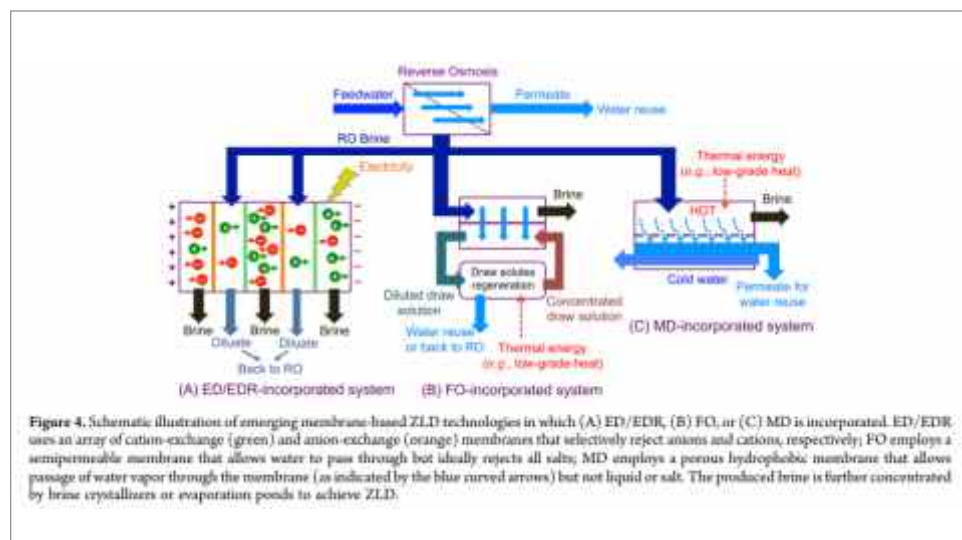
the core separation components of these technologies.

ELECTRODIALYSIS

ED applies an electric potential as the driving force to remove dissolved ions through ion exchange membranes. In contrast to RO membranes that reject all ions, ion exchange membranes selectively permit the transport of counter ions but prevent the passage of co-ions. Cations move toward the negatively charged cathode by passing through cation-exchange membranes, whereas anions migrate in the opposite direction through anion-exchange membranes. As a partial desalination process, ED/EDR has been applied in combination with RO in several ZLD systems. Such systems achieved the dual function of extending the salinity limit of RO and reducing the energy consumption relative to brine concentrators. For example, Oren et al. demonstrated a pilot RO-EDR system for brackish water desalination with a water recovery of 97–98%.⁵ In that system, EDR concentrated the RO brine to a salinity of 100 000–200 000 mg/L prior to a side-loop crystallizer and wind-aided intensified evaporation. In another pilot study, EDR effectively removed hardness to reduce the scaling potential of saline basal aquifer water, thereby improving the subsequent RO recovery without chemical addition. The EDR brine could reach a salinity of 125 000 mg/L and was further concentrated by a brine crystallizer to approach ZLD. In both cases, the EDR effluent was further desalinated by RO or partially blended with RO permeate to attain a desired product water quality.

FORWARD OSMOSIS

Unlike hydraulic pressure-driven RO, FO utilizes an osmotic pressure difference to drive water permeation across a semi permeable membrane. In FO, water flows from the feed water to a concentrated draw solution with a higher osmotic pressure. The





produced brine is sent to a brine crystallizer or an evaporation pond, whereas the draw solutes are separated from the desalinated water to regenerate the concentrated draw solution. Since the driving force in FO is osmotic pressure, FO can treat waters with much higher salinity than RO. When using FO to concentrate feed water beyond the salinity limit of RO, the osmotic pressure of diluted draw solution will surpass the bearable pressure limit of RO. Hence, in this case, draw solutes that depend on RO for regeneration (e.g., NaCl and MgSO₄) will not be suitable. The development of thermolytic draw solutes, such as the ammonia-carbon dioxide (NH₃/CO₂), paved the way for FO incorporated ZLD systems. The NH₃/CO₂ draw solution generates very high osmotic pressure-driving forces and can be regenerated by low-temperature distillation. A recent pilot study demonstrated the application of FO with NH₃/CO₂ draw solution to concentrate produced water from the Marcellus shale region to an average salinity of 180 000 mg/L. Because the thermolytic NH₃/CO₂ draw solution decomposes at moderate temperature (approximately 60 °C at atmospheric pressure) low-grade thermal energy, including industrial waste heat and geothermal energy, can be utilized to regenerate the concentrated draw solution.

MEMBRANE DISTILLATION

MD is a thermal, membrane-based desalination process, in which a partial vapor pressure difference drives water vapor

across a hydrophobic, micro-porous membrane. In MD, the feed water is heated and the resultant temperature difference between the hot feed water (typically 60–90 °C) and colder permeate side creates a vapor pressure difference to drive the water vapor flux. The aqueous permeate can be in direct contact with the membrane (direct contact membrane distillation, DCMD). Alternatively, the water vapor can be collected on a condensation surface separated from the membrane, such as in air gap membrane distillation (AGMD), vacuum membrane distillation (VMD), or sweeping gas membrane distillation (SGMD). MD is more energy intensive than RO and ED/EDR, because water separation by MD requires liquid-vapor phase transition. The theoretical minimum energy of seawater desalination by single-pass DCMD with heat recovery and a feed temperature at 60 °C is 27.6 MJ/m³ of product water, which is much higher than that by RO with a typical recovery of 50% (3.8 MJ/m³ of product water).⁸ In practical use, DCMD was estimated to consume 143–162 MJ (40–45 kWh) per m³ of product water for seawater desalination,⁷⁶ and a comparable value of 80–240 MJ (22–67 kWh) /m³ of product water was reported for AGMD. However, this thermal-based energy consumption cannot be directly compared with the energy consumption of electricity-driven technologies (RO, ED/EDR, and MVC brine concentrators), because the efficiency of electricity generation from thermal energy varies with the quality (temperature) of the thermal energy. Compared to MVC brine concentrators with well-designed energy recovery devices, efficient heat recovery (e.g., use of heat exchangers or brine recycling) is critical to improve the energy competitiveness of MD.

ENVIRONMENTAL IMPACTS

Despite the main goal of ZLD to reduce water pollution and improve water sustainability, application of ZLD also results in unintended environmental impacts. One risk stems from the produced solid wastes. For example, solid wastes stored in evaporation ponds have raised concerns about their odors, potentially negative impact on wildlife, and risk of leakage. Similarly, solid wastes disposed in landfills may result in leaching of chemicals into groundwater. Accordingly, impervious liners and reliable monitoring systems are typically required to prevent potential contamination from solid wastes. As discussed earlier, ZLD consumes large amounts of energy, leading to significant

emission of greenhouse gases (GHG). Some pretreatment methods, such as acidification followed by degasification, release CO₂ from the feedwater into the atmosphere. For example, the application of ED in concentrating RO brine increases CO₂ emission via both energy consumption and decarbonation for scaling control. Incorporating technologies with higher energy efficiency, such as RO, will significantly reduce the GHG emission. In addition, emerging ZLD technologies that can utilize low-grade or renewable energy (e.g., waste heat, solar energy, geothermal energy) enable further reduction of GHG footprint of ZLD systems. Along with advances in improving the energy and cost efficiencies of ZLD technologies, particularly by incorporating membrane-based processes, ZLD may become more feasible and sustainable in the future.

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WASTE TO WEALTH: AN OVERVIEW OF THE RECOGNIZED RESOURCES DERIVED FROM WASTEWATER

By

Dr. Neethu B and Dr. P. S. Harikumar, Center for Water Resources Development and Management

Around 80% of the water we use daily for domestic purpose goes as wastewater. Similarly, a huge quantity of wastewater is being generated at industries, quality and quantity of which varies with the product as well as process involved. Hence, wastewater has gained much attention as a problematic substance by large proportion of the population. As one-quarter of the world now faces water stress, the sole purpose of wastewater treatment plant is being focused to deliver clean water and to reduce the pollution stress on environment. However, treatment plants are capable of doing much more than just cleaning. The wastewater discharged from our house as well as industries are rich source of valuable resources, which if captured efficiently can turn out as wealth. Hence, researchers all over the world are moving together with a mission to change the fate of waste so that it can be viewed at a wide positive perspective. This article is aimed to provide an overview of certain major energy resources as well as value added products that can be extracted from

wastewater.

CLASSIFICATION OF WASTEWATER

Wastewater can be broadly classified as sewage and non-sewage. Sewage includes the wastewater generated from domestic activities with major constituents as urine and faeces. The toilet water from hotels, schools, restaurants, hospitals, etc. can also fall under this category. Whereas the wastewater generated from industrial activities, stormwater, off water from washing clothes, cleaning utensils, etc. can be categorized as non-sewage water. Other well-known terminologies which are gaining attention as wastewater categories are blackwater, grey water and yellow water. The wastewater coming from toilets and kitchen sink, which contains faeces, urine, bits of food material and cleansing chemicals are categorized as black water. Whereas, the blackwater without urine and faeces are identified as grey water. As the name suggests, yellow water solely contains source separated urine.



CHARACTERISTIC OF WASTEWATER

The characteristics of the wastewater, especially the chemical and biological characteristics, are the major factors that decide the nature of recoverable resource. For instance, starch and oil can be recovered from a potato chip making industry owing to the fact that the characteristics of wastewater generated provides provision for such recovery. Similarly, wastewater rich in nutrients enable nutrient recovery. However, certain characteristic feature of wastewater can adversely affect the recovery efficiency. For example, presence of ammonia in wastewater reduces the biogas generation in an anaerobic digester as ammonia inhibit the activity of methanogenic bacteria. Hence, characteristics of wastewater is crucial factor that determines the nature of possible recoveries.

TRASH TO TREASURE

In today's world, the gap between energy requirement and the production is widening, which increased the burden on non-renewable energy sources. In addition to the alarming issues of fossil fuel depletion, it has put severe strain on the environment, which is much evident in the form of climate change and global warming. Similarly, the cost of treatment of wastewater without any additional revenue restrains the industries or other organization from treating the wastewater, which again effects the environment. Ultimate solution for reducing the cost of treatment by simultaneous revenue generation is to produce useful value added products from wastewater in a sustainable nature. This section details



some of the energy forms and valuables that can be recovered from wastewater.

ELECTRICAL ENERGY

Microbial fuel cell, a technology developed with an aim to convert chemical energy present in wastewater to electrical energy with the aid of bacteria, is at the verge of commercialization. Electrogenic bacteria, core of MFC, generates electrons while oxidizing organic matter present in wastewater. The produced electrons are captured by an anode and transported to cathode through an external circuit, wherein electric current is produced. Once taken to field scale, this technology is going to be beneficial to people in remote areas deprived of proper sanitation and electricity. The pilot scale system scaled up to treat wastewater generated in a single toilet used by a family of five proved to be efficient enough to power 2 three-watt bulbs inside and outside the toilet simultaneously for two hours. Hence, this technology is capable of treating the wastewater with simultaneous electricity generation.

BIOGAS

The amount of waste produced in India is expected to rise to 165 million tones by 2030, out of which the organic waste will account to around 50 %. If improperly managed, the environmental as well as health risk associated with the waste will be huge. Hence, India has the potential to convert over 82 million tones of waste into energy, if anaerobic digestion come into picture. Organic waste has the potential to generate huge amount of methane gas via the process of anaerobic digestion. Wherein the bacteria in the absence of oxygen degrade organic matter to produce biogas, methane and carbon dioxide. The lower dependency of population on non-renewable fuel sources are well evident from the exponential rise in the number of biogas plants being installed in the country. Apart from its easiness in design and user friendliness, a biogas plant does not require external energy for its operation. The major application of this renewable energy is at household level, where the women by themselves can operate, maintain and utilize the gas produced for cooking purpose alongside assuring environmental cleanliness.

BIOHYDROGEN

The higher conversion efficiency into power,



lower pollution contribution and better energy density makes the hydrogen gas a striking energy carrier for future. Hence, hydrogen itself is regarded as clean and renewable alternative for fossil fuels. In addition to this, if hydrogen can be produced through sustainable routes with lower carbon footprint it can be considered as an added advantage. Hence, biohydrogen generation from wastewater can be considered as a new avenue in the process of hydrogen production, which proves to be savior of earth from the edge of environmental devastation alongside shielding the energy crisis. The biohydrogen production can be achieved with aid of a wide range of microorganisms including rumen bacteria, Archaea, Clostridia, etc. through dark fermentation process. The low energy intensive nature as well as environmentally friendly nature of dark fermentation process makes biohydrogen future of clean energy source. Another attractive technology capable of producing biohydrogen through degradation of organic waste is microbial electrolysis cell (MEC). However, it has been reported that on combining the dark fermentation and MEC, from 1.3 billion metric food waste approximately 105 million metric ton of hydrogen gas can be produced. Hence, this opens a scope for additional revenue generation alongside wastewater treatment by maintaining environmental sustainability.

HEAVY METAL RECOVERY

Industries including mining and metallurgy, stainless steel manufacturers, aircraft industries, nickel electroplating, battery manufacturing, pigments and ceramic industries contribute to high amount of heavy metal in aqueous waste stream.

Hence, they can be seen as a potential source for recovery of valuable heavy metals. For example, copper can be recovered for electroplating wastewater with the aid of Bio electrochemical technology. Similarly, Reduction crystallization has been identified as effective in recovering Nickel from wastewater. Chemical precipitation of wastewater generated from galvanizing industry is capable of recovering valuable Zinc. Other heavy metals that can be recovered includes silver, gold, lithium, Co, etc. Hence, the nature of the heavy metal depends on the characteristic of the wastewater generated. However, researchers are successful in exploring low-cost recovering process which again can be considered as conversion of trash to treasure.

NUTRIENT RECOVERY

The aggressive use of fertilizers has drastically increased the nutrient concentration in the wastewater streams, the impact of which include eutrophication and oxygen depletion in the receiving stream. However, the high demand for ammonia and phosphorous has increased the demand for nutrient recovery from waste streams. Nutrient recovery from wastewater can give additional advantages including lower sludge production, reduced load on treatment system in addition to the benefit it renders to farmers. Currently, chemical precipitation, adsorption, bioelectrochemical systems as well as other advanced treatment techniques involving forward osmosis, membrane distillation and electrodialysis are found to be effective in nutrient recovery. Apart from these, biological methods via accumulation, storage and recovery with the aid of

polyphosphorus accumulating organisms or microalgae are also gaining much attention recently. The recovery factors that influence the effective recovery includes the pH, temperature, coexistent ions, desorption, etc. The above-mentioned technologies not only aids in nutrient recovery but only reduces the treatment cost, making the economically feasibility significant without compromising the removal efficiency.

ORGANICS AND CHEMICALS

Most of the time the organic sludge acts as excellent house for recoverable resources. For example, volatile fatty acid can be recovered from the sludge via electro fermentation. Similarly, phenol, acetate, sodium hydroxide, etc. are certain other chemicals that can extracted from waste water employing bio electrocheical techniques. Another common practice seen in industries that reduces the load in treatment plant is the solvent recovery. This is done with the help of a distillation equipment, which extracts the useful solvent from the wastewater generated during the industrial process. Sulfuric Acid, Hydrochloric Acid, Nitric Acid can also be recovered via acid recovery exchange mechanisms. Apart from the above mentioned organic and chemicals there are wide range of chemical that can be recovered based on their utility and availability.

CONCLUDING REMARKS

Waste to wealth, also widely recognized as trash to treasure is gaining much attention in todays growing world, where the available non-renewable energy sources are moving towards extension along with the hike in cost. More importantly, the need of the hour is a sustainable, clean, environmental solution for production of energy. Similarly, innovation and employment of techniques to recover value added products from waste stream is need of the hour, owing to the fact that it could drastically reduce the treatment cost and carbon footprint. Hence, researchers are moving forward in search of more efficient techniques to convert waste to wealth in order to make the earth a better place to live.

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WATER RECYCLE, REUSE & ZERO LIQUID DISCHARGE

By

Mangesh Dashrath Surve, Founder- Managing Director (MD), Envicare Technologies Pvt. Ltd.

Water is the most precious thing on our planet. It can be called the only true elixir of life. However, wastewater has impacted water levels and water quality.

It is where wastewater management comes into the picture and can become a vital force in saving water. There are mainly three ways to deal with wastewater for far-reaching impact.

1. WASTEWATER REUSE :

Reusing anything is a classic way of ensuring that the item lasts long, gets utilised in a long term and leaves a mark on the planet. Wastewater reuse can make a positive impact on Earth. It can be called the first step in wastewater management and keeping its creation in control.

However, there are quite a few questions which arise in this regard. The usual query is about the way of reusing wastewater. The vital part is that this reusing should become a continuous process and almost a habit that is hard to let go of.

You must ask yourself questions. One of the most important questions to ask before throwing this water away is – is there any way of reusing this water back?

Yes, there are. But it requires extensive study and implementation later on.

There have been quite a few case scientific studies done on reusing wastewater. One happens to be on the wastewater produced from the washing in the bearing industry. Our simple treatment did the work of using wastewater repeatedly for washing. It includes just removing the oil and grease from the water. The results can be called path-breaking and save the expenditure of washing chemicals and the cost involved in water treatment for meeting discharge standards.

The reuse process must have serious

reconsideration. There need to be experts involved in its reuse prospect. It stands true for the chemical, pharmaceuticals, tannery and electroplating industries, where wastewater treatment can help recover precious minerals, metals from the wastewater involved. The impact on industries will be huge.

There have been technologies that have made inroads in this aspect. Technologies like Anaerobic Treatment and Constructed Wetlands have proved useful in reusing wastewater in lower cost and making use of the by-products.

HOWEVER, THERE ARE CHANCES OF CHALLENGES.

- Right Mindset, perception in reusing the waste
- Lack of Knowledge
- Lack of Awareness for Taking Initiative

That is why there should be urgency in recognising that by figuring out a system, the issue of releasing waste water will go away by at least 50%.

2. WASTEWATER RECYCLING:

The next obvious step will be looking into methods of wastewater recycling. It is the best option to ensure waste water does not go waste and further impacts the environment. You must know the 4Rs of any waste management.

The alarming point in the present water management scenario is the UN's report on India's water situation. It speaks about India being the most troubled country in freshwater availability by 2030. It has to make us even more aware of ways to manage precious water. India's future is very much dependent on our wastewater management.

This big challenge can be met by choosing wastewater recycling. The statistics speak of

90% of wastewater produced by the domestic sectors while the industrial sector makes up 70%. It looks serious. That is why the best and easiest to recycle would be domestic wastewater.

The first step would be changing one's mindset regarding using treated wastewater. A positive thinking towards this treated wastewater can be a stepping stone for recycling. Once that hurdle is crossed, the rest of the road towards recycling will smoothen out.

A classic case study is of RCF, which was named a water production plant. The plant obtains the sewage from the city of Mumbai for recycling. It later sustains the company's freshwater needs for production. It is a boon for the metropolis where millions reside and face water issues.

It is a matter of better ease & saving operating costs to recycle any domestic and industrial wastewater than treating high TDS-seawater desalination. The wastewater recycling management in countries like Brazil and Singapore is worth studying and following.

There can be a few challenges in wastewater recycling too.

- Less R&D as Compared to Other Countries
- Less System Orientation and has a Need-Based Attitude
- Availability of Technology and On-ground Implementation
- Lack of Educated manpower for operating critical systems

The American government has labelled water as a commodity. Wasting this precious resource can be troublesome for future generations. Rumours are going around that water will be the reason for the start of the 3rd World War. So, wastewater recycling has to be decided.

3. ZERO LIQUID DISCHARGE (ZLD):

In the battle for 100% saving of wastewater, ZLD is another option touted for the future. There should be planned design, estimations and expert answers before applying ZLD. It will help apply ZLD better.

ZLD is termed as the ultimate engineering part of dealing with wastewater recycling. It includes process application and end use. It



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can be called the most recent initiative taken by PCB to make wastewater recycling or treatment a compulsory & stringent process.

The typical flowchart involved here is:

Regular ETP >> Ultra Filtration >> Reverse Osmosis >> Multiple Effect Evaporators

The treatment product is obviously on the expensive side for the primary and later for the operating cost. R&D is needed so that the waste water becomes appropriate for the UF and RO feed which then saves the cost of the evaporation system. Better costing is a boon.

Then there is a requirement to conduct studies and reports on the treatability and feasibility to implement the system. It is because ZLD will behave differently with every wastewater.

Another huge challenge would be of managing the concentrated solids disposal. What most must understand is this management can literally improve wastewater products by purification and later use it for proper treatment.

