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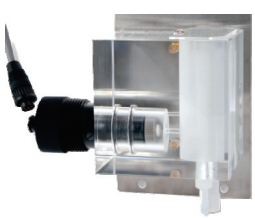

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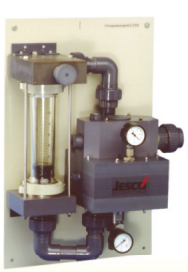
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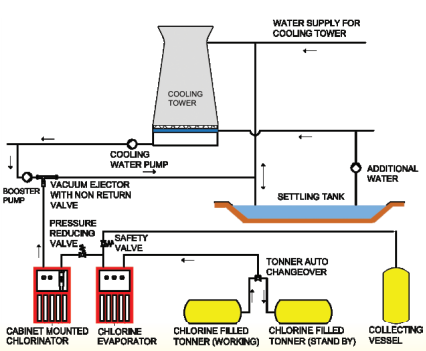
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SMART, SMARTER, SMARTEST

With the economic advancements in India, the infrastructure of cities have development following the need to expand due to ever increasing population along with the mass movement from rural villages to cities in search of livelihood. About 30-40 years back, India was known to have four metro cities Delhi, Mumbai, Chennai and Calcutta, one in each corner of the country. But with the various tertiary industries gaining momentum, and IT industry boom, the tier 1 and tier 2 cities witnessed an outstanding growth and now, cities like Bhubaneshwar, Pune, Jaipur, Indore, Ujjain, Lucknow, Cochin and many more are metro cities in their own.

The need to grow and develop these cities in a planned manner, lead to the National Smart Cities Mission. It is an urban renewal and retrofitting program by the Government of India with the mission to develop smart cities across the country, making them citizen friendly and sustainable. The Union Ministry of Urban Development is responsible for implementing the mission in collaboration with the state governments of the respective cities. The mission initially included 100 cities, with the deadline for completion of the projects set between 2019 and 2023.

Keeping the focus on the theme of Smart Water in Smart Cities, I would like to keep focus on the importance of water in these Smart Cities. We all will agree that water is not only important but a necessity for any city to survive. But now, with limited quantity of water and pressure of providing it to a large population, each city is adapting smart ways to manage supply, and recycling its water resource. This in turn has two direct benefits, first is that with limited wastage and smarter supply, a large population can be supplied with water, and secondly, with better wastewater treatment, we are able to utilize this valuable asset and save a lot of money also, which can add to the municipal budget.

With smart water, cities face an ever-increasing array of ways to collect data and feed it into their decision-making. A Smart City links multiple systems within a network to share data across platforms in order to enhance safety and security and improve the efficiency of municipal services from energy, transportation, building, healthcare, public safety and water. By monitoring real-time information, city operators can stay informed about what is going on in the field at all times and respond quickly and appropriately when a problem arises. This results in a city becoming more efficient and reducing the overall cost of service for the customer.

As per the Urban Affairs Ministry as of November 12, 2021, a total of 6,452 projects at a cost of ₹1,84,998 crore had been tendered. In terms of work progress, 5,809 projects worth ₹1,56,571 crore were under implementation or had been completed, it says, although it is not clear how many were completed. Out these projects many have been for water division only. Hopefully with the completion of these projects, each and every city will become smart and the water network will become smarter and our country the SMARTEST.

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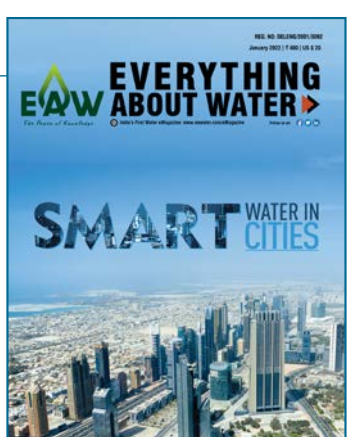
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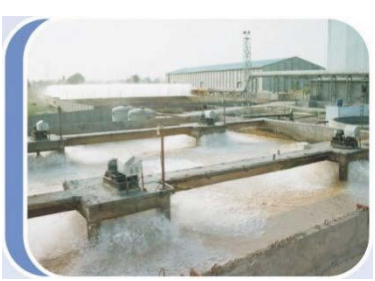
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Specialty Chemicals giant LANXESS appoints Neelanjan Banerjee as the Global Head of its Lubricant Additives Business

Neelanjan Banerjee will be taking over as the new Global Head of the Business Unit Lubricants Additives at LANXESS Corporation, USA effective July 1, 2022 after a brief work-in period. He has been Region Head, Vice-Chairman & Managing Director for LANXESS India Private Limited since August 2018 and has also been an Executive Director since 2009. He has held senior management positions in the last 16 years with the organization.

Schneider Electric Commits to Support the Ministry of Jal Shakti in Sustainable Water Management

Schneider Electric, the global leader in energy management and automation, is lending pivotal support to Ministry of Jal Shakti's various sustainable water management initiatives. This is part of Schneider's commitment towards building a sustainable ecosystem for water management, Schneider's comprehensive suite of IoT enabled software, tools and technologies and universal automation will fulfil current needs for clean, reliable, and economical water. These digital solutions are also pegged to bridge the gap between various water processes to cut down wastage and save water.

Grundfos partners with four organisations to develop a blockchain based Circular System for Assessing Rare Earth Sustainability

Grundfos partners with BEC GmbH, Circularise, Minviro, and the global Rare Earth Industry Association (REIA) to lead a three-year EIT RawMaterials funded innovation project to build a blockchain based Circular System for Assessing Rare Earth Sustainability (CSyARES). This will help companies improve transparency and sustainability of their supply chains when it comes to critical and rare earth materials.

Demand for rare earth metals is skyrocketing and by 2030 it is projected to reach 315,000 tonnes1. These rare-earth metals are irreplaceable in wind turbines, electric vehicles, mobile phones, computers and the defence industry. Rising

The US Patent Office has granted Memsift Innovations patent for its core Membrane Distillation technology

The US Patent Office (USPTO) has granted Memsift Innovations Pte Ltd US patent number 11235284 that covers the compression and expansion based Improved Membrane Distillation process TS-30™ and its various applications.

The system operates in the principle of simple thermodynamic (heat and mass transfer) and the driving force is the partial vapor pressure gradient across the membrane. The TS-30™ system operates relatively low temperature and pressure when compared to the conventional thermal and pressure driven membrane process and handle high salinity wastewater.

The technology has been well demonstrated for industrial liquid-waste treatment and resource recovery for pharmaceutical, chemical/pulp and metal finishing/mining industries. It helps to close the industrial liquid-waste loop and recover up to 100% chemicals (metal salts, acids and other chemical compounds) and >95% of water at >80% lower operating cost compared to traditional evaporators. Moreover, the technology also reduces the carbon footprint by up to 80%.

"We are pleased that the US Patent Office has recognized the uniqueness of our TS-30™ Improved Membrane Distillation technology and granted this patent," said Dr J Antony Prince, the CEO of Memsift Innovations Pte Ltd. "The patent further strengthens our commercialization efforts and differentiate our TS-30™ Improved Membrane Distillation system against the traditional membrane distillation methods and provides Memsift Innovations a sustainable competitive advantage in the market. The patented invention is the core of our business and we believe it will help us to bring this wonderful technology to the global market."



ATER NEWS

Memsift Innovations has an extensive portfolio of patents or patent applications covering all key products and creates shareholder value by giving Memsift Innovations both the freedom to operate and significant product differentiation.