ZLD stands for economisation, corporate commitment and deep consideration for the environment. This process is also a way to lower the wastewater impact on the ecosystems and climate near us.

ABOUT THE AUTHOR



Mangesh Dashrath Surve is a professional Chemical Engineer and Founder- Managing Director (MD) of Envicare Technologies Pvt. Ltd, Pune, India has global presence, which is in the field of Environmental Pollution Control and providing techno-commercial, economical and right solutions in the field of water and wastewater treatment plants for 20+ years.

Envicare Technologies Pvt. Ltd has operations pan India as well as global in more than five countries, completed more than 1500 + no of installations and is associated with more than 750 + no of clientele base. The major national clienteles they are serving as TATA Motors, Pepsico, Mahindra, KSB Pumps, Kirloskar, L&T, 3M, GE, Bridgestone, Godrej, Tata Technologies, BG Shirke, Symbiosis Institute, Toyo Engineering, Bombay Dyeing, Keheine Fie & many more.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.

LOW COST OF MLD/ZLD TREATMENT ACHIEVED THROUGH INNOVATIVE BRINE CONCENTRATION MEMBRANES HELPING THE TEXTILE SECTOR

By

Tina L. Arrowood, Principal Research Scientist, DuPont Water Solutions, USA and Mahesh Kulkarni, Technical Service and Development Scientist, DuPont Water Solutions, India

EXTENDED ABSTRACT

For maximizing wastewater reuse and preventing wastewater discharge, zero-liquid discharge (ZLD) is acknowledged for its benefits in protecting fresh surface waters. Unfortunately, it is typically determined to be too expensive to be practical. A more realistic and cost-effective method is a hybrid approach of minimal-liquid discharge (MLD), using reverse osmosis (RO) membranes, to minimize the volume of wastewater prior to thermal ZLD treatment.

To comply with ZLD regulations over the past decade, India's textile sector has employed MLD using RO membranes followed by thermal evaporation to treat and reuse wastewater streams. The portion of water requiring thermal treatment is still significant and creates a high operational cost and environmental burden. This is driving textile wastewater treatment plant operators to explore new technologies and strategies to lower the amount of wastewater supplied to the thermal treatment and reduce the overall operational cost and environmental burden. Recent innovations in RO membranes enable the recovery of 50% more water prior to thermal treatment – a direct reduction to the environmental impact – and reduce the overall MLD-ZLD operational cost by approximately 10%.

I. INTRODUCTION

Increasing water scarcity and local water discharge restrictions are driving the necessity for industrial wastewater reuse, particularly in regions experiencing rapid

population growth that depend on the economic success of local industries. In many cases, industrial water users are practicing some type of ZLD to maximize water recovery and eliminate contaminant discharge to water sources shared by municipalities, agriculture, or other industrial users. Traditional thermal ZLD will separate salts and other impurities from water through evaporation and condensation of the water vapor to yield a purified water stream and a solid salt source. Due to the high heat capacity of water, a significant amount of energy is required making this strategy prohibitively expensive.

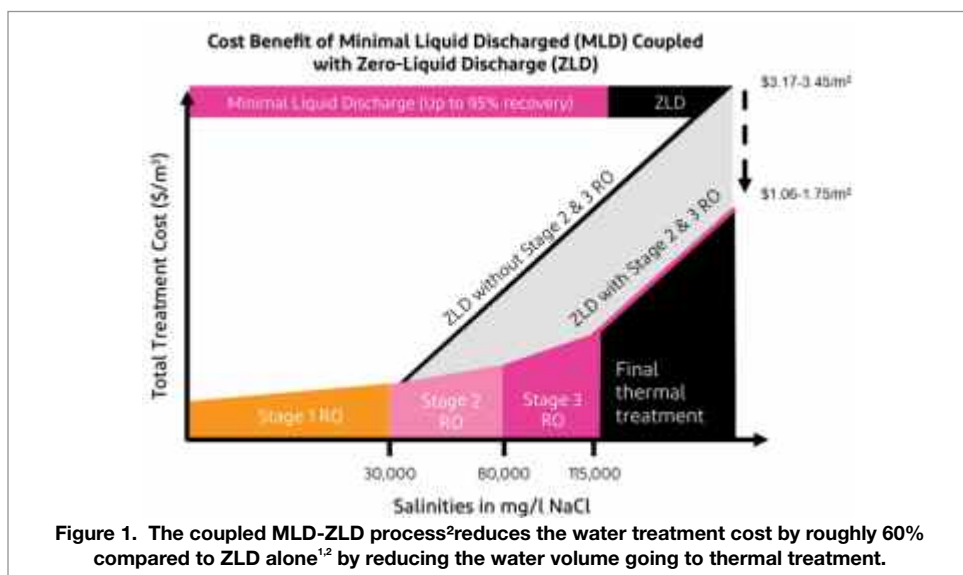
1.1 MINIMAL LIQUID DISCHARGE

Reverse osmosis (RO) membranes use pressure, rather than temperature, to separate contaminants from water and

require a significantly lower energy demand than thermal distillation alone. RO membranes employ a selective barrier that preferentially allows water to pass through (to the permeate stream) while rejecting salts and other contaminants (to the concentrate, or reject, stream). The RO concentrate stream, now only a small portion of the initial water volume, can then be thermally treated at a fraction of the cost. This strategy of maximizing water purification and minimizing liquid discharge to thermal distillation is preferable to ZLD alone.

RO membranes used in MLD systems purify water for reuse and concentrate impurities into a volume that can be as low as 5–10% of the original amount. The cost of thermal distillation to remove the last 5–10% of the water is substantially decreased at this smaller volume. According to Bond & Veerapaneni, the coupled MLD-ZLD process produces water at a net cost that is approximately 60% less expensive than procedures that only use thermal ZLD treatment. Advancements in RO membrane technologies are necessary to achieve higher water recovery and higher total dissolved solids (TDS) concentrations that enable a reduction in the water volume sent to thermal ZLD treatment, which is the highest cost contributor to the overall water treatment process (Figure 1).

II. MODERATE REJECTING RO MEMBRANE FOR BRINE



¹Bond, R.G. and Veerapaneni, S. "Zeroing in on ZLD Technologies for Inland Desalination" Journal AWWA, 2008 100(9), 76-79

²Arrowood, T. "Cloth to Clean Water." IDA WWR Conference. Rome, IT. 2021

CONCENTRATION

The DuPont™ FilmTec™ Fortilife™ XC120 element is an 8-inch diameter, spiral-wound, RO element intended for further concentrating high TDS waters such as concentrated brines from RO systems. Under standard test conditions³, FilmTec™ Fortilife™ XC120 provides 90% salt rejection while producing 12,000 gallons per day of permeate water. The durable and moderately rejecting membrane used in FilmTec™ Fortilife™ XC120 helps enable MLD systems to achieve reject stream concentrations up to 120,000 mg/L (as NaCl) while operating at conventional pressures (< 83 bar). This is achieved through the intentional passage of some TDS to increase the permeate-side osmotic pressure. This directly reduces the overall net-driving pressure and the required feed pressure to achieve a given permeate water flux and enables higher system recovery. Ultimately, FilmTec™ Fortilife™ XC120 can produce a low volume and high TDS concentration reject stream, comparable to a high rejection, ultra-high pressure RO element, while operating at conventional RO pressures. This innovative MLD solution enables the hybrid MLD-ZLD treatment solution while further reducing capital costs, compared to ultra-high pressure RO operation (e.g. high-pressure pumps, high-pressure-rated vessels, piping, etc.).

III. FilmTec™ Fortilife™ XC120 ENABLES A REDUCED TREATMENT COST

Operational data was gathered from several wastewater treatment facilities in Southern India's textile industry to demonstrate the cost reductions that are achievable with a hybrid MLD-ZLD treatment strategy. The average treatment cost is separated into the

Treatment Step	Operational Cost (\$/m³)	Base Scenario		MLD + brine concentration	
		%Water Treated	Cost (\$/m³)	%Water Treated	Cost (\$/m³)
Pretreatment	\$0.60	100%	\$0.60	100%	\$0.60
Primary RO	\$0.61	100%	\$0.61	100%	\$0.61
Brine Concentration (FilmTec™ Fortilife™ XC120)	\$0.67	-	-	15%	\$0.10
Evaporator/Crystallizer	\$3.48	15%	\$3.48	6.5%	\$0.23
Total			\$1.73	Total	\$1.54

following operations: Pre-treatment (~\$0.60/m³), primary RO (MLD) System (~\$0.61/m³) and Evaporator/Crystallizer (~\$3.48/m³). Two scenarios are shown in Figure 2 – a base scenario (top) and a comparative case (bottom). The base scenario includes pretreatment, primary RO (MLD at 85 % recovery), and evaporator/crystallizer (ZLD).

The comparison case includes an additional brine concentration step (~\$0.67/m³), using FilmTec™ Fortilife™ XC120, to further concentrate the primary RO reject stream and reduce the treatment volume sent to the evaporator/crystallizer. For both scenarios, 100% of the feed water is processed through the pre-treatment and Primary RO steps.

In the base MLD-ZLD scenario (Figure 2, top), the Primary RO reject stream, at 15% of the original water volume and approximately 60,000 ppm TDS, is treated through the evaporator/crystallizer at an overall cost of \$1.73/m³ (Table 1). The thermal treatment step accounts for roughly 30% of the overall treatment cost, while only treating 15% of the original water volume.

In the comparative example using FilmTec™ Fortilife™ XC120 to further concentrate the primary RO reject stream (Figure 2, bottom), the volume of water sent to the evaporator/crystallizer is reduced by 43%. Assuming the operating cost of the additional RO brine concentration with FilmTec™ Fortilife™ XC120 is 10% higher than the primary RO treatment, the overall cost of this scenario is approximately \$1.54/m³ – an 11% savings over the base scenario (Table 1). Now, the thermal treatment step accounts for roughly 15% of the overall cost and the savings achieved in that process step (\$0.29/m³) completely offsets the cost of additional brine treatment with FilmTec™ Fortilife™ XC120 (\$0.10/m³).

This field trial demonstrates that FilmTec™ Fortilife™ XC120 RO elements can concentrate brine streams up to 120,000 ppm, roughly double what is achievable in a standard RO system, and reduces the volume of water sent to thermal treatment. This capability enables nearly a 10% cost reduction in the overall treatment process, all while operating at conventional RO pressures (< 80 bar).

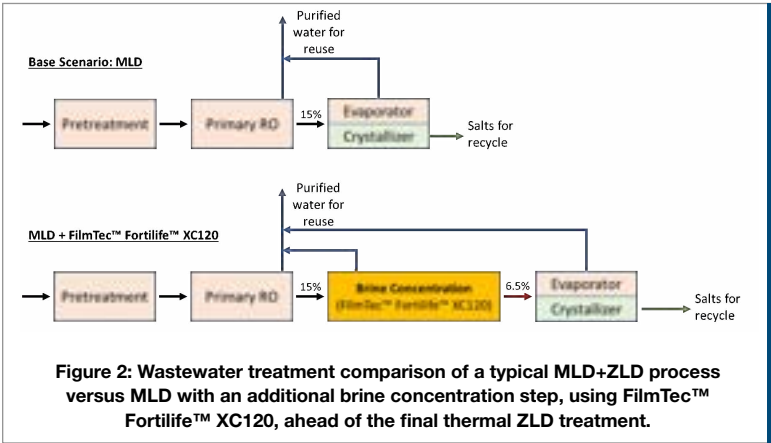


Figure 2: Wastewater treatment comparison of a typical MLD+ZLD process versus MLD with an additional brine concentration step, using FilmTec™ Fortilife™ XC120, ahead of the final thermal ZLD treatment.



Figure 3. Feed, Permeate, and reject samples when treating Textile wastewater with FilmTec™ Fortilife™ XC120.

³Test condition: 600 psi (41.4 bar), 15% recovery. Feed water: 32,000 ppmw NaCl, pH 8, 25 °C
⁴Fortilife™ XC120 Element Product Data Sheet (dupont.com)
⁵Net-driving pressure ($\Delta\pi$), osmotic pressure (π): $\Delta\pi \approx \pi_{\text{feed}} - \pi_{\text{permeate}}$; Permeate flux (J): $J \propto \Delta P = P_{\text{applied}} - \Delta\pi$

IV. PERFORMANCE VALIDATION OF FilmTec™ Fortilife™ XC120

A field test was conducted to validate the flow, recovery, and salt rejection of FilmTec™ Fortilife™ XC120 membranes in a textile dyeing factory in Tirupur, a city in Tamil Nadu. The factory conducted a 90-day trial in collaboration with a system integrator and the project management consultant.

A six-element pressure vessel containing FilmTec™ Fortilife™ XC120 RO elements was put through three operating stages at various recovery points and operated at a constant flux of 10 LMH (L/m²-h). The vessel feed water, the reject stream from the primary RO system, had a high TDS of ~90,000 ppm and was severely fouling due to high chemical oxygen demand (COD ~1200 ppm) and high color (1,400 Pt/Co), both of which are typical in textile wastewaters (Figure 3).

After 90-days of operation, the FilmTec™ Fortilife™ XC120 elements were effective at treating challenging, high TDS, high COD wastewater at operating pressures below 80 bar. A reject water concentration of 120,000 ppm TDS was achieved while only requiring a 60 bar feed pressure. In this operating regime, the permeate TDS was approximately 1000 ppm which was adequate to meet reuse demands after blending with lower TDS permeate water from upstream membrane stages. Despite high salt, COD, and color levels in the fouling feed water, the normalized differential pressure recorded during each test phase maintained below 1.0 bar.

This field trial demonstrates that FilmTec™ Fortilife™ XC120 RO elements can concentrate brine streams up to 120,000 ppm, roughly double what is achievable in a standard RO system, and reduces the volume of water sent to thermal treatment. This capability enables nearly a 10% cost reduction in the overall treatment process, all while operating at conventional RO pressures (< 80 bar).

III. CONCLUSIONS

In places with limited water resources, using MLD to lower the expense of ZLD is becoming standard treatment practice. Opportunities exist to further reduce the cost of ZLD with new developments that reduce the volume of water sent to thermal

treatment. The addition of FilmTec™ Fortilife™ XC120 elements to the MLD process can do exactly that – reduce the volume and increase the salt concentration of the water stream sent for final thermal treatment (ZLD) – providing cost reductions of roughly 10% to the overall treatment process.

ABOUT THE AUTHOR



Tina Arrowood is a PhD Organic Chemist with a 23-year career in Research and Development based in Edina. She holds 16 granted patents, is the 2020 recipient of the American Chemical Society's HEROs of Chemistry award and has authored numerous publications and presentations including a Ted Talk titled "A Circular Economy for Salt that Keeps Rivers Clean" which has received more than 1.8 million views.

She is a membrane innovator and problem solver with a passion of combining science, circular thinking and disruptive innovations to protect and manage the world's freshwater resources..

ABOUT THE AUTHOR

Mahesh Manohar Kulkarni is a Technical Service & Development engineer for DuPont water solutions business in India. He is based at DuPont's Mumbai office.

Overall Mahesh has over 20 years of rich and varied experience in the areas of Water & Waste Water Recycle applied in almost every Industry. He has delivered innovative solutions of Ultrafiltration / Reverse Osmosis / Nano-filtration membranes focusing largely on water reuse applications.

He joined The Dow Chemical Company (and now part of DuPont) in 2011 as a TS & D. Mahesh has successfully provided solutions and supported numerous customers using various product offerings of DuPont. He has been instrumental in establishing DuPont products as the leading component provider in the Indian water treatment industry.

By education Mahesh has received his Bachelor's degree in production engineering from University of Mumbai, India in 1996. He has actively participated in various Water Solutions exhibitions/workshops for and outside of DuPont.

She is a membrane innovator and problem solver with a passion of combining science, circular thinking and disruptive innovations to protect and manage the world's freshwater resources.



To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.

RESPONDING TO EMERGING INFRASTRUCTURE TRENDS IN INDIA WITH BOROUGE'S SUSTAINABLE SOLUTIONS

By

Peck Tze Kang, Head of Regional Marketing, Energy & Infrastructure, Asia South, Borouge

Projected to become the world's most populous country in 2023¹, India is on the cusp of an energy and infrastructure revolution. The government must ensure its rapidly growing population has access to affordable, reliable, sustainable energy and water.

At Borouge, we enable everyday life. As a leading petrochemical company, Borouge provides innovative and differentiated polyolefin solutions for the infrastructure, energy, mobility, advanced packaging, agriculture and healthcare industries. Our solutions also help address several global challenges, including climate change, food protection, access to fresh water, energy conservation, healthcare and waste management.

Our polyethylene (PE) and polypropylene (PP) materials for pipes are used in numerous industries for various purposes: water and gas supply, wastewater and sewage disposal, plumbing and heating, steel pipe coating, and oil and gas pipelines. We design solutions to develop long-lasting, durable pipe applications that are sustainable, safer and more efficient. These solutions help eliminate wastage and loss whilst offering energy savings.

INNOVATIVE INFRASTRUCTURE SOLUTIONS FOR EVERYDAY LIFE

In 2001, Borouge entered the Indian market and introduced its black pre-compounded PE100 material for water and sanitation systems. We have since successfully collaborated with value chain partners, customers, government organisations, industry associations and experts on raising awareness of using pre-compounded black

PE100 pipes as a sustainable solution to conserving water and delivering improved water supply networks.

To ensure we are moving in tandem with our customers and the industry's evolving needs, we have also identified key market trends in India where our reliable infrastructure solutions can make a significant contribution.

1. INCREASE IN DEMAND FOR PE PIPES

In recent years, India has been experiencing a huge spike in demand for PE pipes for water distribution due to the implementation of the Government of India's rural drinking water programme, Jal Jeevan Mission, along with the Atal Mission for Rejuvenation and Urban Transformation 2.0 (AMRUT 2.0) scheme and the push for Smart Cities in India.

Within our comprehensive product portfolio, our BorSafe™ PE products are well established in the market for manufacturing pipes with diameters ranging from 20mm to 2500mm. These pipes can support the demanding needs of such large-scale construction and industrial projects. Our BorSafe™ pre-compounded black PE100 materials have a service life of over 50 years that will help guarantee the longevity of water distribution systems.

These massive projects are likely to involve the open-cut trenching method, which is often challenging and time-consuming. To address such requirements, Borouge has developed a superior grade, HE3490LS-H, for trenchless and Horizontal Directional Drilling (HDD) operations which can provide



over a 50-year lifespan designed to withstand significant surface scratches on pipes that may occur during the installation process.

2. ACCELERATED DEVELOPMENT OF GAS INFRASTRUCTURE

To develop a competitive gas-based economy while meeting its Paris Climate agreement to reduce emissions by 2030, the Government of India is looking to increase the share of natural gas in the country's primary energy mix. This has accelerated the development of requisite gas infrastructures such as gas pipelines and city gas distribution networks, presenting one of the biggest opportunities where industry players can advocate for a secure network by using reliable solutions.

Building gas infrastructure is often a dangerous undertaking. Yet, it is ineffective and eco-friendly way of transporting and distributing energy when designed, built, and maintained according to the highest industry standard. This is where Borouge can add value as we offer our technical expertise and industry experience to ensure



¹Kumar, Manoj. "India to Surpass China as Most Populous Country in 2023, U.N. Report Says." Reuters. Thomson Reuters, July 11, 2022. <https://www.reuters.com/world/india/india-surpass-china-most-populous-country-2023-un-report-2022-07-11/>.

the reliability of gas systems.

Borouge has been providing its BorSafe™ Orange PE100 and Yellow PE80 medium density polyethylene (MDPE) materials for the construction of gas distribution networks, and Black PE compound and adhesive for three-layer polyethylene (3LPE) coating of high-pressure steel pipelines for protection against external corrosion.

3. PIPED SEWAGE TRANSPORT NETWORKS

With the increasing population, India will need sustainable water systems to manage the precious resource around the country. More piped sewage transport networks are necessary to prevent water pollution while supplying treated sewage water for industrial applications and non-potable use. This would require durable pipes that do not react in moist and damp conditions and are highly resistant to chemicals and corrosions.

Our BorSafe™ High Density Polyethylene (HDPE) solution and BorEco™ polypropylene block copolymer (PP-B) pipe grades for Double Wall Corrugated (DWC) pipes are ideal for such piped sewage transport networks. We have produced a special grade of PE100 HE3490ELS-H suitable for pipes, with diameters of up to 2500mm and thicknesses of over 100mm that can transport treated sewage water.



TRUSTED PARTNER FOR DIFFERENTIATED SOLUTIONS

Borouge's quality solutions are not just tailored according to our clients' requirements, but they also meet international standards. We proactively align with the Bureau of Indian Standards (BIS) regularly to advocate and ensure the pipes used in India meet ISO standards.

With growing awareness in the Indian market about the durability of PE pipes and BIS standards, converters and end users are turning towards better-quality pipes and reliable solutions that can minimize potential wastage of water or prevent gas leakage.

For the past 20 years, Borouge has continually contributed to the overall development of sustainable pipe networks by making them safer, efficient and durable. This has eliminated unnecessary water loss during installation and consumption and lowered pipe installation time while saving energy and reducing carbon footprints.

SUSTAINABLE SOLUTIONS FOR TOMORROW

To ensure sustainable living conditions for an emerging urbanization landscape, the Indian government has allocated numerous resources to cater to the needs of the growing economy and population. As one of



its key markets, Borouge remains committed to close collaboration with the industry stakeholders to support the country's infrastructure needs in the coming years.

We will continue to support India's gas and water pipe market as we strive to develop sustainable and differentiated solutions that provide advantages to customers, end-users and the community at large, to inspire a better tomorrow.

ABOUT THE AUTHOR



As Borouge's Head of Regional Marketing for Energy and Infrastructure in Asia South, Ms Peck Tze Kang spearheads the formulation and implementation of marketing strategies. She also oversees the infrastructure markets of Indian subcontinents, Southeast Asia and Australia/New Zealand in various capacities.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.

CLEARBLACK™ – A SMART SEWAGE TREATMENT & RECYCLING SYSTEM

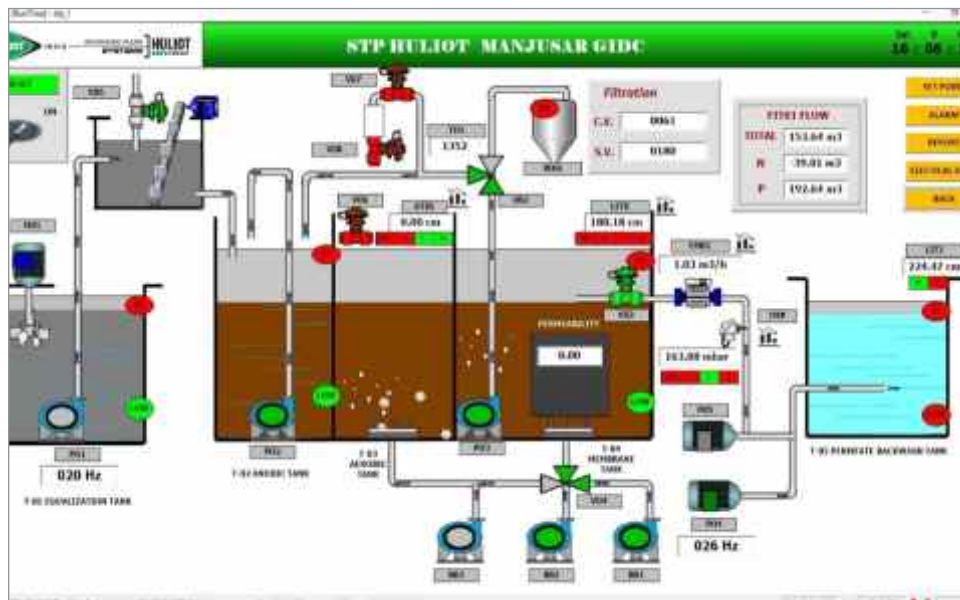
By

Rohan P Vyas, Huliot Pipes and Fittings Pvt. Ltd.

ClearBlack™ is a modular wastewater treatment plant designed and developed by the Huliot Advanced Flow Systems for treatment as well as reclamation and reuse of treated sewage for non-potable purposes. The system presents the Sewage Recycling and Reuse as the best symbiotic solution complementing the optimization of freshwater resources in the time of ongoing water stress and saving them by getting polluted simultaneously by its untreated discharge into the river bodies.

The development of the system draws its inspiration from Israel's Wastewater Management Policy where about 500 Million cubic meter of sewage is produced in Israel every year and 93% of it is treated and reclaimed for reuse reducing the freshwater demand for agriculture by 25-30%.

The system is designed REAL SMART to operate on its own automatically with Israeli Technology including a Real Time Monitoring System displaying the plant performance on a Smartphone Screen. A Screenshot has been shared from one of the trial runs has been depicted below:



1. TECHNOLOGY

The system uses the most advanced and efficient technology of MBR combining activated sludge process treatment with submerged membrane filtration. The membranes with a pore size of 0.04 micron separating all the solids in the process, giving away the solids free clear water. This system is the most compact one among all other systems eliminating the secondary treatment of clarification and tertiary treatment of Pressure Sand Filtration and Activated Carbon Filtration.

The system is tolerant to organic and hydraulic fluctuations producing steady high quality with minimal technician attendance and automated cleaning arrangements.

The treatment process strictly adheres the revised norms of treated sewage discharge as per notification of National Green Tribunal of India (NGT) dated 30th April 2019. The system produces an excellent output water quality consistently with following parameters:

Sr	PARAMETERS	VALUES
1	pH	6.5-8.5
2	Oil and Grease	< 5 mg/l
3	BoD	< 5 mg/l
4	COD	< 30 mg/l
5	TSS	< 2 mg/l
6	Ammoniacal Nitrogen	< 5 mg/l
7	Total Nitrogen	< 10 mg/l
8	Faecal coliform	<= 100 MPN/100 ml

A picture of the treated water quality from trial run of 100 KLD in India has been depicted below:



2. WORKING PRINCIPLE & TREATMENT SCHEME

ClearBlack™ works on the principle of biological treatment of sewage based on the well-known activated sludge process and combines a remarkable ultrafiltration membrane system to consistently produce a colour free, odour free and disinfected treated water safe to handle and reuse.

The treatment scheme for the system is described below:

1. The raw sewage first requires pre-treatment for separation of large solids and Oil & Grease.
2. The pre-treated raw sewage undergoes homogenization in a collection tank and

is pumped to the ClearblackTMSystem. The pre-treated sewage is further screened through an automatic rotary drum screen to separate all the particles larger than 2 mm.

3. The screened sewage enters the Anoxic tank for decomposition of nitrogen compounds which contribute to its pollution. The tank is provided with a mixing arrangement for incoming sewage flow and RAS (Return Activated Sludge) flow.
4. It further undergoes Aerobic treatment in aeration tank for decomposition of compounds of carbon i.e. BOD and COD, which again contribute to its pollution. The tank is installed with a fine bubble diffuser system supplied with air from the blowers.
5. Lastly it enters the MBR tank installed with the membrane system producing exceptionally clean and filtered water. The system is equipped with an automatic cleaning arrangement for membranes. The RAS is recirculated back to the anoxic tank.

A Conceptual Sketch for the treatment scheme inside the Clearblack™System is depicted below:

3. APPLICATIONS OF CLEARBLACK™ OUTPUT WATER:

ClearBlack™ alters the water management

approach from 'use and throw' to a 'use, treat, and reuse' approach for saving the most vital resource on earth by making the treated water available for the following major uses:

- i. Flushing: Flushing is usually the biggest water hog and accounts for 35-40 % of water demand. ClearBlack™ will treat the flushed wastewater and recycle it back for flushing again.
- ii. Vehicle & Floor Washings: A significant amount of water is consumed in keeping the external floorings clean & hygienic as well as vehicle washings etc. at intervals. ClearBlack™ treats the water wasted in such activities and recycle it for reuse again saving all the water while helping in staying clean and hygienic.
- iii. Industrial Processes: The treated water from ClearBlack™ can significantly supplement the freshwater demand in industrial processes and utilities such as Cooling Tower Make-up, Boiler Blowdown Make-up, and Preparation of chemical solutions for ETPs etc.
- iv. Gardening: ClearBlack™ is perfectly fit to use for maintaining the greenery for any kind of area including public parks, sports fields, and tracks etc.
- v. Ground Water Recharge: ClearBlack™ is absolute solution to recharge ground water to maintain humidity levels in soil.

4. SLUDGE MANAGEMENT:

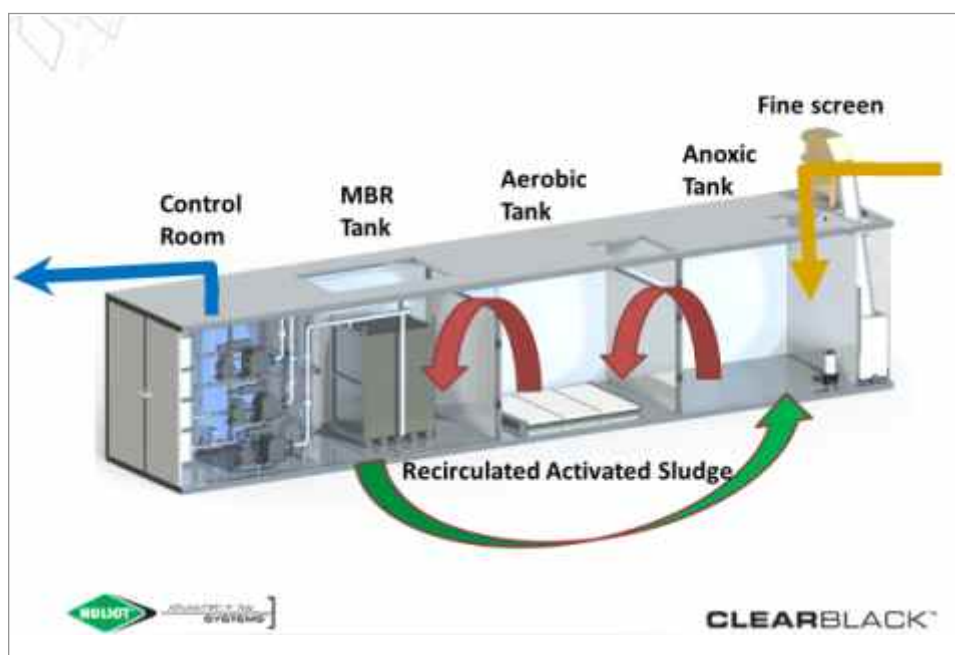
The sludge management in ClearBlack™ System is made simpler comparative to the existing complex systems in following ways:

- The sludge generated in the system is minimal - almost 1/3rd of the conventional systems.
- The sludge wasting can be carried out in long intervals of 30-60 days.
- There is an option of an additional fully automatic multidisc press for sludge dewatering.
- The dewatering press is provided with the self-cleansing mechanism and requires no manual intervention.
- The power consumption of the dewatering press is incredibly low, between 0.2-0.5 kW only with noise levels less than 65 dB.
- The dried sludge can be disposed/processed/reused in lawns as per the local authority norms.

5. SALIENT FEATURES OF CLEARBLACK™ SYSTEM:

ClearBlack™ is a simple, smart, and reliable solution for sewage treatment, recycling and reuse with following features:

- i. 100 % Sewage Recovery
- ii. On-Site Treatment, Recycle and Reuse of Available Wastewater for several Non-Potable Purposes
- iii. Optimization of Freshwater Resources to Save It for Future Generations
- iv. Completely Automated Process Operation with IoT & Smartphone Connectivity
- v. No Tertiary Treatment Required
- vi. Compact & Modular Design
- vii. Lower Space Requirement
- viii. Lower Power Requirement
- ix. Lower Chemical Consumption
- x. Easy Sludge Management



6. ADVANTAGES & BENEFITS OF CLEARBLACK™ SYSTEM:

- i. Return on STP Investment is less than 5 Years.
- ii. Odour free, Colour free & Disinfected Output Water Safe to Handle & Reuse.
- iii. Occupies 50-60% Less Space than Conventional Systems.
- iv. Lower Operation Costs due to Lower Power Consumption.
- v. The Existing STPs can also be upgraded with ClearBlack™ System.
- vi. Significant Savings achieved on Energy and Life Cycle Costs.
- vii. Can be installed in Remote Areas Having No Sewerage Networks upto Centralized STPs.
- viii. Off-Site Operations and Real Time Monitoring for less accessible and remote areas with Online Access.
- ix. Process Operation does not require 24 x 7 Skilled Operators.

7. DISTINCT ADVANTAGES IN PANDEMIC SITUATIONS LIKE COVID-19:

- i. The sophisticated automation with Israeli Technology allows the system to operate on its own without the requirement of personnel for strict supervision.
- ii. The operations monitoring can be carried out online on the Smartphone without the need to daily visit the site.
- iii. The Ultrafiltration Membrane System is helpful in restricting most of the bacteria and many viruses in the treated water.

A BRIEF CASE STUDY:

Huliot India has recently pursued one farm house owner who has a farm house in area of 2.5 acre. There is huge garden area also with swimming pool facility. Total occupancy in the farm house is more than 25 persons considering owner and his family, workers to take care of the surroundings. Huliot India has recommended to install smallest STP of 3 KLD capacity by which gardening, flushing and other requirements like road washing



and car washing can be done. Owner agreed to install the plant and we have installed the plant for which actual pictures are as below:

This STP has a very low foot print say 10 ft. X 6 ft. STP has been installed and it is completely working fine. Also the STP is fully automatic with timer based PLC controller based panel. Hence, there is no requirement of 24X7 manpower for operation of the STP. It is running satisfactorily in automation with



To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.

ABOUT THE AUTHOR

Rohan P Vyas is a Chemical Engineer and has done M. Tech in Chemical Engineering with specialization in Environmental Process Design. He has also done PGD in Environment, Health & Safety and is NEBOSH IGC certified.



He has around 8 years of experience in wastewater treatment field including design to execution for Effluent Treatment Plant and Sewage Treatment Plant, treatability studies and detailed engineering. He has thorough knowledge in RO & MEE – Zero Liquid Discharge (ZLD) systems. He has also developed completely Internet of Things (IoT) based STP system with timer based logic which required very less manpower.



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CASE STUDY

TREATMENT OF OILY WASTEWATER FROM CARBON BLACK MANUFACTURING UNIT

By

Jitendra Khandelwal, Amit Kumar, Pushkar Shukla, Hiten Mehta, Aditya Birla Water Application and Product Development Centre, Grasim Industries Limited (Chemical Division)

Treatment of Oily wastewater is one of the most challenging tasks in effluent treatment. It involves several Physical and chemical processes. Free oil can be separated and recovered using several physical processes like skimmers, oil traps, interceptors etc. However, removal of emulsified oil is extremely challenging and requires chemical treatment with coagulants and flocculants.

The efficacy of emulsified oil separation depends on factors like oil content, nature of oil, charge and molecular weight of the coagulant and flocculants being used and the treatment system (Dissolved Air floatation, Induced gas floatation, clarifier etc.)

In the present case, during handling of Raw materials in a carbon black manufacturing unit oily wastewater is generated which is then sent to Effluent treatment plant for recovery and removal of oil.

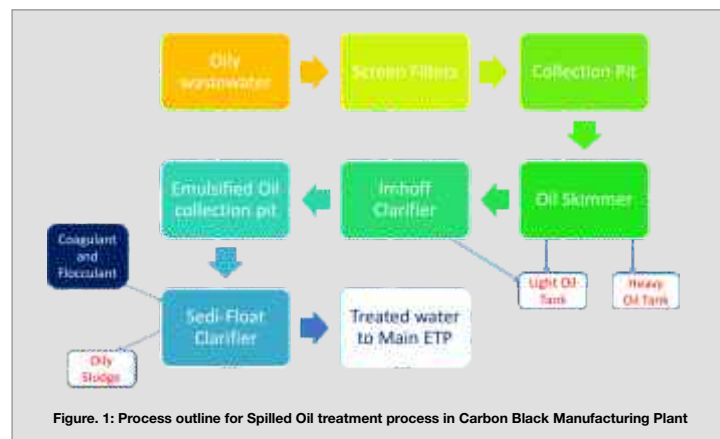


TABLE 1: RESULTS OF JAR-TEST CONDUCTED

BEAKER NO.	COAGULANT		FLOCCULANT		pH	APPEARANCE
	PARTICULARS	DOSE, (PPM)	PARTICULARS	DOSE, (PPM)		
-	Raw	0	-	0	7.4	Clear Supernatant
1	VYTAL 512 (L)	330	VYTAL A971 (P)	2.0	6.7	Clear Supernatant
2	VYTAL 711 (L)	330	VYTAL A971 (P)	2.0	6.7	Clear Supernatant
3	VYTAL 2810 (L)	330	VYTAL A971 (P)	2.0	6.7	Clear Supernatant
4	Existing Coagulant	330	Existing Flocculant	2.0	6.6	Not Clear



Figure 2: (Left to Right) Samples treated with Vytal 512, Vytal 711, Vytal 2810 and Customer's existing product

The brief process is outlined below:

On the basis of the Jar test it was concluded that combination of VYTAL 711 followed by Vytal 971 performed the best with clear supernatant and larger floc size. The performance was much better than customer's existing products.

PLANT SCALE TRIAL:

In total 25 m³ effluent was to be treated for the trial, Vytal 711 was dosed at a rate of 280-300 ppm. 0.1 % solution Vytal 971 was prepared and then dosed at a rate of 2 – 2.4 ppm. Inlet pH was maintained with the help of Caustic Soda and HCl. An Air-water mixture was purged into SDF at a pressure of 1.5 - 2 kg/cm². The settled sludge was taken out through bottom using spiral separator on regular basis.

TABLE 2: RESULTS OF PLANT TRIAL

S. NO	PROPERTIES	UNIT	INLET (AVERAGE)	OUTLET WITH EXISTING TREATMENT	OUTLET WITH VYTAL TREATMENT
1	pH Value of Water	-	7.33	7.18	6.96
2	Conductivity	[μs/cm]	598	740	768
3	Turbidity	[NTU]	46.20	5.66	2.26
4	Total Suspended Solid	[mg/l]	40.0	10.0	5.00
5	Oil & Grease	[ppm]	45.0	25.4	2.40

* Reported Values are Average



Figure 3: (left to right) Inlet and Outlet Samples from Sedi-float clarifier

CONCLUSION:

1) Vytal 711 was found to provide excellent removal of Oil (94.44 %) and meet the Discharge norm of <5 ppm as per Pollution control board.

2) 87.5 % reduction in TSS and 95 % reduction in Turbidity was observed

3) The dose of Vytal 711 was ~ 10 % less than the existing product leading to a more cost-effective treatment.

Thus, it can be concluded that Treatment with Grasim's VYTAL 711 and VYTAL 971 leads to significant improvement in oil removing efficiency of the ETP and helping meet the discharge norms, this was accomplished at lower treatment cost per m³.

ABOUT THE AUTHOR

Dr. Hiten Mehta holds Master of Science in Organic chemistry and Ph.D. in Chemistry. Heading R&D



activities of Development DCA at Vilayat, Bharuch. He has 17 years of experience in industrial research. He has worked for pharma companies like Ranbaxy, Cadila, Unimark. Specialty chemical companies Clariant and Gulbrandsen. He has expertise in process development, Intellectual properties and non-infringement, regulatory compliance for various regions for API, specialty chemical, personal care actives and Aluminium chemistry. He is associated with applications focused product development for personal care, home care and water treatment products. He has more than 20 patents and many research articles in national and international journals. He has presented papers, posters and research articles at various podiums.



ABOUT THE AUTHOR

Dr. Pushkar Shukla holds a Masters degree in Organic Chemistry and Ph.D. in Chemistry from ICT, Mumbai.



He has 10 years of research experience in water, wastewater treatment, adsorption, development of separation and purification technologies and Environment Research.

He presently leads the water product development team at Grasim Industries.

He has 10 research papers and 3 patents to his name.

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He is presently leading Industrial, new product and application development at Grasim Industries Limited.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.

CONJUNCTIVE USE OF SURFACE AND SUB-SURFACE WATERS AND CONJUNCTIVITIS CLOUDING THE FORESIGHT-CASE STUDY OF CHENNAI METROPOLIS, INDIA

By

S Sundaramoorthy, S Saktheeswaran and A Jayabalan

ABSTRACT

Chennai Metropolis is a coastal city of Bay of Bengal dependant wholly on monsoons failing about once in four years and limitations of reservoir storages. Import of water from neighboring state is confronted by monsoon failures there. Seawater Desalination plants are functioning but 90 % of operating cost is subsidized. A study by the United Nations Development Programme (UNDP) during the 1980's and again in 1990's identified sub- surface storage in the city's contiguous riverine aquifer extending to a phenomenal 150 km inland and a storage capacity of 1250 days but is yet to be exploited. Sewage Reuse at drinking grade for offsetting cooling water in petro chemicals for 30 Million Liters Daily (MLD) is practiced here from 1992. Elsewhere, the costal Orange Country in California operates the Ground Water Replenishment Programme (GWRS) at nearly 380 MLD of similarly treated sewage and is blended with inland aquifer water and injected into the local coastal aquifer as a "recycle-reuse" in that desert region. A combination of these practices as a Conjunctive use of monsoon surplus, treated sewage and the local aquifer is the savior but there is conjunctivitis clouding the vision. It is not far off when potential earthquake by land subsidence from over exploitation of ground water may suddenly set in and coupled with monsoon failures the metropolis may well become deserted land. The article underscores the procrastination and the absence of political will to implement and presents the way forward at least now.