With more global legislation and heighten corporate environmental consciousness, Memsift plan to go fund raising to capture the big emerging green circular market opportunities. Memsift wants to accelerate its growth to build a new factory to scale larger industrial production of patented and patent pending membranes and the modules [Stomate®, MemRain™, Mistil™, and GOSEP™], increase time-to-market of the its winning product portfolio, expand market share by opening oversea sales and aftermarket service offices and strengthen its organization capability.

LANXESS makes Siemens a Global Alliance Partner

Mumbai – LANXESS is securing strong support on its growth path and intensifying its long-standing cooperation with Siemens. The companies have now signed a contract for the procurement of technical goods for the global production facilities of the specialty chemicals company. From now on, Siemens will supply LANXESS not only with digital control systems and software, but also with motor control centers and fire detection systems, among other things, at globally uniform conditions. The contract, which will initially run for five years, covers an order volume in the mid-double-digit million euro range and can also be extended to other material groups at any time.

In addition, the two companies want to accelerate the digital transformation at LANXESS through the joint development of digital applications and technologies.

"We are pleased to expand our cooperation with Siemens and to be able to rely on the reliable technical solutions of a premium partner on our growth course. With the now globally uniform procurement conditions for the plant components, we are also making our technical procurement much more efficient," said Hubert Fink, member of the Board of Management of LANXESS AG.

"LANXESS and we have enjoyed a reliable and successful partnership for many years. We are pleased to further expand our cooperation through the new framework agreement. In this way, we are joining forces and speeding up the innovation processes with regard to automation and digitalization in the process industry," says Eckard Eberle, CEO Process Automation at Siemens.

EarthCam 4D Brings Construction Digital Twins to Life

UPPER SADDLE RIVER, NJ, January – EarthCam, the leading provider of webcam technology and services, today introduced EarthCam 4D, empowering virtual design and construction (VDC) teams to overlay and synch live imagery with their digital twins. An intuitive time-line allows users to scroll backward and forward in time to view live imagery in relation to their 4D models.

Built on the Bentley iTwin platform, EarthCam 4D augments Bentley Systems' SYNCHRO 4D models with high-resolution photos from multiple cameras throughout the jobsite, overlaid in

DROPLETS SNIPPETS

demand combined with resource shortages and supply chain disruptions means we need to rely on sustainably mined and processed metals.

Bentley Systems Wins Company of the Year at 2021 Construction Computing Awards

Bentley is honored to be recognized in the construction technology sector. The company attributes its success to Bentley's SYNCHRO software, which offers a complete portfolio of integrated applications from field to office for digital construction management. Together, the applications enable teams to win and deliver heavy civil projects more efficiently by improving the use of data to optimize decision-making, resources, and profitability.

George Rajkumar, Country President, Grundfos India comments on the Indian Budget

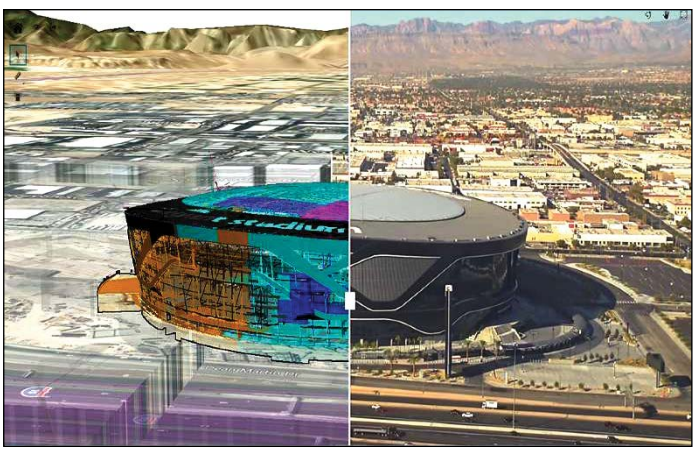
Budget 2022 presents an opportunity to strengthen India's water sector through strategic measures and appropriate budget allocations. In 2021, the honorable Finance Minister announced additional allocations towards the Jal Jeevan Mission (JJM) that led to a boom in tap water connections. Going forward as the government plans to revive consumption for economic growth, we will require a solid foundation to provide water security to both the citizens and industries as unavailability of water poses significant threat to the economy.

ABDUL RAHMAN MOHAMMED, CEO, Sahara Industry comments on the Indian Budget

Until a few years ago, we were not talking about water the way we do it now. The water scenario has changed drastically in the last decade from abundance to scarce. After the liberalisation process which brought about the growth of our economy, our population, our prosperity; but it also led to extracting more natural resources from the planet including higher level of water extraction and use while also creating more pollution with these resources. The surface water availability per capita in India in 1991 was 2309 cubic meters that has been reduced to 1486 cubic meters by 2021. About 36% reduced in three decades and estimated to reduce further to only 1191 cubic meters in next less than three decades.

precise alignment. Viewers can zoom in and out, and the associated live images remain synched. Unique transparency/opacity and model color adjustments enable new and powerful ways to compare and contrast models with reality over time.

"EarthCam 4D is a great and quick tool to help communicate project schedule with our customer, trade partners and public," said Michal D



Wojtak, Mortenson's Integrated Construction Director for sports and entertainment. "The ability to easily compare current and future states of work is valuable to project leadership teams."

"We are delighted to collaborate with EarthCam, and their EarthCam 4D application, which allows for construction teams to monitor planned construction against actual progress. In addition, EarthCam's solution integrates time-lapse imaging with interactive 3D models that are tied to the construction schedule data, adding tremendous value to clients," said Sheena Gaynes, Director, Business Development, iTwin platform, at Bentley Systems. "In doing so, EarthCam joins the growing innovation ecosystem building digital twin applications on the Bentley iTwin platform."
"Digital twins are radically increasing productivity in construction," said Brian Cury, CEO and Founder of EarthCam. "Thanks to Bentley iTwin, we're able to merge the highest resolution imagery from our cameras to SYNCHRO 4D models, and build valuable applications to increase our clients ROI."

"The partnership between EarthCam and Bentley is bringing construction digital twins to life by simplifying the visual communication of project status to all stakeholders. Now anyone can compare what is happening on the jobsite to what was planned virtually within a simple web viewer powered by Bentley's iTwin technology. By mixing 4D models from SYNCHRO with EarthCam's reality models, all stakeholders on the project can quickly see the progress of the project, identify issues, and keep the project on time and on budget from anywhere," said Rich Humphrey, VP, Construction, at Bentley Systems.

EarthCam 4D is the first solution that fully synchronizes time-sequenced images to 4D planning models - stakeholders no longer need multiple software interfaces and different stored image sources to access this critical comparative information. According to FMI, 13% of working hours are spent looking for project data and information. Having real-time imagery synched with a SYNCHRO 4D model in a single interface provides immediate, real-time evidence of every steel beam placement, and every window installation against 4D models, simplifying project management for SYNCHRO users worldwide.

EarthCam 4D will be premiered at Bentley MOMENTUM, the developer showcase for digital twin solutions on January 26th.
EarthCam's Control Center 8 has long been the software of choice among industry leaders for smart project documentation, promotion and security. EarthCam is driving productivity for a more visually informative jobsite, providing camera rentals, same-day delivery and professional installation. EarthCam works with industry leaders around the globe to make construction project management less costly and more efficient using powerful visual data.

Grundfos and EKF sign unique financing partnership agreement

Bjerringbro, Denmark: Grundfos, a global leader in advanced pump solutions and water technologies, and EKF Denmark's Export Credit Agency have entered into an agreement enabling Grundfos to finance projects globally for private commercial and public customers with limited funds available.

The agreement is the first of its kind in the pump solutions industry. It creates new opportunities for Grundfos to finance projects that will further access to water and optimised use of water resources. Moreover, it can help customers meeting their ambitions for reduced carbon emissions.