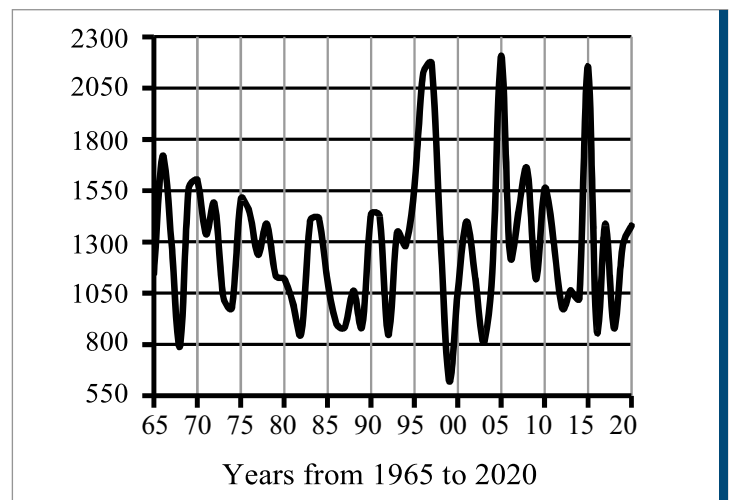
1. THE MONSOON, RESERVOIRS, AQUIFERS AND THE TALE OF MAN-MADE SCARCITY



Fig.1.Chennai (yellow) freshwater reservoirs (blue) & aquifers

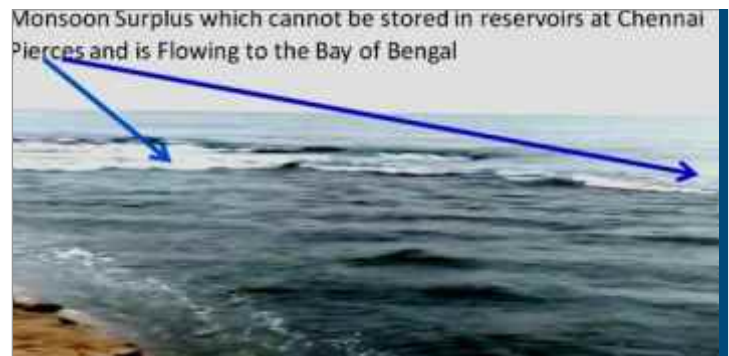
supporting bore wells (green) for extraction

Fig.2. Annual monsoon rainfall with uncertain trend for the day to day public water supply



The Chennai metropolis with population of 14 million spread over 1200 sq km with 4 surface reservoirs and deep well-fields of alluvium of two rivers Araniyar and Kortalaiyar on the north as in Fig.1. The vagaries of yearly monsoon rainfall are in Fig.2 showing the vulnerability for a steady state public water supply. Added to this is the fact the monsoon months are essentially from July to October only confronted by limited storage capacities in reservoirs and it is not unusual to helplessly witness precious rainfall overflowing to the sea as in Fig.3 as a regular feature whenever monsoon rainfall is bountiful.

Fig.3 The familiar sight of the precious monsoon rainfall flowing out to the sea for want of storage



2. CRITICALITY OF THE WATER SOURCES VS STORAGES

This is complied in Table-1 and does not need any explanation to drive home its fragility.

Table 1 - The Fragility of Water Sources for Chennai Public Water Supply

No	Name of Source	Source of the monsoon	Yield MLD	Risk Factors from the past record 1965 to 2020
1	Local surface Reservoirs	North East (NE)	227	SW monsoon in July-Sep
3	Minor lakes in city		5	NE monsoon in Oct to Dec
4	Aquifer on north Kortalaiyar river		68	Failures-Once in four years
5	Local aquifers in the city		240	NE max-2156 mm / yr
6	Distant aquifer as Palar River	South West (SW)	32	NE min-43 mm/yr
7	Water import from Andhra		837	SW max-1821 mm/yr
8	Distant Reservoir, Veeramam		180	SW min-34 mm/yr
9	Seawater desalination, Kattupalli	Bay of Bengal	100	O&M is Rs 50 / 1000 liters but public levy is only Rs 5
10	Seawater desalination, Nemmeli		100	
Total safe yield at best of times			1789	Not even for 50 % time
Total when SW monsoon fails			772	On an average failures occur once in four years
Total when NE monsoon fails			1017	
Total when both SW and NE monsoons fail			200	From desalination
Water Demand is 1600 MLD at about 110 liters /capita Vs standard of 140 liters/capita				

3. CRITICALITY OF THE SOURCES VS RESERVOIR CAPACITIES FOR PUBLIC WATER SUPPLY

A plot of the remaining storages in the reservoirs at the beginning of each month is iterated in Fig.4. It shows the storage in number of days considering, the rainfall, evaporation and abstraction for daily supply when the two North East (NE) and South West (SW) monsoons are normal and when one of these and both of these fail.

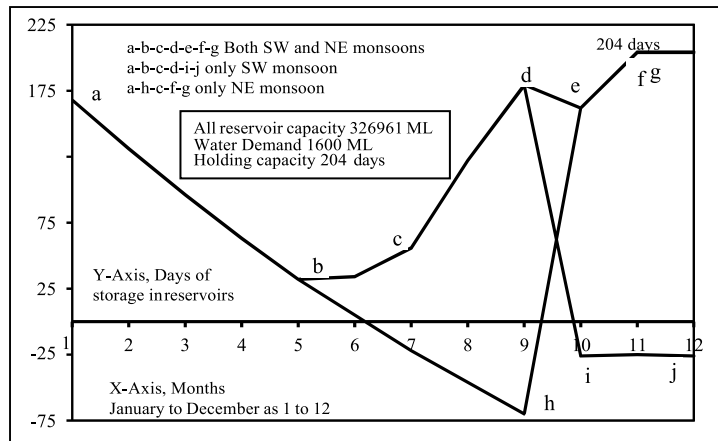


Fig.4 Criticality of Reservoir Storage as the Limiting Factor in Chennai Water Supply

It shows that even the best SW and NE monsoons do not guarantee round the year domestic demand of 1600 MLD because the precipitation overflows the reservoirs to the sea. Monsoon failures gets the reservoir storages reduced sometimes to bare minimum and

is pumped up to the intake bell mouths and then treated after cascade aeration and higher doses of coagulants besides activated carbon dispersion in the flocculator for odour control and supplied once in two or three days or in a rare case as in 1995, complete shutdown of piped water supply and door-to-door supply by water tankers in Fig 5.

4 SEAWATER DESALINATION-PALLIATIVE AT BEST

There are seawater desalination plants of 200 MLD output at O&M of Rupees 50 per 1000 liters, but water charge to public is just about Rupees 5 per 1000 liters and thus heavily cross-subsidized. The 2017 report of the Asian Development Bank is in Table-2 based on the then water tariff at Rs 50 per month per dwelling. This has been increased from Rupees 50 to 80 per month in 2019 but even then, in the next slot in Table-2 in the year 2024, the gain is only 39 million USD which cannot offset the purchase of desalinated water at 62 million USD. This compels a perpetual financial subsidy and clearly will only increase with the passage of time.

Table 2 - Seawater Desalination Costs as Relating to the Revenue and Expenditure at Chennai

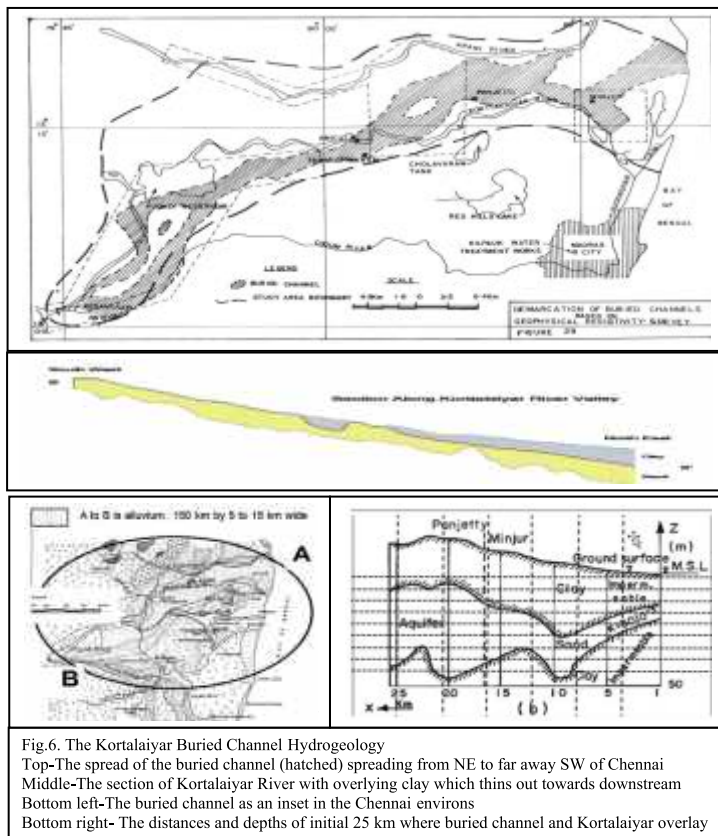
Particulars	Existing				Projected			
	2012	2014	2016	2024	2027	2032	2037	2043
I. Revenue								
- Water & Sewerage Fee	37.0	40.6	44.3	64.9	74.3	93.1	116.8	153.3
- Water & Sewerage Tax	16.1	17.3	25.4	54.6	72.6	116.9	188.3	333.6
- Others Income	10.9	13.2	10.8	10.9	10.9	10.9	10.9	10.9
- Grants and Subsidies	19.3	40.0	53.6	114.3	132.4	245.9	398.4	717.4
Total	83.3	111.2	134.1	244.8	310.2	466.4	711.4	1,204.1
II. Expenditure								
- Salaries & wages	24.7	24.5	30.7	47.3	55.7	73.0	95.8	132.6
- Power	9.8	12.1	28.0	60.0	79.9	128.6	207.1	386.9
- Purchase of Desalinated Water	19.8	26.8	28.9	62.0	62.5	132.9	214.0	379.1
- O&M & Others	20.8	39.4	33.2	60.7	73.3	115.9	163.7	319.9
Total	74.7	102.8	120.8	229.9	271.3	450.4	780.6	1,398.5
Surplus/Deficit	8.6	8.4	13.3	114.9	138.9	215.5	230.8	805.6
III. Debt Service	14.6	14.1	13.9	28.1	21.7	0.4	0.1	2.6
Surplus/Deficit	(7.1)	(5.7)	(0.6)	(13.2)	(2.9)	13.5	10.7	2.6
Operating ratio	89.9%	92.6%	90.1%	91.9%	93.8%	98.6%	98.8%	98.8%

5 THE “BURIED CHANNEL” AND CONJUNCTIVE USE POTENTIAL

The UNDP study of 1990's documented the “buried channel” of 150 km length and 2 to 5 km wide north of the metropolis as in Fig.6 with overlying clay and underlying sandy alluvium. Detailed investigation for initial 25 km shows alluvium of 5 m depth and a belly of 35 m depth after 20 km. At an average sand depth of 20 m and a void ratio of 40 %, the pore volume can be 750 Million cum and can hold up nearly 470 days of the demand of 1600 MLD. In fact, lateral hydraulic diffusion cannot be ruled out and can hold up more. Once saturated, the further advantage is savings of evaporation of 40 % of the storage as in the case of surface reservoir and also avoiding stray pollutants as the Perfluoroalkyl and Polyfluoroalkyl Substances.



Fig.5. Chennai Water Supply in monsoon failures. Pumped water, cascade aerator, WTP and Tanker supply



6. THE “SINK-HOLE” CONCEPT OF GRAVITATED ALLUVIUM RECHARGE OF MONSOON FLOODS

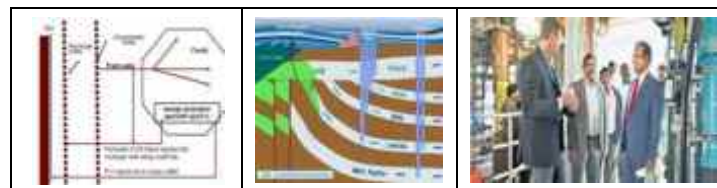
The “sink-holes” are open wells into which the flood waters drain by gravity and reach the underground as a “fixed deposit” and one such is seen in Fig. 7 here in Tamilnadu itself where the 2021 NE monsoon flood waters “vanished” by flowing into this and recharging the surrounding habitations. The Indian Institute of Technology Madras has studied this and estimates that this single sink-hole has recharged 6000 Million Liters of flood runoff in the 2021 NE monsoon and that the surrounding areas are subsurface limestone and calcareous deposits susceptible to chemical dissolution in contact with groundwater or experience repeated wetting and drying cycles and these reactions initiate the formation of small pore cavities, which form preferential flow paths which create micro-fractures that



accelerate chemical reactions and cause further dissolution of limestone rock interconnected caves and caverns termed 'karst aquifer systems'. However, the disadvantage is increasing the hardness of the water from the calcareous deposits and which can precipitate the Calcium bicarbonate into Calcium carbonate on contacting the atmosphere and dangerously bind and seal soil pores. Fortunately, the alluvium discovered by the UNDP studies for Chennai is pure sandy and it should be possible to locate transverse batteries of such sink-holes for gravitated recharge of the alluvium in the case of the surface runoff of the monsoon floods and upstream of the check dams

7. The Hydrogeology of the GWRS, USA

The 380 MLD GWRS system of Orange County in California in USA is illustrated in Fig.8. The advanced treated sewage is blended with water from inland bore wells and injected into coastal bore wells.



8. THE HISTORY SEWAGE REUSE AND ITS DRINKABILITY AT CHENNAI

Chennai has achieved this to drinking grade for industries from R&D over 1965 to 2019 as in Figs.9, 10 and 11.





Fig.11 Demonstrating the Drinkability of the Treated Sewage. Left- The Lead author as Engineering Director demonstrating to Director, World Bank in 1995, Middle, Honourable Minister demonstrating drinking to the public in 2019, Right-Topmost Secretary to Government of India demonstrating drinkability in 2020

9. THE SEQUENCE OF IMPLEMENTATION FOR SEWAGE REUSE

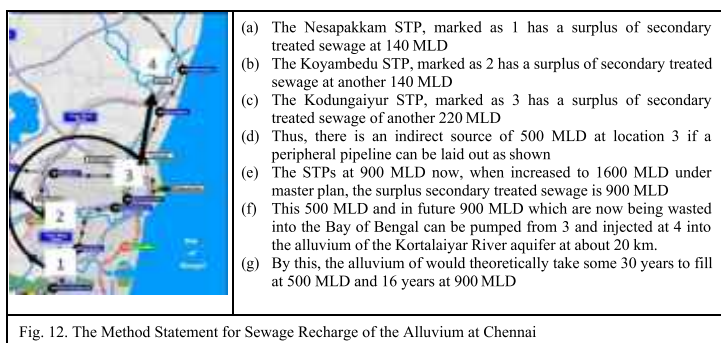


Fig. 12. The Method Statement for Sewage Recharge of the Alluvium at Chennai

The existing STPs are without nitrogen and phosphorous removal which are not needed for the industries, but needed for alluvium recharge. These are to be approached by the entire raw sewage received at these STPs in above ground side-stream leaping weir for a steady flow and the existing aeration tank itself accommodated for biological nitrification-denitrification and Poly Aluminium Chloride added to the mixed liquor for precipitating the phosphorous in excess sludge in final clarifier. Thereafter, the already proven TTRO is continued and blended with fresh water and injected at Kortalaiyar River sea mouth and extracted inland like in the GWRS. An additional safety is the extracted water is pumped to fresh water reservoir for naturalization and treated in the existing water treatment plant. A further advantage is prevention of seawater intrusion as in Fig. 13.

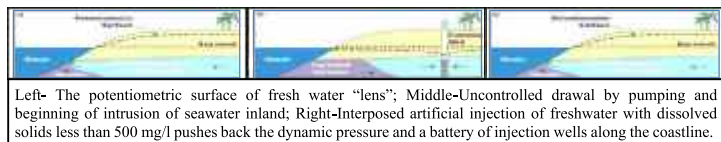


Fig.13 Seawater Intrusion Barrier in coastal aquifers

10. THE ECONOMICS

Pumping the treated sewage, injecting through the aquifer, its extraction inland and pumped conveyance to the fresh water reservoir at about Rs 5 per 1000 liters whereas, seawater

desalination costs Rs 50 per 1000 liters but the public levy is only about Rs 5 per 1000 liters. This 90 % cost subsidy cannot go on forever because, other coastal regions of the state will demand similar seawater desalination and financially impossible.

11. THE RELATIVE UNIT OPERATIONS AT GWRS AND THE PROPOSED CHENNAI INDIRECT POTABLE REUSE

A comparison of the proposed treatment unit operations in sewage reuse at Chennai as compared to the GWRS is presented in Table-3 and may be seen that the proposed Chennai reuse is relatively more robust in its ability to bring about the conjunctive use of freshwater from monsoons, treated sewage from the city and the aquifer of the river system and finely balanced out by optimal use of the existing surface reservoirs itself for all times to come. It does also permit most importantly avoiding the 40 % water lost due to evaporation in surface reservoirs.

Table-3
Comparison of Unit Operations in GWRS and the Proposed Chennai Indirect Potable Reuse

No.	Location	A	B	C	D	E	F	G	H	I	J	K	L
1	GWRS, USA	√	√	√	√								
2	Chennai Reuse	√	√			√	√	√	√	√	√	√	√
Explanatory Notes of Treatment Components													
A	Sewage treatment for N and P and R O					G	Extraction by deep bore wells from aquifer						
B	Aquifer injection of treated sewage/freshwater					H	Pump to surface reservoirs for naturalization						
C	Extraction by deep well pumps					I	Conventional water treatment						
D	Blend with overland freshwater & Public feed					J	MF or UF as needed in lieu of R O membranes						
E	Aquifer lateral displacement for about 25 km					K	Residual chlorination of treated water						
F	Injection of monsoon surplus into the aquifer					L	Pumping to floating peripheral main of city						

12. THE WAY FORWARD

12-1. Identify the least top clay layer and construct check dams between the 20th to 25th km from the sea mouth as can in Fig.6 to intercept the flood runoff and provide transverse battery of sink-holes upstream of the check dam to gravitate the flood runoff into the alluvium

12-2. Provide side-stream balancing of raw sewage in existing STPs and nitrification-denitrification in aeration tank and phosphorous removal on line by coagulating the mixed liquor before final clarifiers.

12-3. Install a 15 MLD pilot plant for demonstrating the injection cum extraction from the aquifer/alluvium and demonstrate the production of indirect raw water at the required water quality.

12-4. Thereafter, the augmentation of reservoirs can be got through for public acceptance and steadily implemented like the GWRS as



personally seen by the Chief Minister himself in 2019 as in Fig.7

13 THE GLITCH

This is defined as a small problem that prevents something from being successful. The glitch herein is though treated sewage at drinking grade is proven it is not in public water supply. But then, with only about 38 % of the country provided with sewerage, the rest of raw sewage flowing into Rivers accepted as water sources. A classical example is the 724 km Tapti (Tapi) river in Surat as in Fig.14 with the WTP at the end despite the sewage discharges aggregating upstream. The WTP takes care of removing the pollutants. *There is a 11th century saga of the local women of Vairav who fought against the conquerors and when exhausted, flung themselves into the Tapti River and drowned, preferring death to dishonour and special prayers offered in their memory at the Fire Temples of Navsari.* Source <https://en.wikipedia.org/wiki/Vairav>

All the same, the glitch in the present Chennai case is entirely a matter of social acceptance and it is for all political powers that be to consciously come together and clinch this noble task.

CONCLUSION

There is a famous time-honoured lyrics in Tamil literature “*Irukum Idathai vittu, Illatha Idam Teadi Engengo Alaikinar Gnanathangame*” which translates to “Instead of realizing it within, they wander searching for it everywhere else (where it is not) Oh precious

wisdom”. Perhaps this reflects the agony of the Chennai metropolis water supply where knowing fully well that radical intervention of conjunctive use is to be taken up on a war footing, still it is procrastination from the hesitancy to sponsor sewage reuse as indirect raw water augmentation. It is best to recall Rudyard Kipling's 1892 poem "Gentlemen-Rankers", echoes the soldiers of the empire who had "lost their way" in the war and were damned “from here to eternity”. That phrase mimics the water supply scenario of this metropolis as of now. The social acceptance of sewage reuse as indirect raw water as the key is for the political thoughts to come together and achieve on the principle laid down by Woodrow Wilson, regarded as the father of public administration, who said “it is a perspective on how it is different from politics and to be studied independently and separately as an academic field”. That summarizes the compelling need to come free of the conjunctivitis and see the reality of the otherwise impending water desertification of this metropolis.

ABOUT THE AUTHOR

Dr S Sundaramoorthy is the former Engineering Director of Chennai Metro water Board and has sailed with the plants cited here right from the R&D starting way back in 1965. A Jayabalan is the Hydro geologist Chennai Metro water Board and the team member of the UNDP study cited here S Saktheeswaran is former Sanitation Expert of World Bank in India and earlier, the project manager of one of the reuse projects cited here.



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CASE STUDY

RAIN WATER HARVESTING CASE STUDY: CENTER FOR INDUSTRIAL TECHNOLOGICAL STUDIES AND SERVICES MEXICO

By

Prathamesh Gawde, Senior Product Marketer, Bentley Systems

OVERVIEW

A technical institution in Mexico used Bentley applications to develop a digital twin of a rainwater harvesting project, which is expected to reduce campus carbon dioxide emissions by 32 tons.

UPDATING TEACHING TECHNOLOGY TO MEETING INDUSTRY STANDARDS

The Center for Industrial Technological Studies and Services is an educational institution that offers careers in architecture and construction in Mexico City, Mexico. The institution wanted to update their digital teaching tools, as their previous software did not facilitate digital integration of planning, design, and engineering processes, which are becoming increasingly popular in the industries. Therefore, they decided to offer a new digital workshop based on BIM and reality modeling, piloting an environmental initiative to harvest rainwater and reduce campus energy consumption.

FINDING SOFTWARE FOR IMPROVED DIGITAL COLLABORATION

To ensure efficient and coordinated workflows among students, the Center for Industrial Technological Studies and Services needed integrated modeling technology. The technology would allow them to manage all phases of their sample project—from design through execution—to better teach the students about using BIM in the workplace. However, they realized that their past software did not allow integration or handling of a practical sequence of all the processes. Therefore, each project phase had to be developed independently, leading to significant coordination and data access challenges. As a result, they sought software that would integrate a project covering the design, projection, and execution phases for more efficient and coordinated work on the rainwater and solar energy harvest project.

DEVELOPING A DIGITAL TWIN TO REDUCE ENERGY CONSUMPTION

After considering their options, the Center for Industrial Technological Studies and Services selected Context Capture to gather data captured by an unmanned aerial vehicle. With Micro-Station and Open



PROJECT PLAYBOOK

ContextCapture, MicroStation, OpenBuildings

OUTCOMES/FACTS:

- The Center for Industrial Technological Studies and Services wanted to update their digital teaching tools, as their previous software did not facilitate digital integration of planning, design, and engineering processes.
- With Micro Station and Open Buildings, the team generated a digital twin to calculate rainwater harvesting volumes and determine the geometric dimensions of a storage tank, as well as achieved maximum efficiency of annual sun exposure on the campus buildings.
- Using the digital model, the students determined the viability of harvesting rainwater, expecting to save 50% annually in campus drinking water consumption and 25% to 30% in electricity consumption.

Buildings, the team generated a digital twin to calculate rainwater harvesting volumes and determine the geometric dimensions of a storage tank. The applications also allowed project participants to determine solar exposure times according to the buildings' positions on the campus. By finding the best location to place photocells, they achieved maximum efficiency of annual sun exposure. The digital solution served as a teaching tool for integrating lifecycle project procedures while saving significant delivery time, as well as streamlining and coordinating student workflows.

IMPROVING THE INSTITUTION'S ENVIRONMENTAL IMPACT

Using the digital model, the students

determined the viability of harvesting rainwater, expecting to save 50% annually in campus drinking water consumption and 25% to 30% in electricity consumption. Following this method would reduce carbon dioxide emissions by 32 tons, the equivalent of planting 1,620 trees per year. It will also save the campus USD 77,000 per year, with a 25-year savings of USD 2.57 million. When applied across the 456 campuses, that is a savings of over USD 24 million a year, a reduction of carbon dioxide by almost 15,000 tons, and the equivalent of planting over 730,000 trees a year. The program will benefit the approximately 920 students with majors in architecture and construction on the campus, as well as indirectly benefit the 400,000 students studying across all campuses.

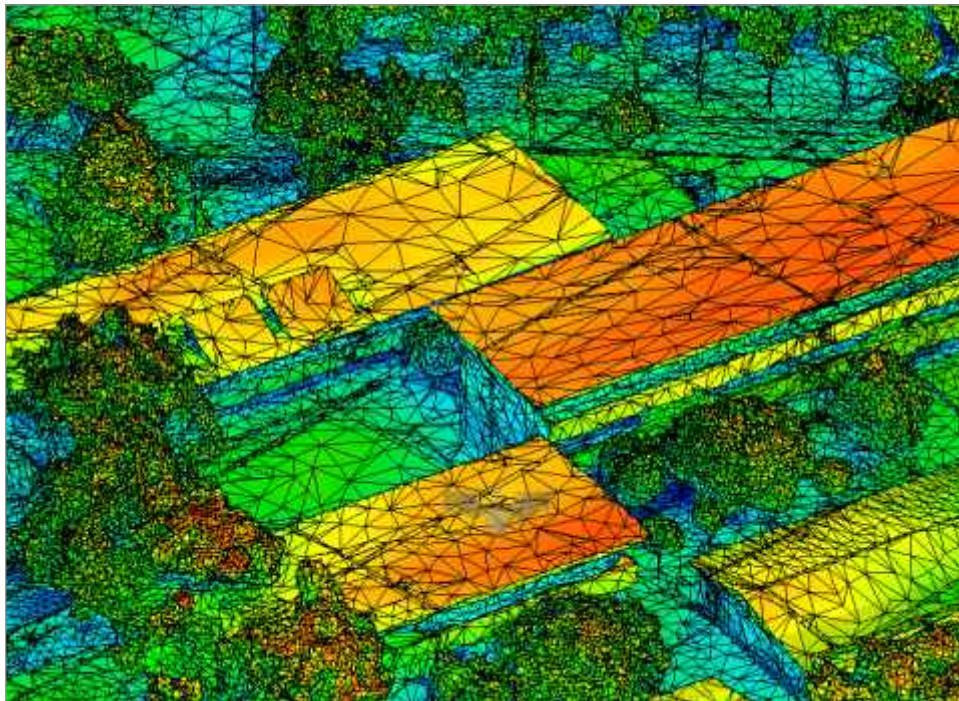


Image caption/courtesy 1 (header): The Center for Industrial Technological Studies and Services wanted to update their digital teaching tools, as their previous software did not facilitate digital integration of planning, design, and engineering processes. Image courtesy of Center for Industrial Technological Studies and Services No. 33.

Image caption/courtesy 2 (copy): With MicroStation and OpenBuildings, the team generated a digital twin to calculate rainwater harvesting volumes and determine the geometric dimensions of a storage tank. Image courtesy of Center for Industrial Technological Studies and Services No. 33.

Image caption/courtesy 3 (copy): Using the digital model, the students determined the viability of harvesting rainwater, expecting to save 50% annually in campus drinking water consumption and 25% to 30% in electricity consumption. Image courtesy of Center for Industrial Technological Studies and Services No. 33.

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Bentley's OpenBuildings confirmed the viability of the project, making an economic investment with security guarantees. Without Bentley's applications, promoting a project that has the potential to involve more than 450 schools would be impossible, unthinkable. The savings in resource hours means 80% less, that is why it is totally possible."
- Martha Velia Méndez Soriano, Project Coordinator

ABOUT THE AUTHOR

Prathamesh Gawde is a marketing leader with over ten years of experience in the B2B industry. He joined Bentley Systems as a senior product marketer, focusing on marketing strategies and campaigns for Bentley's building software portfolio.

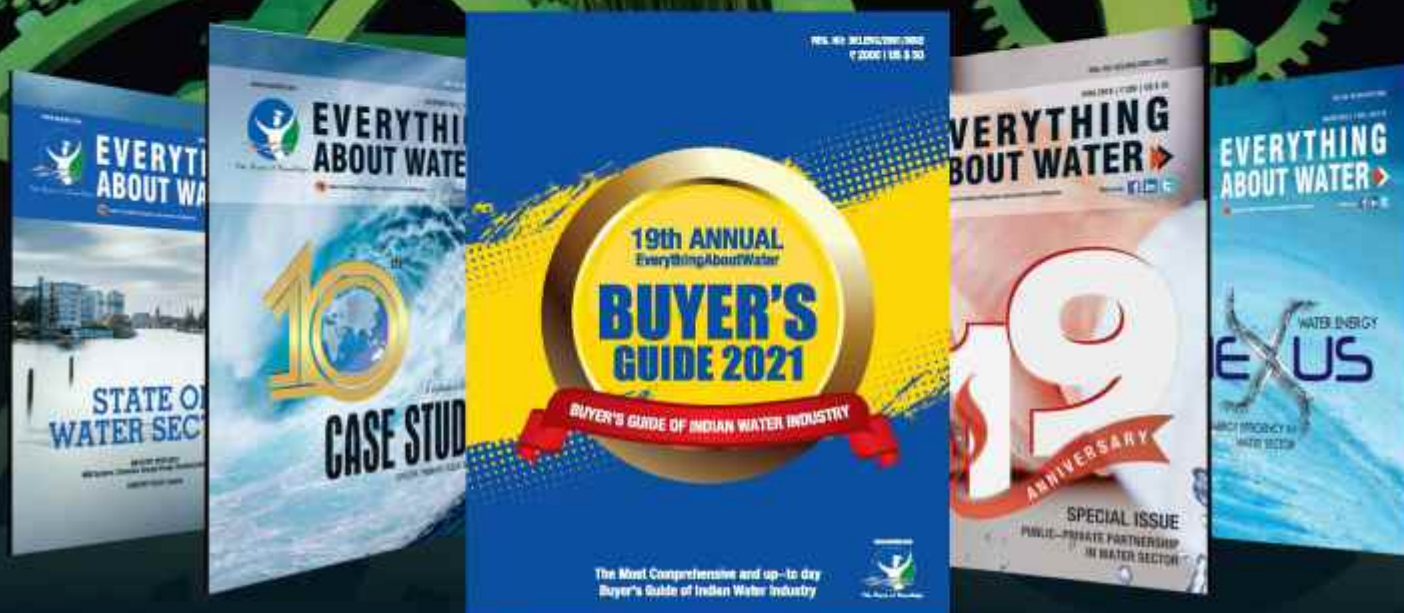
Prathamesh is a digital marketing expert with experience in conceptualizing, developing, and implementing revenue marketing, digital marketing, account-based marketing, and demand generation strategies and programs in global and fast-paced corporate environments.

Before joining Bentley Systems, Prathamesh held multiple marketing and business development positions with leading IT and engineering companies. He earned a master's degree in management studies with an emphasis in marketing and a bachelor's degree in mechanical engineering from the University of Mumbai.





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RECYCLE AND REUSE OF GREY WATER – A CASE STUDY

By

Hemalatha D. S. and Sadashiva Murthy B. M.

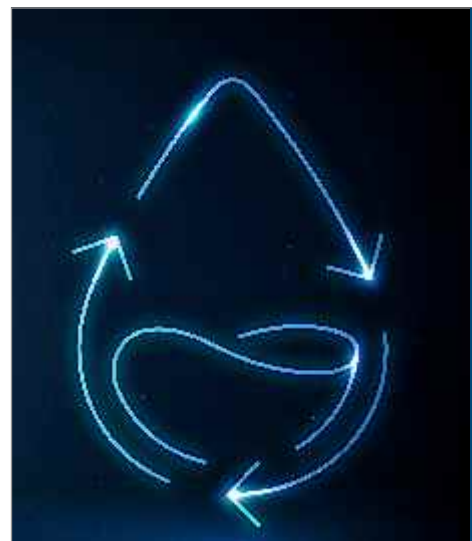
ABSTRACT

The grey water includes 80–85% of household wastewater. The re-use of this kind of wastewaters is considered as an alternative to the reduction of clean water consumption. The main objective of this dissertation work is to study and design a low cost treatment of grey water and its reuse for non-potable purpose. SJCE Boy's Hostel of JSS S&TU, Mysuru was selected as suitable site for the present work and collected the grey water samples from four different sources. The physical, chemical and bacteriological characteristics of the raw grey water samples were analysed. Performance of the lab scale filtration system was evaluated and found the treatment efficiency. The lab scale filter was very efficient in reduction of turbidity, total solids, BOD5, phosphate and MPN to about 90%, 63%, 55%, 87% and 61% respectively. A design proposal of a single centralized vertical filter unit and individual filter units for each block was prepared. The treated grey water from the sand and gravel filters can be reused for non-potable use like flushing tanks, gardening, street cleaning

and sewer cleaning. It was found that if the treated grey water is reused in the selected site (SJCE Boy's Hostel), a reduction of about 60 – 75% in use of fresh water can be achieved.

INTRODUCTION

Water once used or utilized in any domestic purpose generates the Domestic wastewater. Grey water and black water are the two streams that make up this residential wastewater. Grey water is typically characterized as water from the shower, bath, washbasin, washing machine, and dishwasher. Black water is the residual bathroom water. 80–85 percent of the wastewater from households is included in the grey water. Reusing these wastewaters is suggested as an alternative to cutting back on the use of clean water. The re-use of treated grey waters is not, however, mandated by law in many nations. On the other hand, as water becomes much scarce, there is a growing interest in this subject. This interest in reuse is further fueled by the low organic matter and pathogen content of grey waters.



SOURCES OF GREY WATER

The main source of grey water at households include the water generated as by-product of processes such as bathing, Cloth washing (laundry), cooking, washing utensils, washing livestock. Whereas, on the other hand, Black water is the wastewater that is contaminated with fecal matter and urine. The components present in the grey water are entirely different from black water. Grey water has only 1/10 of nitrogen found in black water and comparatively less load of pathogens than black water. Therefore, the organic content of grey water gets decomposes rapidly than black water. Thus, the treatment of grey water generated from households is easier. These main factors makes it usable as a sustainable source for irrigation, provided it meets quality criteria.

COMPOSITION OF GREY WATER

The amount of wastewater generated from any household or residential building or institutions mainly depends on number of occupants in the building, their life style, availability of adequate water supply system, quantity of water supplied, water usage pattern, customs, water cost and the climate. Grey water is the wastewater generated in the bathroom, laundry and kitchen. Therefore, grey water is that component of domestic wastewater which does not include the wastewater from the toilet or urinal.

The composition of grey water also vary from place to place and people to people. Living standards of people, social and cultural practices of people and level of water crisis in the region are the main factors that



influences the composition of grey water. Other factors on which the composition of grey water depend are type and kind of cleansing agents such as soaps, detergents, shampoos, tooth paste, dish washing agents etc. Huge fluctuation in chemical and

therefore it can be easily treated to a high quality water using simple techniques such as sand/gravel filters or using activated charcoal, etc. Figure 2 shows the filtration spectrum for different separation process.

CASE STUDY

Grey water samples from an institutional hostel premises were collected and its physico-chemical characteristics were determined. Performance evaluation of a lab scale sand and gravel filter media for low cost treatment of grey water was carried out for grey water samples. The filtered grey water was proposed to reuse in the flushing tanks of toilets, which may lead to reduction in consumption of fresh water.

students. The hostel provides the students both boarding and lodging facility. Three number of cloth washing machines were provided for the students at back side of the Block 1. Drinking water facility is provided to the students by installing Reverse Osmosis (RO) units at each individual blocks. Hot water facility for bathing is given by using Solar Water Heaters and Boilers/Geysers.

In the present study, discrete sample, also known as grab sample of grey water viz., bathroom wastewater, Hand Wash Basin Wastewater, Cloth Washing (Machine Washing) wastewater and kitchen wastewater were collected in an individual container separately from four different sampling points. The layout of the study area and location of the four sampling sites chosen for present study are shown in Figure 4.

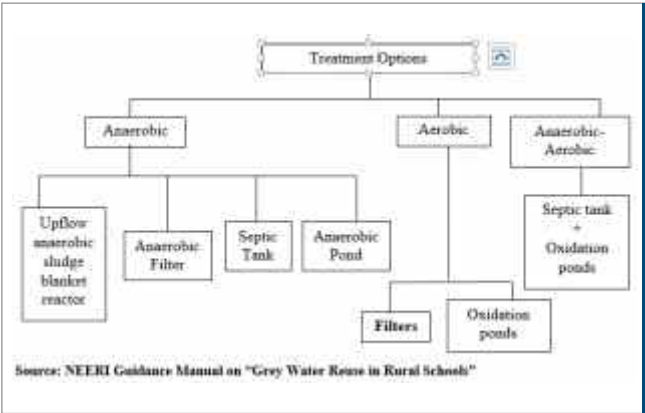


Figure 1: Grey Water treatment Options

microbial quality of grey water occurs

depending on the source of generation and type of grey water.

Among the above mentioned options the filtration was followed in the present dissertation work due to the following advantages:

- Simple in operation and upkeep
- Economical
- Comprehensive physical treatment
- Better quality treated water
- Use of locally accessible filter media
- No external energy source is required.

Filtration is the simple treatment adopted for separating the macro particles present in grey water. Grey water has relatively low nutrient and pathogenic content and

The work was carried out for the grey water samples collected from SJCE Boy's Hostel, JSS Science and Technology University, Mysuru, Karnataka, India. The study area is located at a latitude of 12.3133°N and



Source: <https://www.googleearth.com>
Figure 3: Aerial View of the Study Area

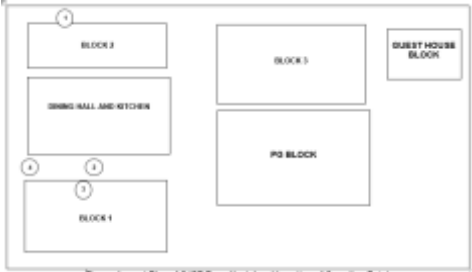


Figure 4: Layout Plan of SJCE Boys Hostel and Location of Sampling Points

The collected sample was brought to the laboratory and stored in Sample Preservator at 4°C. The physical, chemical and

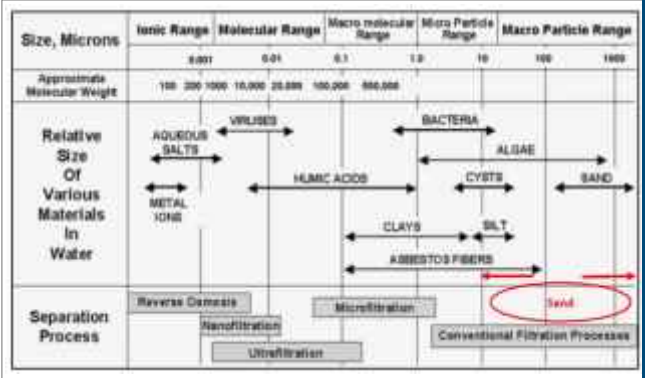


Figure 2: Filtration Spectrum for different separation process

76.6134°E. The aerial view of the study area is shown in Figure 3.

The hostel premises comprises of a kitchen and dining hall, three big blocks named as Block1, Block 2 and Block 3 hosting around 650 students, one PG block hosting 55 students and six guest house blocks hosting around 120



Table 1: Characterization of raw grey water samples.