"We are thrilled to partner with EKF, which is allowing us to offer this new financing opportunity to our customers in need of financial support to realise their ambitions within water. The agreement accelerates the process of equipping customers and end-users with solutions that reduce CO2 emissions and provides access to clean water to vulnerable areas," says Grundfos CFO, Mikael Geday.

Under the agreement, private commercial and public customers can receive financing on projects above 0.5m EUR for up to five years directly through Grundfos. EKF will provide Grundfos a credit guarantee covering 50% of the credit exposure significantly reducing the risk in financing such projects.

"We are thrilled that in collaboration with Grundfos, we have established an entirely new approach which will make it easier for Grundfos´ worldwide customers to obtain financing for purchase of new pump and water solutions as well as helping the company reduce



the risk involved. This is an example of EKF´s pragmatic contribution to the global green transition," says Peder Lundquist, CEO of EKF Denmark´s Export Credit Agency.

SMC Infrastructures Pvt Ltd completes execution of 22.75 million litres per day sewage treatment and recycling plant based on latest Membrane Bioreactor technology

Mumbai, Maharashtra, India - SMC Infrastructures Pvt. Ltd, the leading infrastructure company in India, was awarded the work of the new Sewage Treatment Plant at RCF in Trombay, Mumbai. The project which costs INR 167.53 crores, was successfully completed on January 31, 2020. This STP is a sustainable development project (/topic/sustainable-development-project) that is equipped with advanced technologies to treat sewage wastewater and transform it into treated reusable water.

The state-of-the-art independent RCF STP (/topic/stp) was inaugurated by Mansukh Mandaviya, Union Minister of State for Shipping (Independent Charge), and Chemicals & Fertilizers, Government of India. Using advanced Ultrafiltration method based on membrane bioreactor technology followed by reverse osmosis (RO) technology, SMC set up the 45.5 MLD raw sewage pumping station (at MCGM's Ghatkopar premises) by means of the well-sinking method and a 22.75 MLD wastewater treatment facility followed by 20 MLD RO plant at the RCF's Trombay facilities to generate treated reusable water.

Of this, partly treated water from this plant is being utilized by RCF for their internal process plants and rest is sold to Bharat Petroleum Corporation Limited by RCF for usage in their process plant.
The scope of the project included carrying out detailed engineering, essential surveys, and investigations, procurement, supply, fabrication, transportation of all raw materials to the construction site, civil & mechanical instrumentation works, assembly, installation, and total project management, along with commissioning and stabilized operation of the plant before handing over of Sewage Treatment Plant to RCF.

Delhi Jal Board's interceptor sewer project nears completion

The Interceptor Sewer Project (ISP), a project approved by the Delhi Cabinet more than a decade ago to trap and treat the sewage that finds its way to the Yamuna, is "almost" complete, according to the Delhi Jal Board (DJB).

The facility to 'trap' the sewage in the drains is mostly complete, except for a stretch in Seelampur that will be completed by March, according to a senior DJB official. However, the treatment capacity for the trapped sewage is yet to be fully operational. Work on the ISP is being executed by Engineers India Limited, a public sector undertaking.

Out of the 242 MGD (million gallons per day) of waste water that the project was expected to trap and treat, around 170 MGD is being treated, according to a report submitted by the Delhi Pollution Control Committee (DPCC) to the Ministry of Jal Shakti in December last year.

Work at the Kondli, Rithala, and Coronation Pillar sewage treatment plants (STP) is underway and expected to be complete by December 2022, and the capacity to treat the remaining sewage will be available only once these are commissioned, the DJB official said. The capacity of these existing STPs is being enhanced.

Going by the DPCC report, the estimated quantity of sewage generated in the city is 720 MGD, and the existing treatment capacity at 34 STPs is 577 MGD, leaving 143 MGD of waste water untreated. Of the existing capacity, only 514 MGD is utilised. In December, 22 STPs did not comply with the treatment standards prescribed by the DPCC.

Three large drains - the Najafgarh, Supplementary and Shahdara drains – carry most of the sewage into the Yamuna, while smaller drains meet these larger drains. As part of the ISP, interceptor chambers have been constructed at these drains to 'trap' the sewage. Pipes have then been laid along the drains to transfer the waste to the nearest sewage pumping station, and from there to the nearest STP. Water from around 108 drains is being trapped under the project.

The cost of the ISP, which is the trapping system, is around Rs 1,395 crore, the official said. This is excluding the cost of the work on the STPs.

Environmentalists are skeptical about the impact, if any, that the project might have on the river. "The existing STPs are not working properly and do not meet the standards prescribed for treated water. The project was conceived a long while ago based on sewage output of those times. Since then, the output has increased and the treatment gap will still remain," said Diwan Singh, environmentalist who has been associated with water conservation projects.

GLOBAL WATER NEWS

According to the minutes of a meeting held last month of the Principal Committee appointed on the orders of the NGT to monitor the cleaning and rejuvenation of the river, Prof A. K. Gosain, Professor Emeritus, IIT Delhi, told the committee that the work being done by the DJB to trap natural drains and control the entry of untreated sewage into the river, "will remain a temporary measure" till a sewerage master plan is implemented for the city. "DJB has to complete the laying of sewers so that sewage shouldn't get discharged into existing stormwater channels," as per the minutes of the meeting.

Manoj Misra, convenor of the Yamuna Jiye Abhiyaan, said, "The STPs are not ready. Even if EIL says they have done their job, if the STPs are not ready, what is the point. Besides, not all drains were taken into account under this project."

Pharmaceuticals have polluted almost all the world's rivers, study by a UK university finds

Pharmaceutical pollution of the world's rivers is far more extensive than previously thought – so much so that it now poses a global threat to environmental and human health, according to new research. A team of scientists from York University in the UK took over 1,000 water samples from 258 rivers in 104 countries and found that many contained concentrations of medicinal drugs that exceeded safe levels.

Only two rivers in Iceland and one near a village in Venezuela, whose inhabitants use no modern medicine, were completely unaffected by pharmaceutical pollution.

The highest concentrations were found at Lahore, Pakistan; La Paz, Bolivia; and Addis Ababa, Ethiopia. The Kai Tak River in Hong Kong SAR had the greatest number of drugs present in a water sample, with 34 pharmaceuticals identified.



Rivers in the Belgian capital Brussels, in Luxembourg and Dallas, Texas, were among the 20% of waterways with the highest concentration of drugs. Even in Antarctica, four types of pharmaceuticals were detected. Samples were taken from every continent, and the problems appear worse where wastewater treatment is least effective and in some places where drugs are manufactured, according to the researchers.

BMC Floats Fresh Tenders For Sewage Plants After Supreme Court

After a rap from the SC and scrapping sewage treatment plant (STP) tenders worth around Rs 18,000 crore a fortnight ago, the has floated fresh tenders. The BMC floated new tenders for setting up seven STPs in Mumbai. This is the fourth time the BMC is floating tenders for the project in recent years, which has been marred by allegations of irregularities and cost escalation.
The SC recently rapped the BMC for delaying installation of STPs to prevent discharge of sewage into the sea in complete disregard of orders from the apex court and the. The BMC floated tenders for STP plants in Worli, Malad, Dharavi, Bandra, , Bhandup and . The BMC has asked bidders to submit a deposit of Rs 20 crore to participate in the bids.

The BMC had scrapped the tenders for the third time in three years as the SC stated that Mumbaikars' well-being and fate cannot be left to the BMC's inaction and lethargy. After it emerged that companies had bid over 40% above the BMC's own estimates, Leader of Opposition



(LoP) Devendra had alleged due to restrictive tender conditions, the BMC is setting up the costliest STPs in the country.