Sl. No.	Parameter	Unit	Concentration				Typical Analysis of Strong Wastewater
Physical Characteristics			S1	S2	S3	S4	
1	Colour	RYBN	1.1, 1.1, 1.0, 1.1	0.1, 1.1, 1.0, 1.0	0.3, 1.1, 1.1, 1.0	1.0, 1.1, 1.0, 1.2	-
2	Temperature	°C	17 – 24.3	15.8 – 24.4	17 – 24.6	17 – 25.2	-
3	Turbidity	NTU	28 - 420	57 -96	49	30 – 35.5	-
4	Total Solids	mg/L	960 - 2280	1040 - 2480	1040-1160	1240 – 1440	1200
5	Total Dissolved Solids	mg/L	680 - 1640	680 - 1360	800 - 960	560 - 680	850
6	Total Suspended Solids	mg/L	280 - 640	360 - 1120	200 - 240	720 - 880	350
Chemical Characteristics							
7	pH		8.12-8.90	6.20 – 6.90	7.92–8.06	6.82–7.20	-
8	Conductivity	µS/cm	1199-2810	1094-1134	1156-1749	1109-1160	-
9	Salinity	mg/L	899-2100	820-850	860-1311	831-910	-
10	Oil and Grease	mg/L	126-188	50-134	52-99	200-222	150
11	Total Alkalinity as CaCO ₃	mg/L	1380-3200	380-440	264-360	280-320	-
12	Chloride	mg/L	116-200	114-130	140-200	110-130	-
13	Biochemical Oxygen Demand (BOD)	mg/L	1164-1287	1076-1351	1534-1920	2056-2277	-
14	Chemical Oxygen Demand (COD)	mg/L	2400-3200	2260-3200	3600-4800	3600-4800	-
15	Nitrate	mg/L	0.56-4.49	2.19-7.34	1.84-4.59	0.96-2.83	0.0
16	Phosphate	mg/L	43.91-67.29	45.67-46.37	20.49-54.06	56.23-65.97	15
17	Sulphate	mg/L	4.93-6.72	5.61-6.88	5.24-12.51	13.24-16.18	-
Bacteriological Characteristics							
18	MPN – Total Coliform	No./100 mL	>110000	>110000	>110000	>110000	-
19	MPN – Fecal Coliform	No./100 mL	46000	>110000	>110000	>110000	-
20	MPN – Fecal Streptococcal	No./100 mL	300	46000	300	5300	-

The collected samples were filtered using the lab scale model of filtration system.

The lab scale model of filtration system was used to check the efficiency of treating Grey Water samples. The system was square shaped, vertical type filter made of thick glass (acrylic) material. Plate 1 depicts the Lab Scale Filtration System used for treating Grey Water Samples

Filtration treatment was given separately for the four different types of grey water viz., bathroom wastewater, hand-wash basin wastewater, washing machine wastewater, kitchen wastewater. Performance of the filtration system was evaluated keeping the following parameters of concern as reference. It includes Turbidity, Total solids, Chloride, Biochemical oxygen demand (BOD₅), Chemical oxygen demand (COD), Phosphate and MPN. The percentage reduction in concentration, parameters of concern in filtered grey water samples are shown in Table 2: The filtered grey water can be reused for toilet flushing, street cleaning, cleaning of sewer lines, gardening, ground water recharge, firefighting and construction of buildings. In this present work it was proposed to reuse the treated grey water in the flushing tanks of toilets provided in Block 1 of the study area. The



Plate 1: Lab Scale Filtration System Used for Treating the Grey Water Samples

amount of fresh water needed in each flush tank was estimated as follows:

For flush tanks in block 1

No. Of flush tanks (FT) : 28

Capacity of each FT : 10 l

No. Of occupants : 170

Usage of FT per person : 2 times/day

Quantity of fresh water needed for all FT = 28 * 10 * 170 * 2 = 95200 l/day = **95.2 kl/day**

Total quantity of grey water generated per day: **77.96 kl/day**

From the above estimation it is clear that if the treated grey water is reused in the selected site (SJCE Boys Hostel) for toilet flushing in Block 1, a reduction of about 60 – 75% in use of fresh water can be achieved.

CONCLUSIONS

The conclusions of this article are listed below:

- Lab scale unit of Low cost treatment technique - Sand and gravel filters performance was evaluated and had satisfactory treatment performance.
- Sand and gravel filters were very efficient in reduction of turbidity, total solids, BOD₅, phosphate and MPN to about 90%, 63%, 55%, 87% and 61% respectively.
- The treated grey water from the sand and gravel filters can be reused for non-potable use like flushing tanks, gardening, street cleaning and sewer cleaning.
- If the treated grey water is reused in the selected site (SJCE Boys Hostel) for toilet flushing in Block 1, a reduction of about 60 – 75% in use of fresh water can be achieved.
- Gravity governed sand gravel filters are eco-friendly, economical and enhances

DIMENSION OF LAB SCALE FILTRATION SYSTEM

Length : 0.2 m

Breadth : 0.2 m

Depth of System : 1.1 m

Depth of Filter Sand : 0.15 m

Depth of Gravel Layer : 0.3 m

Depth of Collecting Tank : 0.2 m

BASE MATERIAL - COARSE AGGREGATE - GRAVEL

The base material consists of 3 layers of different sizes viz.,

Bottom Layer : 40 – 60 mm

Middle layer : 20 – 40 mm

Top Layer : 05 – 20 mm

Filter Media – Sand – Course Sand and Fine Sand

Sand used as filter media should possess the following physical properties –

Effective Size = 0.3 – 0.6 mm

Uniformity Co-Efficient = 1.5 – 2.5 mm

Specific Gravity = 2.55 - 2.65

environment sustainability.

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ABOUT THE AUTHOR

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He received his Bachelor of Engineering in “Civil Engineering” from SJCE, Mysore, University of Mysore, M.Tech in Environmental Engineering from SJCE, Mysore, PGDEP in Environmental Planning from IDS, University of Mysore and Ph.D (Civil Engineering) from Visvesvaraya Technological University, Belgaum. His areas of specialization are Solid and Hazardous Waste Management, Pollutant Transport, Ground Water Modelling and Water Quality Monitoring with a teaching experience of 30 years.

Table 2: Percentage reduction in concentration, parameters of concern in filtered grey water samples

Sl. No.	Parameter	Percentage Reduction in Concentration			
		S1	S2	S3	S4
1	Turbidity	79 - 86	86 - 90	80	80
2	Total Solids	38 - 56	60 - 63	54 - 56	55 - 57
3	Chloride	22 - 30	14 - 18	39 - 41	33 - 34
4	Biochemical Oxygen Demand (BOD)	50 - 55	51 - 54	51 - 54	50 - 52
5	Chemical Oxygen Demand (COD)	40 - 46	52 - 55	57 - 58	49 - 56
6	Phosphate	83 - 87	85	71 - 80	82 - 84
7	MPN – Total Coliform	58	61	52	58

ABOUT THE AUTHOR

HEMALATHA D.S. is a Post Graduate student and recently (August 2022) completed her M.Tech in Environmental Engineering at Sri Jayachamarajendra College of Engineering, JSS Science and Technology University, Mysuru and awaiting for her 4thsem results.



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IDEAL IFAS™ CASE STUDY: SHARJAH WWTP, SHARJAH, UAE

By

World Water Works

QUICK FACTS

- INDUSTRY: Municipal
- PROCESS TYPE: Activated Sludge
- TECHNOLOGY: Ideal IFAS®
- DESIGN: 130 MLD; 50,320 kg/day BOD;
9,380 kg/day TN
- STARTUP DATE: September 2019

BACKGROUND

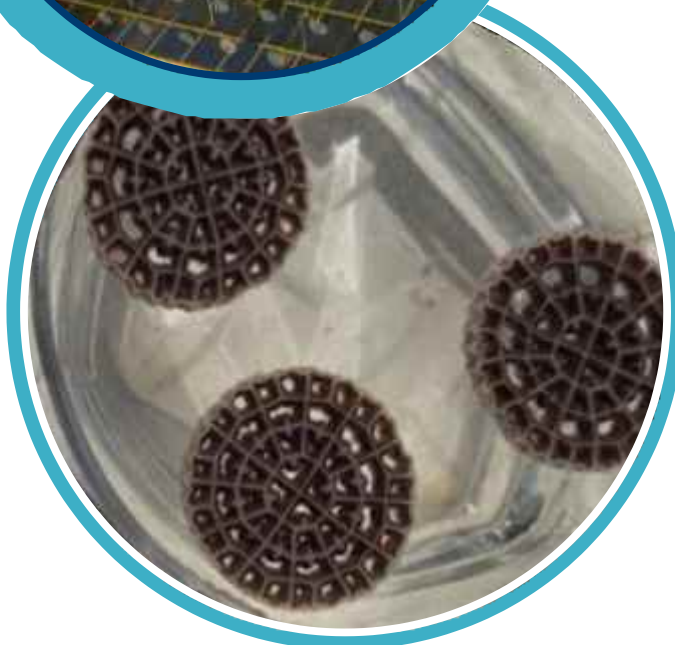
Sharjah Municipality of the United Arab Emirates (U.A.E.) was requiring to treat more and more flow despite having very little space for new treatment systems. They were looking at wanting to expand their plants No. 4 & No. 5 plants to meet new total nitrogen limits and try to do so by having to reuse the existing systems.

Sharjah's engineer, having worked with other large cities around the world, upgrading them to meet new lower effluent permit requirements relating to Total Nitrogen and Ammonia- Nitrogen, showed Sharjah Municipality what could be done using their existing tanks and upgrade them without having to build any new tanks. This type of upgrade would save on cost as well as space at the plant.

SOLUTION

The process used for this type of upgrade is called Integrated Fixed Film Activated Sludge (IFAS). This is the combination of Conventional Activated Sludge (CAS) and Moving Bed Biofilm Reactor (MBBR) System in the same tank. The goal is to retain / grow the slower growing bacteria called nitrifiers on the MBBR media. In the figure, one can see the Activated sludge in the bottom portion of the graduated cylinder and the MBBR media on top which houses the slower growing bacteria.

The system reached full capacity in May 2020 and has treated 115% of its average load since this time. Figures 1 – 5 show operationally the influent loads for COD & TKN with also removal rate of Total Nitrogen and SVI of the MLSS.



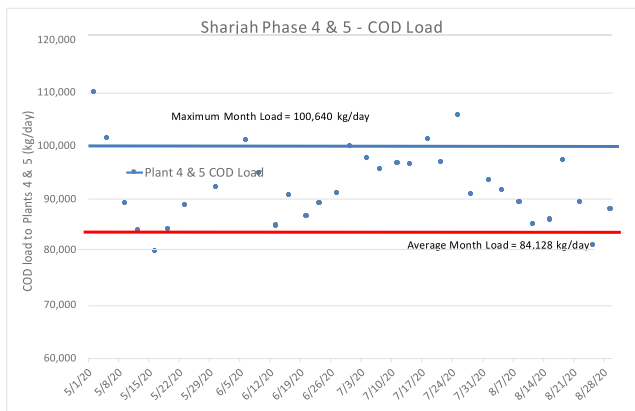


FIGURE 1 - TOTAL COD LOAD MAY 2020 - AUG 2020

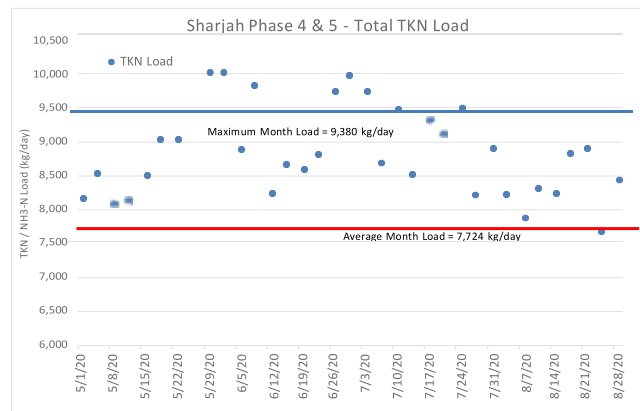


FIGURE 2 - TKN LOAD MAY 2020 - AUG 2020

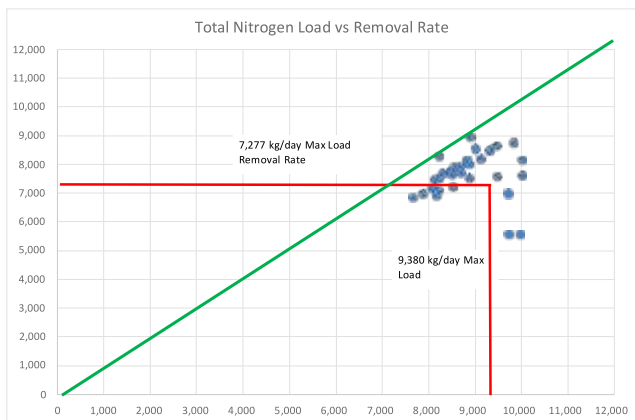


FIGURE 3 - TOTAL NITROGEN LOAD VS REMOVAL RATE

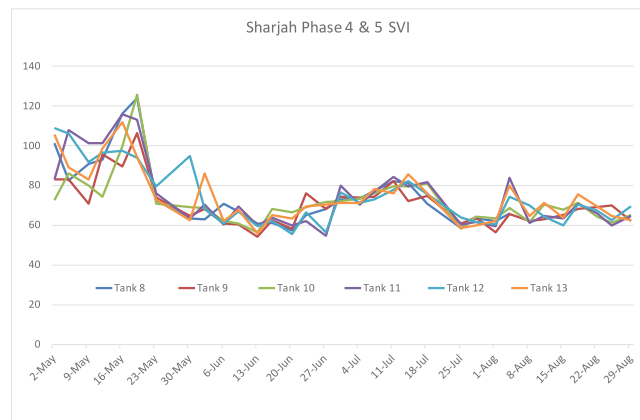


FIGURE 4 - SVI OF 6 IFAS TRAINS MAY 2020 - AUG 2020

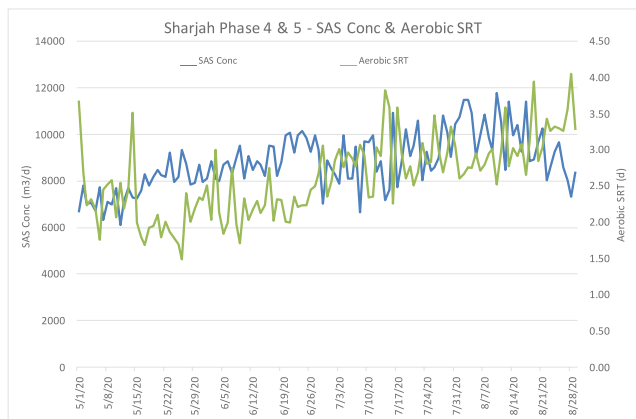


FIGURE 5 - SAS CONC & AEROBIC SRT MAY 2020 - AUG

ABOUT THE AUTHOR

World Water Works International Inc and its affiliated companies ("World Water Works" or "WWW") is an innovator in the wastewater treatment industry, driven to help industrial and municipal customers find wastewater treatment solutions that deliver clean water, perform better, recover resources and save money. The company was founded in 1998 in USA, with a strong focus on innovation, quality and customer satisfaction. For over 20 years, executing these goals have enabled WWW to establish a leading reputation and meaningful relationships with over 700 customers including Nestle, Easen Unilever, Coca-Cola, Hindustan Unilever Limited, JSW, Toshiba Water Solutions, Danone, Disney, Hormel Foods, Sharjah Municipality, Proctor & Gamble, Wipro, National Peroxide Ltd. and several of the leading municipalities. WWW have installations in more than 29 countries across the world.

WWW is a global leader in Biological nutrient removal and solid-liquid separation technology and our core technologies comprise of Ideal DAF, Ideal MBBR / Ideal IFAS, BIOCOS, DEMON and InDense.

At WWW, we have a diverse international design team consisting of engineers, operators, mechanics, electricians and managers that lead and supports World Water Works' innovative approach. Combining this expert team with a strong commitment to Research & Development and Customer Commitment yields some of the most robust, yet cost-effective high-performance products for our Clients.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com.

COOLING TOWER WATER OZONATION:

OZONE WONDER

Most of these happen to be opportunistic gram-negative bacteria and many of them are recent classifications of potent future pathogens. We provide below some extracts that have been reported on these bacteria. Many of them have been reported now and then in Hospital infections in water system, instruments and also in patient's body fluids and blood. Some of them have been reported to be present in the water in the Pharma industry. They are not easily removed by conventional water treatment processes. Ozonation appears to me the only alternative. This content will appear in two parts. Most of them were classified as pseudomonas strains earlier. They all seem to require higher ozone doses and more than the normal contact time. Selected few are listed here with some known behavioural pattern

PART I

1. *Sphingomonas paucimobilis* Gram Negative *Pseudomonas* variety renamed now. Found in environment especially soil Susceptible but contact time not known. Ability of *S. paucimobilis* to pass through the 0.2 µm filters. In one Japanese hospital, water obtained from a reverse osmosis system, as well as from an ultra-filtration unit tested positive for *S. paucimobilis*, and the level of contamination was higher than that in tap water from the same hospital (indicating that it passes through UF and RO and proliferates in system loops). Further studies showed a correlation between the chlorine level in the water and the amount of growth of this organism, suggesting that chlorination of the water may have some inhibitory effect on its growth. It is implicated in microbial influenced corrosion of water pipes suggesting that it can exist and proliferate in bio fouling material. Heating the water to

64°C decreases these reactions and microbial growth

2. *Cupriavidus pauculus* Gram negative Strains have been isolated from pool water, ground water, and bottled mineral water. It passes through Ultra filtration system. Found in soils. Not much is known about this
3. *Methylobacterium* species: Gram Negative They include bacteria previously grouped in the *Pseudomonas* genus. The ability to form biofilms and to develop tolerance to disinfecting agents, high temperatures, and drying may explain the frequent occurrence and colonization of *Methylobacterium*. Opportunistic bacteria also found in biofilms and likely to resist disinfection hiding within biofilms
4. *Elizabethkingia meningoseptica*, Gram Negative It has been isolated in the hospital environment in water supplies, disinfectants, and medical devices. Isolation of this organism in handwash sink and water is a significant finding as they have been reported to survive in chlorinated water. Environmental studies have revealed that the organism can survive in chlorine-treated municipal water

supplies, often colonizing sink basins and taps, intubation tubes, humidifiers, incubators for newborns, ice chests and syringes, and has become a potential reservoir for infections in the hospital environment. Active infection control measures like regularly inspecting the hospital water tanks, water surveillance, and hyper chlorinating the water might be required for controlling infection with this challenging bacterium.

5. *Deftia acidovorans* Gram Negative Earlier known as *Pseudomonas acidovorans*, is found in soil, water and the hospital environment.
6. *Oligella ureolytica* is a commensal of the GU tract, and most clinical isolates are from the urine, predominantly from men. From origin the source in water could be contamination of municipal water through sewage
7. *Stenotrophomonas* (*Xanthomonas*) *maltophilia* Gram Negative *Stenotrophomonas* (*Xanthomonas*) *maltophilia* is an aerobic bacillus that is found in various aquatic environments. Not much has been reported about this bacteria and its susceptibility to ozone

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WATER: THE NEW STYLE STATEMENT

In 2021, footballer Cristiano Ronaldo, the Portugal captain removed two bottles of Coca-Cola kept in front of him at Euro 2020 press conference, encouraging people to drink water instead. The devastating effect on the stock prices of Coca Cola, one of the most recognized brand and one of the largest consumed soft drink shocked many, but clearly put water as the champion of any official or unofficial drink. The relationship between Celebrities and Water is not new. It's been years since water has been making its own rounds among the celebrities and creating a style statement of its own. The normal brands of packaged drinking water like Aquafina, Dasani, Danone are still selling in millions and are serving the thirst of the masses. But lately a new segment of packaged drinking water has come up especially created for those who make it a style statement, rather than mere means of quenching thirst.

Decade and a half ago, Perrier was associated with celebrities and was looked up to as a sign of luxury and style in the water bottle market. Perrier is a French brand of natural bottled mineral water captured at the source in Vergèze, located in the Gard département. Perrier is best known for its naturally occurring carbonation, a distinctive green bottle, and higher levels of carbonation than its peers.

But with changing times, new favorites have

placed themselves as Rolls Royce of bottled drinking water.