According to data compiled by studying the cost of over 60 STPs across India, Fadnavis had said the BMC will spend almost four times the cost for treating per millions of litre per day (MLD) of sewage compared to all other STPs in the country, making it the most expensive STP project in India. According to Fadnavis, while the average cost of sewage treatment is around Rs 1.7 crore for STPs across India, the BMC will end up spending around Rs 7.47 crore per MLD. "We had pointed out based on a nationwide survey of STPs how the BMC's cost was the highest in the country. The SC has also rapped the BMC and we believe that the SC will take cognisance of the escalated cost once gain," Fadnavis said.

Renovation of existing STP complete

The Trimbakeshwar Muncipal Council, (TMC), has completed the renovation of its existing sewage treatment plant (STP) to treat 1 million litre per day (MLD) of sewage in the town even as the work for the new STP with a 4.5 capacity has already begun.



Chief officer of the municipal council said renovation of the STP constructed in the year 2003-04 has been completed and augmentation of the same is also being carried out by installation of an ozonation plant to add to its capacity. "The council carried out the renovation of the existing STP by replacing its pumps and other things. Currently, the output of the plant suggests that the biochemical oxygen demand (BOD) is less than 7 as against the expected figure of 10," Jhadhav said.

Mumbai: BMC scraps STP tenders once again over allegations of cost escalation

A day after being pulled up by the highest court in the land for delaying work on sewage treatment, the on Tuesday again scrapped tenders worth around Rs 18,000 crore for setting up six sewage treatment plant (STPs) in Mumbai. The Supreme Court had rapped BMC for delaying installation of STPs to prevent discharge of sewage into the sea in complete disregard of orders from the apex court as well as the National Green Tribunal (NGT).

The BMC has now scrapped the tenders for the third time in three years. The SC had said that "well being and fate can't be left to the civic body's inaction and lethargy". It had directed the municipal commissioner to remain present through video conferencing at the next hearing to explain the delay.

The STP project has been stuck in red tape, technical glitches, allegations of irregularities and cost escalations for close to 15 years. Referring to its latest decision, a senior civic official said, "Since the bids received were over 40% above the BMC's estimates, we have scrapped all of them. We will revise the estimates and then float new tenders." Leader of Opposition (LoP) had alleged that due to restrictive tender conditions, the BMC was setting up the costliest STPs in the country. And since the issue has come up ahead of polls in the city, the decision appears to have been taken to withhold the tender.

Of the tenders issued for the seven STPs, BMC had received bids for six at Versova, Dharavi, Bhandup, Ghatkopar, and Bandra and none for the one at Malad. But bids received were at least 30-50% higher than the estimates, taking the total cost of the project to around Rs 18,000 crore. Analysing the cost of over 60 STPs across India, Fadnavis had said that at the given rate the BMC will spend almost four times the cost for treating one million litres per day (MLD) of sewage compared to other STPs in the country, making it the most expensive such project for sewage treatment. According to Fadnavis, while the average cost of sewage treatment is around Rs 1.70 crore for STPs across India, including those being set up at Navi Mumbai, Delhi and Chennai, the BMC will end up spending around Rs 7.47 cores per MLD. The BMC's plan to upgrade/rebuild completely the STPs is part of the Mumbai Sewage Disposal Project-II (MSDP). The seven plants will have the capacity to recycle around 1,700 million litres of water daily. The BMC had formed three committees with technical and financial experts to study the technical proposals and do a complete cost analysis including rate analysis and then arrive at reasonable rates.



NEED FOR "SMART WATER MANAGEMENT"

By Dushyant Jindal, Co-Founder, Hitech Enviro Solutions



India is undergoing dramatic shifts caused by a growing economy and population. Water woes recently reached crisis proportions with parts of Marathwada region in Maharashtra facing its worst drought ever. Special trains traversed a distance of 350 km and transported water to the drought prone area in late March and early April 2016, with more expected to follow.

Several other states are suffering as well from droughts, depleting groundwater, loss of water from leaks and insufficient water-recycling facilities. Water problems were identified earlier and India's 12th five-year plan (2012-17) has focused attention on water. The plan puts great emphasis on aquifer mapping, watershed development, involvement of NGOs, and efficiency in developing irrigation capacity.

In 2015, the Indian cabinet approved $US7.5 billion for the development of 100 Smart Cities and around another $US7.5 billion for urban rejuvenation in another 300 cities that has been taken up with alacrity. These cities and the solutions they implement are expected to act as the catalyst and model for other cities to replicate. Of the 24 features identified by the Ministry of Urban Development as areas that cities need to address in their plan, three are directly related to water and another seven are indirectly related to it. Water related topics to be addressed and implemented include: smart meter management, leakage identification, preventive maintenance, and water quality modeling.

At an average of 60%, India has among the highest Non-Revenue Water (NRW) rates in the world due to poor, aging and leaky distribution networks. One of the challenges has been to provide water with the existing facilities as the population growth in cities was not foreseen. Water, like cities, are state subjects in the constitution and the union government has little control over its enforcement in a city.

The Smart City approach to solving cities' water problems has been an ingenious veiled way to solve the water issue with a national design, vision and citizen engagement. An interesting factor that is expected from this will be Indian cities' ability to "leap frog" modern cities such as Los Angeles or Paris by implementing modern technology from the start instead of replacing outdated systems.

The Smart Cities Council defines a "Smart City" as a city that "uses information and communications technology (ICT) to enhance its livability, workability and sustainability."

Smart cities are being designed to redefine the possibilities of modern infrastructure. Water related topics to be addressed and implemented within the 100 Smart Cities as part of India's Smart Cities Mission include: smart meter management, leakage identification, preventive maintenance, and water quality modeling - all of them related to the existing ageing and creaking centralized water distribution network.

A Smart City links multiple systems within a network to share data across platforms in order to enhance safety and security and improve the efficiency of municipal services from energy, transportation, building, healthcare, public safety and water.
Within a Smart City, a "Smart Water Network" (SWN) allows cities to better anticipate and react to different types of water network issues, from detecting leaks, theft and water quality incidents to conserving energy and tracking residential water consumption.

By monitoring real-time information, city operators can stay informed about what is going on in the field at all times and respond quickly and appropriately when a problem arises. This results in a city becoming more efficient and reducing the overall cost of service for the customer.

Investment in smart water network runs in hundreds of millions of rupees creating infrastructure that is an extension of the current conventional and archaic supply and conveyance system. Therefore, we are facing the risk of

- Locking in, for next several decades, infrastructure that is arising from an unsustainable non-circular thinking; and
- Locking out the opportunity for building more sensible and appropriate infrastructure given that they are easy to build in most cities as the current conventional system installed capacity has a capacity gap of 70-90% and therefore have no legacy infrastructure that one would have to deal with.
- Smart Water Network is being developed in a water policy vacuum.
- There is no current water policy framework rooted in key principles of sustainable water management either at Central or

- State level to provide directions to utilities and urban local bodies (ULBs) responsible for providing water services.
- Instead, what we have is government prescriptions for building specific technology (E.g. Fecal Sludge Treatment Plant, 24/7 water supply network) and regulations without effective enforcement or monitoring (rainwater harvesting and sewage treatment plants). So, it is no surprise that the smart water plans are short-sighted and lack in future vision of transitioning to more sustainable water management
- Smart Water Network plans of Smart Cities fail to acknowledge a growing trend of communities harvesting rainwater, recharging groundwater and building sewage treatment plants within building premises.
- Therefore it does not incorporate or make room for the opportunities that could arise from creating smart networks out of such local on-site decentralized and small-scale water systems.