1. **Voss Water:** Voss is Norwegian-based bottled water from the village of Vatnestrom in Iveland municipality, Agder county. Contrary to its name, the water is not bottled in the municipality of Voss, which is more than 400 kilometers (250 mi) from the bottling site. It is available in both still and sparkling forms. The bottle has also shown up on multiple movie screens and on high profile celebrities' social media. Dwayne "The Rock" Johnson even signed a brand ambassador contract with VOSS in 2019 saying he's been hydrating with the brand for years on set, in his "Iron Paradise" (i.e., his home gym), and with family and friends. The price for a 500ml bottle is usually around a couple dollars.
2. **Flow Water:** Flow is 100% naturally alkaline water sourced from our artesian springs. It has a smooth, clean taste and comes in eco-friendly packaging. Stars such as Kim Kardashian and Shawn Mendes have been seen drinking it, with Kardashian even showing off her big stock of Flow on her Instagram account.
3. **Svalbarði Polar Iceberg Water:** Svalbarði is an award winning ultra-low mineral, superior purity, still Arctic iceberg water. The unexpected pricing of



such a hard to obtain and elegantly bottled water has been discussed on both Jimmy Kimmel Live! and The EllenDeGeneres Show, though we'd like to offer them both a chance not just to see and taste but to understand how Svalbarði is helping to save the Arctic.

4. **Fiji water:** Fiji Water is a brand of bottled water derived, bottled, and shipped from Fiji. According to marketing materials, the water comes from an artesian aquifer in Viti Levu. Headquartered in Los Angeles, California, Fiji Water is available in 330 ml, 500 ml, 700 ml, 1 liter (0.22 imp gal; 0.26 US gal), and 1.5-liter bottles. Fiji Water's areas of expertise are in Bottled Water, Health, Beverage, Consumer Packaged Goods, E-Commerce, Luxury, and CPG. Fiji Water is reputed to be the favourite of many Hollywood stars including Nicole Kidman and Justin Timberlake. And according to the Daily Mail, even former US president Barack Obama.

5. **Evocus Water:** In India, celebrity water was in the news when Virat Kohli revealed that the water he consumes is called black water which is not an ordinary one. The Virat Kohli's black water contains natural-black alkaline water, which helps you stay hydrated. The benefits of the water are that it is high in pH which improves immunity and helps one remain fit. Earlier, it was reported that Kohli drinks special mineral water called 'Evian' which is imported all the way from France, and it costs more than 600 rupees per liter.

With so many luxury water brands to choose from and each celebrity endorsing this basic drink, it is quite evident that water is finally a style statement, which many others will follow.



TENDERS

OWNERSHIP:

Authority : Municipal Corporation
Address : Tilak Road Tirupati, Pincode
City : Chittoor
Location : Chittoor | Andhra Pradesh | India
Bid Open Date : 13 Oct 2022
Tender Value : ₹38.42 Lac
Doc Collection Date : 13 Oct 2022
Competition: Domestic Competitive Bidding
FTID : 22092442860
 Supply Delivery Of Commodities And Safety Measures To Uds Workers And Stp Workers Maintenance Under Ground Drainage And Sewerage Treatment Plant In Municipal Corporation, Tirupati.

OWNERSHIP:

Authority : Municipal Corporation
Address : Dy Hod (Projects), Ahmedabad Municipal Corporation, Sardar Patel Bhavan, Block-B, 2nd Floor, P.W.A. Office, Danapith, Ahmedabad 380 001 (Gujarat) India, Pincode 380001
City : Ahmedabad
Location : Ahmedabad | Gujarat | India
Bid Open Date : 14 Oct 2022
Tender Value : ₹10.31 Crores
Doc Collection Date : 13 Oct 2022
Competition : Domestic Competitive Bidding
FTID : 2209234129900
 Engineering, Procuring, Constructing, Erecting, Commissioning (Epc) Of 2.0 Mld Capacity Sewage Treatment Plant And It's Successive Operation And Maintenance For The Period Of Ten Years, At Sola Lake-Garden For Ahmedabad Municipal Corporation

OWNERSHIP:

Authority : Municipal Corporation
Address : Dy Hod (Projects), Ahmedabad Municipal Corporation, Sardar Patel Bhavan, Block-B, 2nd Floor, P.W.A. Office, Danapith, Ahmedabad 380 001 (Gujarat) India, Pincode 380001
City : Ahmedabad
Location : Ahmedabad | Gujarat | India
Bid Open Date : 14 Oct 2022
Tender Value : ₹10.91 Crores
Doc Collection Date : 13 Oct 2022
Competition : Domestic Competitive Bidding
FTID : 2209234129980

Engineering, Procuring, Constructing, Erecting, Commissioning (Epc) Of 2.0 Mld Capacity Sewage Treatment Plant And It's Successive Operation And Maintenance For The Period Of Ten Years, At Mahila Lake-Garden For Ahmedabad Municipal Corporation

OWNERSHIP:

Authority : Municipal Corporation
Address : Dy Hod (Projects), Ahmedabad Municipal Corporation, Sardar Patel Bhavan, Block-B, 2nd Floor, P.W.A. Office, Danapith, Ahmedabad 380 001 (Gujarat) India, Pincode 380001
City : Ahmedabad
Location : Ahmedabad | Gujarat | India
Bid Open Date : 14 Oct 2022
Tender Value : ₹10.01 Crores
Doc Collection Date : 13 Oct 2022
Competition : Domestic Competitive Bidding
FTID : 2209234130030
 Engineering, Procuring, Constructing, Erecting, Commissioning (Epc) Of 2.0 Mld Capacity Sewage Treatment Plant And It's Successive Operation And Maintenance For The Period Of Ten Years, At Asarwa Lake-Garden For Ahmedabad Municipal Corporation.

OWNERSHIP:

Authority : Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited
Address : Cmc Ii Atp Anpara, Pincode 231225
City : Dudhi
Location : Dudhi | Uttar Pradesh | India
Bid Open Date : 18 Oct 2022
Doc Collection Date : 15 Oct 2022
Competition : Domestic Competitive Bidding
FTID : 220924423810
 N.S.R-Running And Operation Of Sewage Treatment Plant Of Capacity 4800m3 (Av) Per Day Including Proper Operation Of Six No. Pumps And Motor Of 25hp In Pump House And 03 No. Pump And Motor Of 10 Hp In Sump Of Second Clarifier And Digester, 02 No. Pump And Motor Of 05 Hp In Sump Of Primary Clarifier, 02 Nos. Motors With Gear Box Of 20hp In Areaters, 04 Nos. Motors With Gear Of 1 Hp In Primary & Secondary Clarifier Installed At Sewage Treatment Plant For Treatment Of Sewage From Colony Premises

Include

OWNERSHIP:

Authority : Central Public Works Department
Address : Project Division, Kahikuchi Bazaar
City : Guwahati
Location : Guwahati | Assam | India
Bid Open Date : 29 Sep 2022
Doc Collection Date : 29 Sep 2022
Competition : Domestic Competitive Bidding
FTID : 2209244152810
 Providing And Supplying Sewage Treatment Plant I/C Operation Maintenance At Ihm, Hengrabari, Guwahati (Sh: Construction And Recarpeting Of Internal Bituminous Road With Other Miscellaneous Items At Ihm Hengrabari, Guwahati)

OWNERSHIP:

Authority : Central Public Works Department
Address : Cpwd, Gc Crpf Khatkhathi
City : Kohima
Location : Kohima | Nagaland | India
Bid Open Date : 29 Sep 2022
Doc Collection Date : 29 Sep 2022
Competition : Domestic Competitive Bidding
FTID : 2209244161130
 Development Of Site (Civil And Elect) At 155 Bn Bsf Campus Chedima Kohima Nagaland (Phase - I) Sh Installing Testing And Commissioning Of Water Treatment Plant Capacity 40 Cum Per Hour At Bsf Campus Chedima Kohima

OWNERSHIP:

Authority : Kandla Port Trust
Address : Executive Engineer Civil Off Shore Oil Terminal Ao Building Jetty Vadinar, Pincode 361010
City : Khambhalia
Location : Khambhalia | Gujarat | India
Bid Open Date : 29 Sep 2022
Tender Value : ₹4.53 Lac
Doc Collection Date : 29 Sep 2022
Competition : Domestic Competitive Bidding
FTID : 220923452470
 Operation And Maintenance Of Water Treatment Plant And Supply System At Oot, Vadinar For A Period Of 06 Months.

OWNERSHIP:

Authority : Central Public Works

Department

Address : Project Division, Kahikuchi Bazaar
City : Guwahati
Location : Guwahati | Assam | India
Bid Open Date : 29 Sep 2022
Doc Collection Date : 29 Sep 2022
Competition : Domestic Competitive Bidding
FTID : 2209244152810
 Providing And Supplying Sewage Treatment Plant I/C Operation Maintenance At Ihm, Hengrabari, Guwahati (Sh: Construction And Recarpeting Of Internal Bituminous Road With Other Miscellaneous Items At Ihm Hengrabari, Guwahati)

OWNERSHIP:

Authority : Central Public Works Department
Address : Cpwd, Gc Crpf Khatkhathi
City : Kohima
Location : Kohima | Nagaland | India
Bid Open Date : 29 Sep 2022
Doc Collection Date : 29 Sep 2022
Competition : Domestic Competitive Bidding
FTID : 2209244161130
 Development Of Site (Civil And Elect) At 155 Bn Bsf Campus Chedima Kohima Nagaland (Phase - I) Sh Installing Testing And Commissioning Of Water Treatment Plant Capacity 40 Cum Per Hour At Bsf Campus Chedima Kohima

OWNERSHIP:

Authority : Kandla Port Trust
Address : Executive Engineer Civil Off Shore Oil Terminal Ao Building Jetty Vadinar, Pincode 361010
City : Khambhalia
Location : Khambhalia | Gujarat | India
Bid Open Date : 29 Sep 2022
Tender Value : ₹4.53 Lac
Doc Collection Date : 29 Sep 2022
Competition : Domestic Competitive Bidding
FTID : 220923452470
 Operation And Maintenance Of Water Treatment Plant And Supply System At Oot, Vadinar For A Period Of 06 Months.

OWNERSHIP:

Authority : Kandla Port Trust
Address : Civil Division, Off-Shore Oil Terminal Department, First Floor, Ao Building, Vadinar – 361010, Gujarat, Pincode 361010

TENDERS

City : Khambhalia
Location : Khambhalia | Gujarat | India
Bid Open Date : 29 Sep 2022
Tender Value : ₹4.53 Lac
Doc Collection Date : 29 Sep 2022
Competition : Domestic
 Competitive Bidding
FTID : 2209234129660
 Operation And Maintenance Of Water Treatment Plant And Supply System At Oot Vadinar For A Period Of 06 Months

OWNERSHIP:

Authority : Corporation Of Chennai
Address : No 664 Puzhuthivakkam Main Road Puzhuthivakkam Chennai 600 091, Pincode 600091
City : Saidapet
Location : Saidapet | Tamil Nadu | India
Bid Open Date : 29 Sep 2022
Tender Value : ₹7.84 Lac
Doc Collection Date : 28 Sep 2022
Competition : Domestic
 Competitive Bidding
FTID : 2209244102070
 Operation And Maintenance Of Water Treatment Plant And Supply System At Oot Vadinar For A Period Of 06 Months

OWNERSHIP:

Authority : Directorate Of Municipal Administration
Address : Pincode 560001
City : Bangalore
Location : Bangalore | Karnataka | India
Bid Open Date : 30 Sep 2022
Tender Value : ₹1.24 Lac
Doc Collection Date : 29 Sep 2022
Competition : Domestic
 Competitive Bidding
FTID : 2209244229180
 Providing Manpower Security Guard Service To Mcc Office, Slaughterhouse, Water Supply Treatment Plant And Park In Ward No 41 To 60 For The Period Of One Year In Mcc Limits

OWNERSHIP:

Authority : Directorate Of Municipal Administration
Address : Pincode 560001
City : Bangalore
Location : Bangalore | Karnataka | India
Bid Open Date : 07 Oct 2022
Tender Value : ₹30.00 Lac
Doc Collection Date : 07 Oct 2022

Competition : Domestic
 Competitive Bidding
FTID : 2209244236410
 Providing Manpower Security Guard Service To Mcc Office, Slaughterhouse, Water Supply Treatment Plant And Park In Ward No 41 To 60 For The Period Of One Year In Mcc Limits

OWNERSHIP:

Authority : Zilla Parishad
Name : Prodhan, Jasaitala Gp
Address : Jasaitala, Lalgola, Murshidabad
Location : Murshidabad | West Bengal | India
Bid Open Date : 07 Oct 2022
Tender Value : ₹30.00 Lac
Doc Collection Date : 07 Oct 2022
Competition : Domestic
 Competitive Bidding
FTID : 2209244236410
 Construction Of Water Treatment Plant Near Pirtala Halt Station At Pirtala Sansad.

OWNERSHIP:

Authority : Zilla Parishad
Name : Eo,Bhagwangola - li Ps,Msd
Address : JEo,Bhagwangola - li Ps,Msd
Location : Murshidabad | West Bengal | India
Bid Open Date : 12 Oct 2022
Doc Collection Date : 12 Oct 2022
Competition : Domestic
 Competitive Bidding
FTID : 220924214560
 Construction And Installation Of Arsenic Free Water Treatment Plant At Issurpara Village Under Saralpur Gp, Bhagwangola li Panchayat Samity

OWNERSHIP:

Authority : Zilla Parishad
Name : Eo,Bhagwangola - li Ps,Msd
Address : JEo,Bhagwangola - li Ps,Msd
Location : Murshidabad | West Bengal | India
Bid Open Date : 12 Oct 2022
Doc Collection Date : 12 Oct 2022
Competition : Domestic
 Competitive Bidding
FTID : 220924214580
 Construction And Installation Of Arsenic Free Water Treatment Plant In The Premises Of Nashipur Hut Jumma Maszid Under Nashipur Gp, Bhagwangola li Panchayat Samity

OWNERSHIP:

Authority : Health Engineering
Name : Executive Engineer, Malda Mechanical Division,Phed
Address : Office Of The Executive Engineer, Malda Mechanical Division, Phe Dte. Doulatpur Phe Complex, P.O. Maliha, Dist. Malda, Pin 732102
Location : Malda | West Bengal | India
Bid Open Date : 19 Oct 2022
Doc Collection Date : 19 Oct 2022
Tender Value : ₹20.34 Lac
Competition : Domestic
 Competitive Bidding
FTID : 220924211190
 Supply, Delivery And Storage Of Vacuum Operated Gaseous Chlorination Spares For Gaseous Chlorination Plant S (0-5 Kg Per Hr. Capacity) Under Different Water Treatment Plant Of Southern Sector And Northern Sector Of Malda Arsenic Area W/S Scheme

OWNERSHIP:

Authority : Rajkot Municipal Corporation
Name : Executive Engineer, Malda Mechanical Division,Phed
Address : Add City Engineer Drainage Project Branch Rajkot Municipal Corporation Shree Harisinhji Gohil Bhavan, 150 Ring Road, Rajkot-360005
Location : Rajkot | Gujarat | India
Bid Open Date : 17 Oct 2022
Doc Collection Date : 17 Oct 2022
Tender Value : ₹1.6 Crore
Competition : Domestic
 Competitive Bidding
FTID : 22092432170
 Supply, Delivery And Storage Of Vacuum Operated Gaseous Chlorination Spares For Gaseous Chlorination Plant S (0-5 Kg Per Hr. Capacity) Under Different Water Treatment Plant Of Southern Sector And Northern Sector Of Malda Arsenic Area W/S Scheme

OWNERSHIP:

Authority : Indianoil
Name : Gm Cc
Address : Indian Oil Corporation Limited Md Western Region Office Regional Contract Cell Plot No C 33 G Block Bandra Kurla Complex Bandra E Mumbai 51
Location : Ahmednagar | Maharashtra | India
Bid Open Date : 04 Oct 2022

Doc Collection Date : 04 Oct 2022
Tender Value : ₹1.38 Crore
Competition : Domestic
 Competitive Bidding
FTID : 220924238920
 Limited Tender For Job Of Supply, Installation, Testing And Commissioning Of Package Sewage Treatment Plant Stp Of Capacity 10kld Including Allied Civil, Mechanical And Electrical Works At Vashi Terminal, Jnpt Terminal And Ahmednagar Depot Under Maha

OWNERSHIP:

Authority : Farakka Barrage Project - River Development And Ganga Rejuvenation
Name : Executive Engineer Equipment Division
Address : Farakka Barrage Project, P.O. Farakka Barrage, Dist. Murshidabad, West Bengal, Pin 742212
Location : Murshidabad | West Bengal | India
Bid Open Date : 30 Sep 2022
Doc Collection Date : 30 Sep 2022
Tender Value : ₹17.27 Crore
Competition : Domestic
 Competitive Bidding
FTID : 220924224620
 Cleaning And Washing Of Flocculator, Central Drive Clarifier, Oxidation Pond, Drains Along With Renovation Or Overhauling Of 4 Nos. Pressure Filters With Supply Of Filter Media At 2 Mgd Water Treatment Plant Of Farakka Barrage Project

OWNERSHIP:

Authority : Oil India Limited
City: Duliajan
Address : Production Services Support Oil India Limited P O Duliajan Assam 786602 :: Ocs 3 Stf Madhuban And Itf Tengakhat, Pincode
Location : Duliajan | Assam | India
Bid Open Date : 10 Oct 2022
Doc Collection Date : 10 Oct 2022
Competition : Domestic
 Competitive Bidding
FTID : 2209244198560
 Utilization Of Solid Extract Of The Desalination Plant At Secondary Tank Farm Stf Madhuban And Intermediate Tank Farm Itf Tengakhat Oil India Limited

EVENT CALENDAR



SEPTEMBER 2022

Water Expo - Hyderabad

Thu, 15 - Sat, 17 Sep 2022
Hyderabad, India
<http://www.waterindia.net/>

Thai Water

Wed, 14 - Fri, 16 Sep 2022
Bangkok, Thailand
<https://www.thai-water.com/thw/2022/en/index.asp>

Plumbdrain Africa

Tue, 20 - Thu, 22 Sep 2022
Johannesburg, South Africa
<https://www.plumbdrain.co.za/contact/>

Monitoring and Evaluation of Water Sanitation and Hygiene WASH Programmes

Mon, 19 - Fri, 23 Sep 2022
Nairobi, Kenya
<https://www.who.int/activities/monitoring-water-sanitation-and-hygiene>

World Water Tech North America Summit

Wed, 28 - Thu, 29 Sep 2022
Torrance, USA
<https://worldwatertechnorthamerica.com/>

Water Harvesting Techniques For Rural Development Course (Clean Water Solutions Training)

Mon, 19 - Fri, 23 Sep 2022
Nairobi, Kenya
<https://comms.southsudangoforum.org/t/water-harvesting-techniques-for-rural-development-course/46405>

Water Innovation Summit

Wed, 28 - Thu, 29 Sep 2022
New Delhi, India
<https://worldwatertechinnovation.com/>

Annual Produced Water Management Permian Basin

Tue, 27 - Wed, 28 Sep 2022
Houston, USA
<https://producedwatersociety.com/events-calendar/produced-water-society-permian-basin-2022/>

Produced Water Management

Tue, 27 - Wed, 28 Sep 2022
Houston, USA
<https://www.aweimagazine.com/article/produced-water-management/>

LANKAWATER - International Water supply and Treatment Industry Exhibition

Thu, 22 - Sat, 24 Sep 2022
Colombo, Sri Lanka
<http://lankawater.org/index.html>

IFAT India

Wed, 28 - Fri, 30 Sep 2022
Mumbai, India
<https://www.ifat-india.com/>

International Indo Africa B2B Trade Expo Kenya (IIATE)

Thu, 22 - Sat, 24 Sep 2022
Nairobi, Kenya
<https://www.indoafricaexpo.com/>

P3 Water + Energy Summit

Wed, 21 - Thu, 22 Sep 2022
San Diego, USA
<https://www.p3waterenergysummit.com/>

OCTOBER 2022

Pak Water & Energy Expo

Tue, 04 - Thu, 06 Oct 2022
Karachi, Pakistan
<https://pakwaterexpo.com/>

Power-Gen Int'l Expo

Thu, 20 - Sat, 22 Oct 2022
Dhaka, Bangladesh
<https://www.powergen.com/>

Rocky Water Brew Fest

Sat, 22 Oct 2022
Melbourne, USA
<http://rockywaterbrewfest.com/>

Water Education Foundation Water Summit

Thu, 27 Oct 2022
Sacramento, USA
<https://www.watereducation.org/foundation-event/water-summit-2022>

Virtual Conference on Pipe Materials in Water & Wastewater Systems

Wed, 12 Oct 2022
India
<https://www.cii.in>

International Conference on Integrated Natural Disaster Management (ICINDM)

Tue, 11 Oct 2022
India
<http://asar.org.in/Conference/23022/ICINDM/>

Water Bangladesh International Expo

Thu, 13 - Sat, 15 Oct 2022
Dhaka, Bangladesh
<https://www.bangladeshwaterexpo.biz/>