In order to make this first step towards smart water, ageing water infrastructures, some of which have been in place for over a hundred years, need to be updated and upgraded with IoT technologies, allowing them to come online and communicate with other parts of the system and city.

Smart water systems, much like smart energy systems, use the IoT enabled sensors to collect real-time data. This enables the optimization of water facilities, by detecting leaks or monitoring how water is being distributed across the network and allows people to make more informed decisions about water management. For example, these smart sensors can detect leaks in water pipes and immediately alert engineers to take action and mitigate the consequences.

This data is even more valuable when shared. For example, watershed management teams can use predictive technology to gain insights into when and which areas are likely to flood, before this actually occurs. By sharing this information, transport departments can then pre-emptively warn people about this and divert traffic accordingly. Predictive intelligence enabled by IoT and big data is going to have a huge impact on cities, saving time and conserving resources.

These benefits are extended to consumers too. Smart water technology is allowing consumers to monitor their usage remotely via apps. It can tell them when there is a leak, allowing people to resolve the problem much sooner and prevent water from being wasted unnecessarily. Smart water devices are becoming more and more popular, giving consumers the power to monitor their own water consumption and make decisions based on the data they are seeing, helping them to use water more sustainably as well as cutting costs.

As we strive to make the most of the opportunities available to us through technology to become sustainable, it is important that we do not forget to include the resource which, after all, we physically cannot live without. Upgrading water systems with smart technology will not only help manage the increased demand from mass urbanization but will help to reduce the amount of water wasted and make our consumption more efficient.

About the Author

Dushyant Jindal is an Engineer with MBA has an extensive experience working on environmental project for different sectors of Government and non-government organizations in India. He is the Co-Founder at Hitech Enviro Solutions, engaged in environmental monitoring services and consultancy.

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TAPPING INTO INTELLIGENT TECHNOLOGY FOR EFFICIENT DOMESTIC WASTEWATER MANAGEMENT

By Ramanan Viswanathan, Area Sales Director, Domestic Building Services, INDO Region, Grundfos



Water resources in Indian cities have been polluted over the years, with 70% of the urban sewage being untreated. Releasing untreated waste water back into nature will have catastrophic effects on the environment and people. The impact can be traced back to the contamination and destruction of natural habitats, wildlife and ecosystems to becoming the source of waterborne diseases spreading amongst people. This can be mitigated through proper urban sanitation and by adapting sustainable methods to manage, reuse and treat domestic waste water. With the growing concerns, we are also witnessing a steady rise in home owners who are becoming more conscious of their environmental footprint. They are looking at ways to ensure that their domestic wastewater is not left untreated and instead reuse it for myriad applications, including domestic landscaping, flushing, washing vehicles and sanitation.

There exists a gap in the terms of domestic wastewater treatment in our country which can be filled with decentralized treatment solutions. The policy of decentralization, that is, treatment and disposal or reuse of wastewater from small and low-density communities, buildings and dwellings in remote areas, private properties, coupled with the role of intelligent, sustainable and energy efficient technological solutions, will ensure effective wastewater treatment.

The challenges associated with domestic wastewater treatment require identification and addressal in multiple phases. In the coming days, intelligent water solutions driven by technologies such as Artificial Intelligence (AI) and Internet of Things (IoT) can be used to make these domestic wastewater management systems more efficient and sustainable as well.

We at Grundfos, have the necessary water solutions to meet such domestic wastewater challenges and through these, we are actively contributing to the United Nation's Sustainable Development Goal (SDG) 6 that focusses on water and sanitation to make a positive impact.

Moving ahead with technology

Most homeowners think domestic wastewater as something that disappears all by itself. However, if one starts experiencing problems with backwater, flooding or groundwater entering cellars, it is a sign that their wastewater infrastructure is not functioning properly. In situations such as these, domestic households require solutions either in the shape of a lifting station, submersible drainage pump or dewatering pumps. Grundfos offers a variety of solutions when it comes to domestic wastewater.

- **Efficient waste water removal:** The process involves the use of carefully calibrated systems and processes, from lifting stations to submersible pumps that regulate water pressure enabling efficient management of wastewater from it from the property, while ensuring maximum backflow protection. For instance, to meet the demands from the municipality and their own requirements for management and operability, the homeowners' association in Sweden chose Grundfos as their solution. It included pumping stations, pumps, other equipment, consultancy and installation, along with Grundfos' Dedicated Controls - a wastewater control solution that ensures optimum pump network management for collection of waste water from private homes and transport onwards to the municipal wastewater treatment plant. Alarms and reports from the network pumping stations are sent directly to the homeowner's association.

- **Compact lifting stations for individual households:** In domestic buildings, lifting stations give homeowners the flexibility to design their houses without having to worry about wastewater challenges. These are 'all in one' prefabricated solutions that can efficiently handle both black and grey wastewater. Its compact design allows the solution to be fitted in smaller spaces and offers protection from backflow. Grundfos Unlift, Sololift and Multilift series of lifting stations are designed to pump non-aggressive water and grey wastewater such as drainage and domestic effluents.

- **Submersible waste water pumps:** Submersible wastewater pumps are suitable for domestic wastewater management including drainage, effluent and domestic sewage pumps. The Grundfos AP and KP series of submersible pumps are designed for pumping non-aggressive water and grey wastewater such as drainage and domestic effluents

- with particles ranging from 10mm-35mm. These pumps can be used as a portable unit or stationery installation inside and outside the buildings.

- **Solving water logging with reliable dewatering pumps:** With the monsoon season around the corner, water entering garages and homes are becoming a common scenario. Cost-efficient and reliable solutions are required to pump the wastewater out of waterlogged areas within such homes. Grundfos' KPC and UNILIFT series are all equipped to drain basements and garages which are subject to flooding. Their compact, easy-to-handle form makes them portable pumps for such emergencies.

Awareness is key

We in India are highly impacted by wastewater problems and this is increasing the water-stress issues in the country. Through effective systems in place that will enable the reuse of domestic wastewater, we can reduce the burden on our natural water resources, in turn positively impacting the environmental ecosystem. With the rising awareness being seen among homeowners, the future does seem full of possibilities.

The answer to this lies in focussing on feasible solutions that are sustainable and intelligent. This will enable homeowners enjoy a host of benefits such as reduced costs due to energy efficiency and reduced maintenance.

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About the Author

Ramanan Viswanathan is the Area Sales Director of Domestic Building Services (DBS). In his role, he is responsible for the DBS Business Development and Sales in the INDO Region. A seasoned sales professional, Ramanan joined Grundfos India's Sales Department in August 1999. Under his able leadership, Grundfos established home offices, branch offices and regional office in the states of Andhra Pradesh, Karnataka and Goa.

He has more than 33 years of experience in Sales & Marketing of engineering products with a short stint in Contracts and Production management.

Ramanan started his career with Greaves Limited and went on to work with WILO Mather & Platt and Caterpillar prior to joining Grundfos India. He holds a Degree in Civil Engineering from Anna University and a Post graduate Diploma in Business Administration with specialization in Marketing from AM Jain College Institute of Management, Chennai.

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



INDUSTRIAL WATER: BUSINESS & ECONOMIC GROWTH

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



Nothing is more fundamental to life and economic activities than water. It is not only a basic human need, but adequate and safe water supports the nation's health, economy, security, well - being and ecology. The primary challenge in the present time is to ensure adequate quantity and quality of water to meet human, commercial, agriculture and ecological needs amid the growing distress and broadening water scarcity. The situation demands a better understanding of complexity of water resources and urgency of technological intervention and instant public attention to remain sustainable over the long run.

Making sufficient amount of safe water available to municipal and industrial consumers presents a great challenge. Cities and industries have mostly grown without appropriate planning, resulting in higher extraction of ground water, drying up of surface water sources and polluting the remaining water. This has caused hydrological and meteorological alterations, such as increasing air temperature, evapotranspiration, soil salinity and even flood risk. Consequently, water has become less available, making it scarce and impacting life and economy. The way to address water challenges and resource problems will requisite that decision makers at all levels of government need to make informed choices with proper investment and accept conflicting and uncertain alternatives with swift and decisive actions.

Worth of Water

What is the worth of water? This is a billion dollar or may be a trillion dollar question as water is impacting lives and businesses globally. There is no easy answer to this simple question. On the one hand, water is infinitely valuable resource needed for life to exist, on the other, water is taken for granted, misused and wasted every day, everywhere.

According to economic theory, the value of a good is determined by scarcity - the gap between limited resources and unlimited needs. We have been using water as if it was limitless, abundantly available and have no value. That traditional thinking and behavior resulted in water getting scarce faster than any expectations across the globe. If this was not enough, an estimated 80% of all industrial and municipal wastewater is released into the environment without any kind of treatment, making the remaining fresh water polluted and not usable.

Water is indeed both a social and an economic good. Water satisfies basic human needs and services, which are classified as life-support functions. Access to clean water is fundamental to life and ecological and environmental balance and critical for the existence of living systems including humans. After the human and ecological need, water is important to all commercial activities and economic development. It is absolutely a market good of which the efficiency of use and benefits can be maximized through proper allocation and smart demand-supply management. Industrial development happens when water is available in adequate quantity of specified quality at

Water has an established economic value with its various uses and should be recognized as an important factor for economic development.



the disposal of the industries. The worth of water can be understood as it is being traded internationally at commodity stock exchanges along with gold and oil. This is going to be the new oil of future and may become precious than gold in time to come.

How the actual value of water could be determined? The 2021 World Water Development Report focuses on this crucial issue. The assessment suggests several methods to value water across different sectors and identifies how this process can be improved, with a view to better evaluating what water is worth to our societies. It explains various approaches to valuing water for drinking purposes, sanitation and hygiene, environmental considerations, agriculture production, industrial and manufacturing, and water - related infrastructure development. It looks at valuating water on the premises of food and agriculture, business, industry, energy and economy.



Water Challenges

Fresh water is very limited on earth and with unsustainable use; it is becoming scarcer day by day. Over 2.2 billion people already live in areas facing severe water stress as the United Nations reported a while ago. The water assessment predicts that, the world will face a global water deficit of 40% by 2030. This situation may be further worsened by global challenges of climate change and pandemic resurgence.

The surface water reserves and aquifers are being drained rapidly across the globe. In many countries including India, water pollution as a result of agriculture is central to water loss and degradation. Irrigation is the largest user of water in India making up to 80% of fresh water use. The aquifers depleted by intensive groundwater pumping and fertilizer overflow from agriculture including fervent use of pesticides and waste from livestock significantly affect surface and groundwater sources.

Water for Industries

The industries developed in growing economies in a much faster rate than other segment.

The higher costs, lower earnings and substantial financial losses are related to inefficient use of water in industries.

Growing population demands more food and to cater this demand, more industries are established in this segment. The global food and beverage sector is worth an incredible $6 trillion and lies at the very heart of the water crisis, with companies in the industry reliant on vast amounts of water. As the sector demands more water, they are among the first to feel the impacts of interruptions and unpredictability of water supplies. The industry for years, have been looking for strategies and practices to reduce the impact on the environment and new ways to sustainably manage their water consumptions. With growing water shortage and manufacturing disruptions, in economic terms, water savings have a direct impact on profits, so water-saving strategies are an important pillar in management plans.

As the traditional water resources are being depleted and polluted at increasingly alarming rates, it has now become absolutely vital for food industry to review their water consumption and make necessary changes with treatment and reuse facilities effectively. Aquality Water Solutions have been advocating the efficient use of water for industries across the spectrum and have installed technologically advanced best quality water treatment plants in several industrial units across India. These fully automated plants not only reduce wastage of water optimally, but also produce ultra-pure water for better production facilities.

Case Study: Industrial Water Treatment Solutions

Client: CPA India Pvt. Ltd.
Industry: Food Industry

Background: C P Aquaculture (India) Private Limited is a subsidiary of Charoen Pokphand Foods (CPF) Public Limited Company, a Thailand based multi-national conglomerate with $35 billion businesses in Agro-Industry & Food, Retail and Telecommunications. Charoen Pokphand Group (C P Group) is one of the largest group companies of Thailand. The enterprise in its legacy of 70 years has developed and spread technology in Agro-Industrial business to provide the highest level of produce to both farmers and consumers.

In the year 1992, honoring the invitation by the then Prime Minister of India, (Late) P V Narasimha Rao; the CP Group started investing in India. CPA (C P Aquaculture) started its

The significant value of water for business is well established.

first feed mill in Chennai as C P Aquaculture (India) Private Limited with its first commercial production in 1996. With a clear vision and dedication over the years, they have expanded the business in major places in North & South India. CPF is the world's largest Shrimp Feed Producer and ranks among the Top five of the world's largest Animal Feed Producers as well. One of the largest manufacturers of poultry and fish feed globally, it operates in 17 countries and exports to over 30 countries in five continents, covering more than 3 billion people.

The Project: CPF operates integrated agro-industrial and food business, including livestock and aquaculture such as broiler, layer, duck, shrimp and fish. The businesses are categorized into 3 categories, namely Feed, Farm and Food. The Company also operates retail and foods outlets as well. In order to produce cooked and ready meal products with the aim to deliver great taste, convenience and variety of healthy foods in line with changing trends and consumer liking, they wanted to install best quality water treatment plant at their industrial unit situated at Rajahmundry, Andhra Pradesh. This plant is established with a capex of Rs.700 Crore having a monthly water consumption of 16 million litres.

Water Infratsructure: Aquality Water Solutions Pvt. Ltd. was engaged by the plant to install high capacity RO water treatment plant in line of their requirement and specification. The engineers visited the facility and studied their production units and live stock farms, analysed their capacity expansion plans of future and worked out the best possible solutions that can be enhanced for all future requirements. The company has supplied, installed, tested and commissioned the following water treatment infratsructure at the facility.



- Twin Commercial RO Plants with combined capacity of 576KLD installed. The produced water is being used for broiler feed.
- 144KLD RO Plant was installed for Super PS Plant within the facility
- 12 Softeners of 6 M^3/Hr installed at multiple locations within the facility
- A centralized drinking water plant is installed for providing safe drinking water for hundreds of employees
- 8 Point of use purification, cooling and dispensing systems are installed.

Aquality Water Solutions Pvt. Ltd. is also providing operation & maintenance of the water treatment infrastructure and all related systems and equipment since its commissioning in 2015.

Way Forward

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About the Author

A first generation entrepreneur, he is an avid innovator and risk taker. He established the acclaimed Aquality Water Solutions Pvt. Ltd. with the idea to provide technologically advance water treatment solutions for industries and institutional clients. With an ardent interest in clean drinking water facilities, he contributed immensely in improving the life of people with commitment, technological innovations and quality excellence.

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SPECIALITY SOLUTION FOR SEPARATION OF RESINOUSORGANIC MATERIAL FROM EFFLUENT GENERATED FROM EPOXY RESIN PLANT

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






Epoxy resin is a thermosetting polymer formed by copolymerization of an epoxide with another compound having two hydroxyl groups. These resins are known for their enhanced performance in numerous industrial applications like paints & coatings, adhesives, composites, and electronic encapsulation owing to superior mechano-chemical properties such as corrosion resistance, thermal stability, mechanical strength, notable toughness, resistance to chemical and moisture and superior adhesion. Globally epoxy resin market is a $7 Billion Industry growing at a rate of 7 % CAGR.