Meeting of the Bureau to the Water Convention

Thu, 20 - Fri, 21 Oct 2022
Geneva, Switzerland
<https://unece.org/>

E Expo China

Wed, 19 - Fri, 21 Oct 2022
Shanghai, China
<https://muenchen.de/en/technical/events/e-expo-china-2022.php>

INDOWATER

Wed, 05 - Fri, 07 Oct 2022
Jakarta, Indonesia
<https://indowater.com/>

Aquarama Trade Fair

Thu, 20 Oct 2022
Belgium
<https://www.aquarama.be/en/tradefair/edition/2022/home>

Water Environment Federation Technical Exhibition & Conference (WEFTEC)

Sat, 08 - Wed, 12 Oct 2022
New Orleans, USA
<https://www.weftec.org/>

WWEM - Water, Wastewater and Environmental Monitoring Conference

Wed, 12 - Thu, 13 Oct 2022
Telford, UK
<https://www.ilmexhibitions.com/wwem/>

The Oceans from Space Symposium

Mon, 24 - Fri, 28 Oct 2022
Italy
<https://www.oceansfromspacevenice2020.org/>

Taiwan International Water Week

Thu, 13 - Sat, 15 Oct 2022
Taipei, Taiwan
<https://www.taiwanintlwaterweek.com/en/index.html>

Training Course on Integrated Water Resource Management

Mon, 03 - Fri, 07 Oct 2022
Nairobi, Kenya
<https://www.maximpact.com/water-resource-management-training/>

Aquatech China

Sun, 09 - Tue, 11 Oct 2022
Shanghai, China
<https://www.aquatechtrade.com/china/>

Water Management Show

Thu, 20 - Sat, 22 Oct 2022
Dhaka, Bangladesh
<https://www.tradeindia.com/tradeshows/105725/water-management-show-2022.html>

Shanghai International Water Treatment Exhibition (Aquatech China)

Sun, 09 - Tue, 11 Oct 2022
China
<http://www.aquatechchina.com/>

Middle East Produced Water Management Conference and Expo

Mon, 17 - Tue, 18 Oct 2022
UAE
<https://middleeast.produced-water-management.com/>

International Conference on Integrated Natural Disaster Management (ICINDM)

Sun, 09 Oct 2022
India
<https://conference.ft.unand.ac.id/index.php/icdm/icdm2022>

International Conference on Sustainable Water Management (ICBMSE)

Mon, 03 - Tue, 04 Oct 2022
Aarhus, Denmark
<http://conferencefora.org/Conference/547/ICSWM/>

Oceans Conference & Exposition

Mon, 17 - Fri, 21 Oct 2022
USA

EVENT CALENDAR



<https://www.oceansconference.org/>

Minnesota Water Resources Conference

Tue, 18 - Wed, 19 Oct 2022
Saint Paul, USA
<https://ccaps.umn.edu/minnesota-water-resources-conference>

Water Leaders Summit

Wed, 05 - Thu, 06 Oct 2022
Milwaukee, USA
<https://thewatercouncil.com/water-leaders-summit-2/>

Renewable Energy Show

Thu, 20 - Sat, 22 Oct 2022
Dhaka, Bangladesh
<https://renewableenergyindiaexpo.com/>

Cairo Water Week (CWW)

Sun, 16 - Wed, 19 Oct 2022
Cairo, Egypt
<https://www.cairowaterweek.org/>

Middle East Smart Water Utilities Exhibition and Conference

Wed, 12 - Thu, 13 Oct 2022
Dubai, UAE
<https://www.middleeast.smart-water-utilities.com/>

NOVEMBER 2022

Agro Bangladesh Expo (ABExpo)

Fri, 18 - Sun, 20 Nov 2022
Dhaka, Bangladesh
<https://www.cems-agroexpo.com/>

China International High-end Drinking Water Industry Expo

Fri, 11 - Sun, 13 Nov 2022
Beijing, China
<http://www.waterexpocn.com/en/>

Hard Water Ice Fishing Expo

Fri, 18 - Sun, 20 Nov 2022
Blaine, USA
<https://www.hardwatershow.com/>

[Kansai] Smart Energy Week

Wed, 16 - Fri, 18 Nov 2022
Japan
<https://www.cantonfair.net/event/13112-kansai-smart-energy-week>

National Drainage Show (NDS)

Wed, 23 - Thu, 24 Nov 2022
UK

<https://drainageshow.com/>

Water Loss Asia

Tue, 08 - Thu, 10 Nov 2022
Kuala Lumpur, Malaysia
<https://www.waterlossasia.com/>

Waste Expo Brasil

Tue, 08 - Thu, 10 Nov 2022
Brazil
<https://www.wasteexpo.com.br/>

Natural Disasters Expo California (NDE California)

Wed, 09 - Thu, 10 Nov 2022
USA
<https://www.ndecalifornia.com/>

World Congress and Expo on Recycling

Mon, 21 - Tue, 22 Nov 2022
Netherlands
<https://blackcycle-project.eu/19th-world-congress-and-expo-on-recycling/>

National Drainage Show (NDS)

Wed, 23 - Thu, 24 Nov 2022
UK
<https://drainageshow.com/>

Wuhan International Water Technology Expo (WTE)

Fri, 11 - Sun, 13 Nov 2022
China
<https://www.neventum.com/tradeshows/the-wuhan-international-pump-valve-pipeline-water-treatment-expo-wte>

Industrial Water

Tue, 22 - Thu, 24 Nov 2022
Germany
<https://www.usgs.gov/special-topics/water-science-school/science/industrial-water-use>

Myanmarwater

Thu, 03 - Sat, 05 Nov 2022
Yangon, Myanmar
<https://myanmarwater.org/index.html>

Natural Disaster & Emergency Management Expo (NDEM)

Wed, 16 - Thu, 17 Nov 2022
USA
<https://www.ndemevent.com/en-us.html>

India Water Week (IWW)

Tue, 01 - Sat, 05 Nov 2022
Greater Noida, India
<https://www.indiawaterweek.in/>

World Congress and Expo on Recycling

Mon, 21 - Tue, 22 Nov 2022
Netherlands
<https://blackcycle-project.eu/19th-world-congress-and-expo-on-recycling/>

International Water Conference (IWC)

Sun, 06 - Thu, 10 Nov 2022
Orlando, USA
<https://eswp.com/water/overview/>

International Conference on Clean Water, Air & Soil

Fri, 11 - Sun, 13 Nov 2022
Malaysia
<https://inwascon.org.my/conferences/>

Urban Drainage Group Annual Conference (UDG Annual Conference)

Tue, 08 - Thu, 10 Nov 2022
UK
<https://hopin.com/events/urban-drainage-group-annual-conference-2021>

Climate Smart Engineering Conference (CSE)

Tue, 22 - Thu, 24 Nov 2022
Australia
<https://www.eacse.com.au/>

Water Loss Forum

Wed, 02 - Thu, 03 Nov 2022
Istanbul, Turkey
https://www.waterlossforum.org/en_US/home

International Rivers Symposium

Sun, 27 - Wed, 30 Nov 2022
Austria • Online
<https://riversymposium.com/>

Water Conservation & Environmental Management

Fri, 11 - Sun, 13 Nov 2022
Kota Kinabalu, Malaysia
<https://inwascon.org.my/wc2em/>

The International Water Conference

Sun, 12 - Thu, 16 Nov 2023

San Antonio, USA
<https://www.iwccferences.com/>

Annual Cost Effective Shale Water Management Marcellus & Utica

Tue, 01 - Wed, 02 Nov 2022
Pittsburgh, USA
<https://www.shale-water-marcellus-utica.com/>

DECEMBER 2022

Storm Expo Asia

Wed, 07 - Thu, 08 Dec 2022
Singapore
<https://www.thestormexpocalifornia.com/index.asp>

Maine Rural Water Association Annual Conference & Trade Show (MRWA Annual Conference & Trade Show)

Tue, 06 - Thu, 08 Dec 2022
USA
<https://www.mainerwa.org/>

E-Waste World Conference & Expo

Wed, 30 Nov - Thu, 01 Dec 2022
Germany
<https://ewaste-expo.com/>

KISAN Agri Show

Wed, 14 - Sun, 18 Dec 2022
Pune, India
<https://krishijagran.com/events/kisan-agri-show-2022/>

Hydrology & Water Resources Symposium

Wed, 30 Nov - Thu, 01 Dec 2022
Australia • Online
<https://hwrs.com.au/>

ASIAWATER (AW)

Wed, 07 - Fri, 09 Dec 2022
Kuala Lumpur, Malaysia
<https://www.asiawater.org/>

JANUARY 2023

Water Expo & Forum

Mon, 16 - Wed, 18 Jan 2023
Abu Dhabi, UAE
<https://www.worldfutureenergysummit.com/en-gb/water.html>

Iran International Water & Wastewater Exhibition (Water and

EVENT CALENDAR



Wastewater Exhibition)

Fri, 30 Dec 2022 - Mon, 02 Jan 2023
Tehran, Iran
<https://watex.ir/en>

NEWEA Annual Technical Exhibition & Conference

Mon, 23 - Wed, 25 Jan 2023
Boston, USA
<https://annualconference.newea.org>

Michigan Onsite Wastewater Conference

Tue, 10 - Wed, 11 Jan 2023
Lansing, USA
<https://www.canr.msu.edu/>

FEBRUARY 2023

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

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

WATER TODAY'S WATER EXPO

Thu, 23 - Sat, 25 Feb 2023
Chennai, India
<https://www.watertoday.org/>

Wash Futures-Water, Sanitation & Hygiene Conference

Mon, 13 - Sat, 18 Feb 2023
Brisbane, Australia
<https://washfutures.com/>

Netherlands Aqua Trade Fair

MARCH 2023

Tue, 21 - Thu, 23 Mar 2023
Gorinchem, Netherlands
<https://expotobi.com/aqua-nederland-vakbeurs>

Oman Sustainability Week (OSW)

Sun, 12 - Thu, 16 Mar 2023
Muscat, Oman
<https://www.omansustainabilityweek.com/>

Watercon Conference

Mon, 20 - Thu, 23 Mar 2023
Springfield, USA

https://www.isawwa.org/mpage/Microsite_Registration

Water Philippines Expo & Conference

Wed, 22 - Fri, 24 Mar 2023
Pasay, Philippines
<https://www.waterphilippinesexpo.com/>

Rural Water Conference

Mon, 27 - Thu, 30 Mar 2023
State College, USA
<https://www.rwau.net/events>

Future of Utilities Water

Mon, 20 Mar 2023
London, UK
<https://marketforcelive.com/future-of-utilities/events/water/>

Water India

Mon, 27 - Wed, 29 Mar 2023
New Delhi, India
<https://www.waterindia.com/>

APRIL 2023

Smart Water Systems

Mon, 17 - Tue, 18 Apr 2023
London, UK
<https://www.smartwater.com/>

Texas Water

Tue, 11 - Fri, 14 Apr 2023
Houston, USA
<https://www.txwater.org/>

AUGUST 2023

The Water Expo

Wed, 23 - Thu, 24 Aug 2023
Miami, USA
<https://www.thewaterexpo.com/>

SEPTEMBER 2023

Water Indonesia

Wed, 13 - Sat, 16 Sep 2023
Jakarta, Indonesia
<https://www.waterindonesiaexpo.com/>



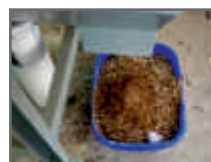
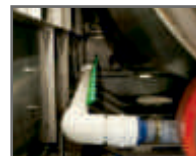
Mechanical Screens

Rotary Drum Fine Screen

The internally fed rotary fine screen is composed of a tank and a spiral connected to the drum for the transport of screening.
The screen is composed of a perforated plate whose holes diameter is as big as the desired opening size. The drum is operated by a geared motor.

Salient Features:

- Perfect for screening of MBR feed, to protect the membrane from scouring / damage due to solids in feed
- Perforated Circular screening drum
- MOC IS2062 PP coated / SS 304/304L/316/316L.
- Continuous Operation
- Backwash arrangement for perforated screen washing
- Suitable for line installation
- Suitable for separation of soft solids from waste water, such as food waste/ canteen /hotel waste etc.
- Hole opening: 1, 2, 3 and 5 mm.
- Piped inlet.



ENVIRONMENTALLY FRIENDLY WATER TREATMENT: BY LANXESS



WATER - THE INVISIBLE TREASURE

The Corona pandemic highlights the importance of clean water and hygiene. After all, hygiene is almost impossible without water. The blue gold is vital for humans and animals. But clean drinking water is not available in sufficient quantities everywhere. It must therefore be purified - as environmentally friendly as possible.

Agriculture and industry also depend on water to produce products. Water scarcity becomes an issue for everybody, not only for developing countries or desert regions. The increasing demand for the scarce resource constantly needs new and improved solutions, to ensure that clean water remains available in sufficient quantity and quality. We need to understand that water is essential to life and needs protection. This is the challenge we must face.

- It is obvious that companies like LANXESS, which themselves develop and offer products, technologies and solutions for efficient water treatment, can do more. At the end of 2020, LANXESS launched a water program that includes Group-wide targets and voluntary commitments as well as local "water stewardship program". Initially, primarily for four water risk sites in India, Italy and China.

TINY SPECIALISTS FOR WATER TREATMENT

- In addition to its own production sites, LANXESS also supports the sustainable use of water as a resource by its customers. For example, ensuring reliable treatment of clean drinking water as well as customized wastewater treatment or groundwater

remediation. This is where our Lewatit® ion exchange resins come into play. Ion exchange resins are small polymer beads that selectively remove pollutants from water without any harmful additives.

• RECOVERY OF PRECIOUS METAL

If metal ions are present in higher concentrations, for example in industrial wastewater, recovery may be worthwhile. Lewatit® ion exchange resins selectively bind certain metal ions, e.g. precious metals such as platinum or gold. Minor components can also be separated, such as zinc from copper electrolytes or cobalt from nickel or copper salt solutions. The metal ions are thereby removed from the aqueous solution and at the same time enriched on the ion exchange resin, which considerably facilitates their further processing or, in the case of wastewater streams, purification. In addition to ion exchange resins, iron oxide adsorbers are also efficiently used for water treatment.

EFFICIENT WATER MANAGEMENT IN THE INDUSTRY

• WATER TREATMENT IN POWER PLANTS

Water-steam circuits are at the heart of all thermal power plants that generate electricity from fossil or nuclear fuels. Here, the water and steam serve as an energy carrier and cooling medium.

Lewatit® ionexchange resins have helped to ensure efficient, safe and reliable operation of these power plants worldwide over many years. They play a key role in demineralizing the cooling and boiler feed water and in condensate polishing in the water-steam circuits. This is the only way to prevent incrustations, which ensures optimum heat transfer in the long term.

In addition, corrosion can be effectively reduced or avoided in this way. Together with the efficient regeneration of the resins, this ensures long-lasting, economical operation of the power plants.

DRINKING WATER TREATMENT

Contamination of surface water by "Natural



Organic Matter" (NOM), for example polyphenols, humic and fulvic acids, which are formed during the decomposition of plant material, can be removed with strongly basic ion exchange resins of specially adjusted porosity. These functional resins bind or adsorb the impurities.

GROUNDWATER TREATMENT

Pollutants can also enter groundwater in agricultural regions. Especially in Germany, nitrate from fields overfertilized with liquid manure is a current problem. But even if the slurry is thickened and processed into solid fertilizer, the liquid residual phase containing ammonia must not be discharged untreated into surface waters.

Lewatit® ion exchange resins efficiently separate nitrate and ammonium ions and ensure that they are converted into solids that can either be landfilled or used specifically as fertilizer.

REMOVAL OF NATURAL CONTAMINANTS

Natural arsenic contamination of drinking water is the most significant natural trigger of poisoning worldwide, especially in India and Bangladesh. Water is also contaminated with arsenic in parts of Argentina and Chile or the western United States. In addition to acute and chronic illnesses, increased tumor development can be the result. In order to comply with the limit of 10 mg/l set by the World Health Organization (WHO), millions of people rely on treatment of their drinking water. Special Bayoxide®-type iron oxide adsorbers approved for drinking water applications from our Krefeld plant, have proven to be very efficient for this purpose and are used in filter systems worldwide.

WETEX AND DUBAI SOLAR SHOW



WETEX and Dubai Solar Show organised by Dubai Electricity and Water

Authority (DEWA), are in line with Dubai's vision to build a sustainable future for the Emirate and is held annually under the directive of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, Ruler of Dubai and under the patronage of HH Sheikh Ahmed bin Saeed Al Maktoum, Chairman of the Dubai Supreme Council of Energy.

WETEX and Dubai Solar Show are the perfect platforms to display the latest technological advancements and discuss the latest trends related to energy, water conservation, saving natural resources and building a sustainable environment. They provide an ideal opportunity for local and international companies and organizations to share and showcase their products and services, along with offering a forum to share best practices and experiences with exhibitors from around the world.

DATE: 27-29 September 2022

VENUE: Dubai World Trade Centre

WEBSITE: <https://www.wetex.ae/>



AQUATHERM® TASHKENT



Aquatherm® Tashkent is the only industry specialised exhibition in Uzbekistan, presenting the latest developments, novelties and innovations in the field of HVAC technologies. The place of the annual meeting of manufacturers, dealers, distributors, chief industry specialists. A platform for expanding business ties and

establishing new contacts.

The 10th Anniversary International Exhibition for Heating, Ventilation, Air Conditioning, Water Supply, Sanitary ware, Basins, Environmental Protection Technologies and Renewable Energy Sources - Aquatherm® Tashkent 2022 is held with the support of the Ministry of Housing and Communal Services of the Republic of Uzbekistan.

DATE: 28-30 September 2022

VENUE: Tashkent, Uzbekistan

WEBSITE: <https://www.aquatherm-tashkent.uz/en/>



INDOWATER 2022 EXPO & FORUM



PT.NAPINDO MEDIA ASHATAMA prides itself in delivering real benefits and results to all our exhibitors, visitors and delegates. Established in 1989, PT. Napindo Media Ashatama has built up a portfolio of market leading exhibitions and conferences in major industry sectors including communications, multimedia and information technology, livestock and feed, water & wastewater, presentation technology, electrical engineering/power and livestock.

Our success is credited to an experienced team of staff which is dedicated to provide the best service and support for our exhibitors, visitors, speakers and delegates. In addition, PT. Napindo Media Ashatama work closely with key government ministries and departments, embassies, associations and institutions in ensuring that the events organised contribute positively to the related industries.

PT. Napindo Media Ashatama is a leading exhibition & conference organizer in Indonesia which is responsible for Internetworks Indonesia Expo & Forum, Indo Telecom Expo & Forum, Indo Water Expo & Forum, IVAC Expo & Forum, Indo Waste Expo & Forum, Indo Renergy Expo & Forum, Indo Meelex Expo & Forum, Indo Wireless Expo & Forum, IndoCommIT Expo & Forum, Indo Livestock Expo & Forum, Indo Fisheries Expo & Forum, Indo Security Expo & Forum, Indo Firex Expo & Forum, Indo Defence Expo & Forum, Indo Aerospace Expo & Forum and Indo Marine Expo & Forum.

DATE: 05-07 October 2022

VENUE: Jakarta Convention Centre, Indonesia

WEBSITE: <https://indowater.com/>



EverythingAboutWater conference on Current Challenges and Futuristic Solutions for the Water Issues of Western India

Despite consisting of India's richest states, having access to global infrastructure, natural resources including massive coastline, a good economic condition and strong manufacturing sector, the western part of India has been dealing with water issues.

The problems are diverse, ranging from the water scarcity in Maratwada, Saurashtra and Kutchh areas to floods along Narmada River and major districts in Gujarat. The mega cities struggle to

keep pace with upgradation of their water and sewage treatment plants and water supply issues and NRW remain a constant pain for the water bodies. The opportunity to take benefit of desalination plants is a ray of hope for many, but the operational and environmental costs and question on the long term sustainability still remains a concern.

EverythingAboutWater is bringing the think tanks of the water industry together on a common platform and discuss the challenges and sustainable solutions at the upcoming mega conference on the theme of "Current Challenges and Futuristic Solutions for the Water Issues of Western India" on 11th and 12th November in Mumbai India.

DATE: 11-12 November 2022

VENUE: Mumbai, India

W E B S I T E :

<https://www.eawater.com/event/everythingaboutwater-conference-on-current-challenges-and-futuristic-solutions-for-the-water-issues-of-western-india/>



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