During manufacture of epoxy resin, there is in situ generation of by-product sodium chloride (Salt) which is undesired. Removal of the salt from reaction mass is very essential to achieve desired product. Large quantity of water is being consumed for washing stage for removal of salt from the resin. There issignificant quantity of free and emulsified organic/resinous material which gets carried away with high salinity water. Separation of this emulsified organic &resinous material from saline wastewater is a major challenge for smooth operation of the manufacturing process.

In the present case study, speciality approach for treatment of effluent from one of the epoxy resin manufacturing plant in India is discussed. The company manufactures two major products Liquid epoxy resin (LER) and Reactive diluent (RD). Two separate wastewater streams are generated during production of LER and RD; both the streams have high salt and organic content which contributes to significant biological oxygen demand (BOD) and chemical oxygen demand (COD) load. Both streams are taken in separate pits and treated with chemicals to remove organic impurities prior to Dissolved Air Floatation (DAF) operation. Post chemical treatment, both stream concentrated in multi-effect evaporator (MEE) and atmospheric thin film dryer (ATFD) respectively. Condensate from both MEE and ATFD is sent to biological treatment followed by filtration through Multi-grade and activated carbon filter (ACF). After passing through both filter, treated water discharged as per environment norms.

The key challenge here is efficient separation of emulsified resinous material from saline wastewater, which, the manufacturing unit was finding difficult to achieve with conventional chemicals.

Effluent Characteristics of LER and RD:

Effluent from both streams were collected and analysed for different parameters as shown below:

Table 1: Physio-chemical characteristics of LER and RD stream

Sr. No.	Parameter	LER	RD
1.	pH	10-11.5	10-13
2.	Turbidity, NTU	70-200	70-200
3.	Total dissolve solid (%)	21-25	14-20
4.	Total suspended solid (g/L)	3-6	10-20
5.	COD (g/L)	15-20	20-200
6.	BOD(g/L)	4-8	5-10
7.	Temperature(°C)	60-80	60-80

Above results clearly indicate that both effluentswere alkaline in nature and have high total dissolved and suspended solids (TSS & TDS), BOD & COD.

Challenge:

Resinous material/organic impurities were leading to scale formation in multi-effect evaporator (MEE) and atmospheric thin film dryer (ATFD).

This was mainly due to inefficient separation of emulsified components from the saline water by conventional chemicals.

Grasim Dual chemical system:
Based on the above inputs a novel formulation containing a combination of coagulant and de-emulsifier called Vytal 3310 is introduced.

A number of laboratory trial were taken with Vytal 3310 followed by Vytal 971 proved to be a good combination for efficient separation of resinous material from high salinity effluent as shown below:

Table 2: Jar test results for treatment of effluent from reactive diluent (RD) plant

Sr. No.	Coagulant	Dose of Coagulant (ppm)	Dose of Flocculent (ppm) - Vytal-971	pH	Turbidity (NTU)	Remarks
Day 1	(Control)	-	-	11.0	78	
	Vytal-3310	400	6	6.0	4.5	Dense floc
Day 2	(Control)	-	-	11.5	70	
	Vytal-3310	500	6	5.9	3.2	Dense floc
Day 3	(Control)	-	-	11.8	76	
	Vytal-3310	500	6	5.9	3.5	Dense floc

Table 3: Jar test results for treatment of effluent from Liquid epoxy resin (LER) plant

Sr. No.	Coagulant	Dose of Coagulant (ppm)	Dose of Flocculent (ppm) - Vytal-971	pH	Turbidity	Remarks
Day-1	(Control)	-	-	10.2	67	
	Vytal-3310	250	7	6.4	2.0	Dense floc
Day-2	(Control)	-	-	10	81	
	Vytal-3310	225	7	6.9	1.9	Dense floc
Day-3	(Control)	-	-	10	71	
	Vytal-3310	250	8	6.92	1.8	Dense floc

The results from Table 2 & 3 clearly indicate more 90% turbidity reduction was achieved with Vytal 3310 followed by Vytal 971.

Plant Scale Implementation:

Based on the successful lab trial, the developed system was evaluated for plant trial. The Effluents from both (RD and LER) streams were collected separately, neutralized to pH 6-7. The dosage of Vytal 3310 and Vytal 971 added 450 ppm and 6 ppm respectively for RD's effluent before flash mixer. Similarly, 250 ppm and 8 ppm of Vytal 3310 and Vytal 971 were added in LER's effluent prior to flash mixer as shown in Fig.1 and sent to dissolved air floatation tank. Turbidity of treated effluent was measured after diffuses air floatation (DAF).

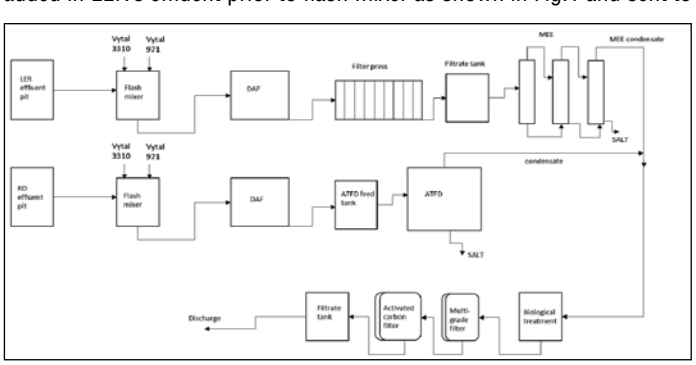
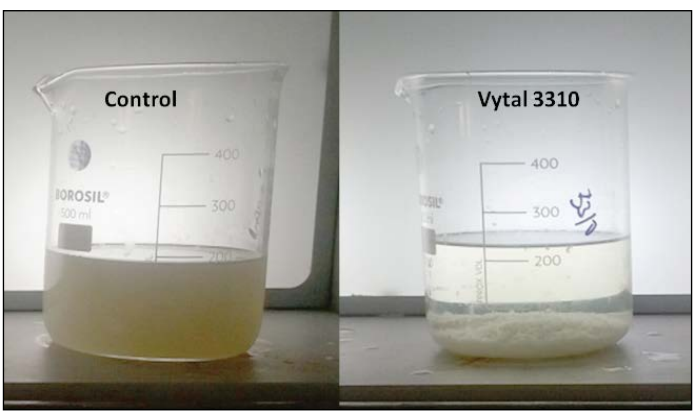


Fig.1: Effluent treatment scheme for Epoxy plant

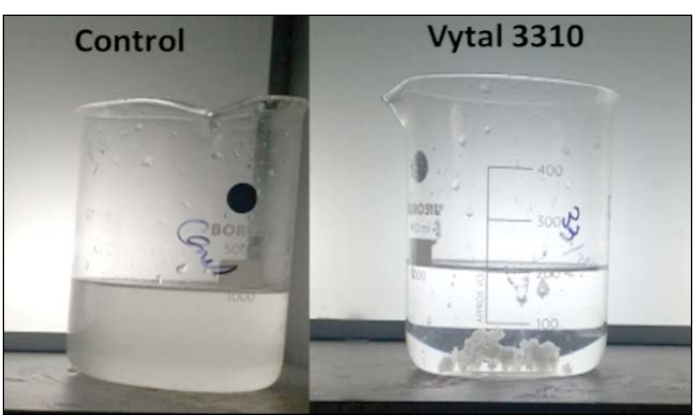
Results:

Identified primary treatment resulted in large floc formation in DiffusedAir Flotation (DAF) system. Excellent clarification of wastewater was achieved.

VYTAL 3310 successfully de-emulsified the organic/resinous material. Turbidity of individual effluent after DAFwas reduced to less than 5 (from 100) NTU shown in Fig. 2 & 3.

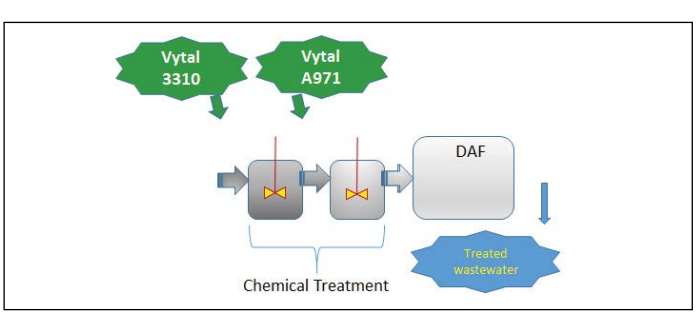


(RD)



(LER)

Fig.2: RD and LER pre and post treatment



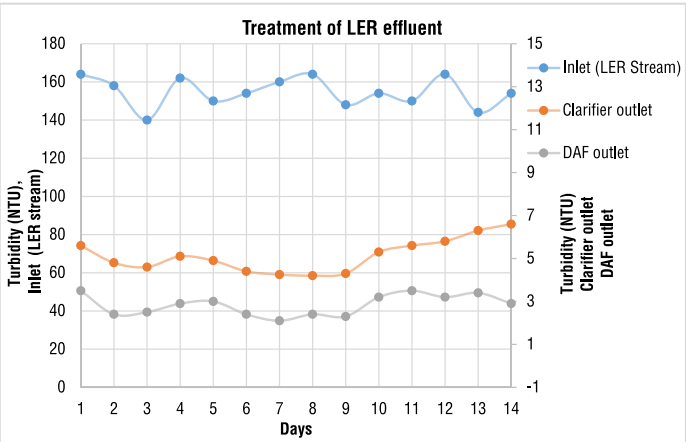


Fig. 3 Treatment of LER effluent

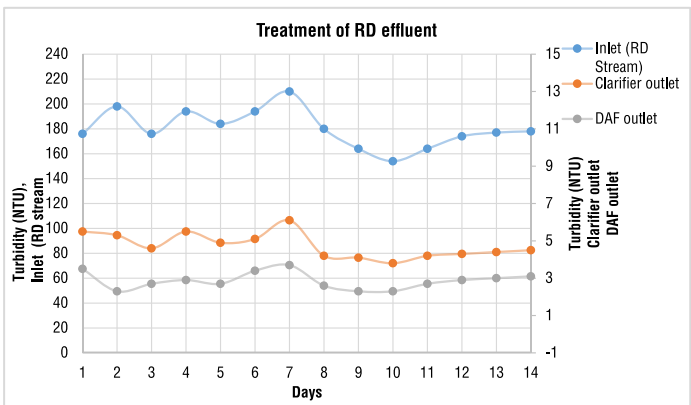


Fig. 4 Treatment of RD effluent

Conclusion:

Grasim dual chemical system comprising of Vytal 3310 and 971 was tested for de-emulsificationof resinous/organic material from effluent.

The key achievements were:

1. More than 90% turbidity reduction was achieved.
2. Smooth operation of MEE and overall ETP
3. Salt quality improved to a level of 99.8% purity from earlier < 95 %.
4. Low dose of Vytal 3310 and 971 saved ~ INR 7 million per annum in chemical costs.

About the Author

Dr. Hiten Mehta holds Master of Science in Organic chemistry and Ph.D. in Chemistry. He has 17 years of experience in industrial research. His expertise includes process development, Intellectual properties, regulatory guidelines for various regions of API, specialty chemical, personal care actives, Aluminium chemistry and applications focused product development. 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.

Dr. Sanjeev Gupta holds Master of Science in Applied Chemistry and Ph.D. in Chemistry. He has 18 years of experience in industrial research. His expertise includes water & wastewater treatment, hybrid bio-chemical treatment, environmental management, Chemical recovery, New product development etc. Dr. Gupta was awarded Mecaster Young Scientist Award for the year 2011. He has published more than 35 research papers in national and international journals and presented papers at International conferences at Canada and Chile. He has more than 25 research and consultancy reports to his credit.

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.

Mr. Amit Kumar holds Master degree in Chemical Engineering from IIT Roorkee. He is having 7 years experience in speciality chemical for water treatment and oil & gas industries. He is presently leading Industrial, new product and application development at Grasim Industries Limited.

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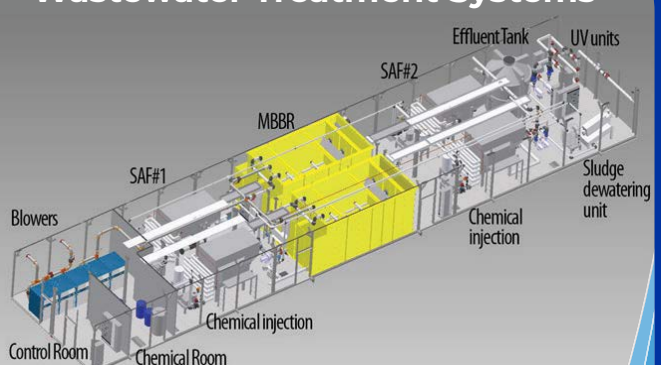
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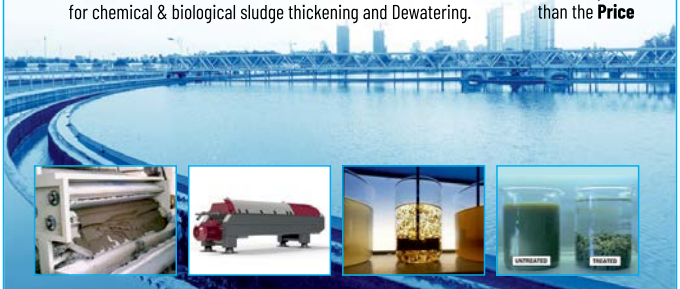
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IRRIGATION OF LEAFY FRUIT AND VEGETABLE CROPS BY UNTREATED OR PARTIALLY TREATED WASTEWATER "A SHORT NOTE"

By Dr. Anil Kumar Mishra, (Bacteriologist), Delhi Jal Board, Govt. of NCT Delhi



Due to the urbanization and industrialization, quality and quantity of fresh water has been reducing drastically in India as well as in other countries. Number of farmers using sewage water (untreated/partially treated) for irrigation of herbaceous vegetables, fruits, and other crops and these practices are drastically increasing day by day due to scarcity of water, urbanization and its economic and agronomic importance. This water is easily available in metropolitan cities and has sufficient amount of Macronutrients (Ca, N, P, Mg, k etc.) and Micronutrients (Cu, Zn, Mo etc) which are required for the proper growth of the plants but on the other side this sewage water also contains pesticides, heavy metals (Hg, Pb, As etc), Bacteria, viruses, spores, and other microorganisms, organic and inorganic pollutants which are very harmful for human, plants and other animals; as through plants food chain, these pathogens and organic/ inorganic contaminants reaching in our metabolic pathways and its concentration increasing day by day in our body or in other plants and animals due to biomagnifications of pesticides and other toxic metals. The cultivation of leafy vegetables using sewage water is a common practice in Delhi, NCR and other part of country and worldwide and we are eating these fruits and vegetables with or without cooking ,

Due to lack of sufficient quantity of fresh water, day by day increasing population and the deterioration of surface as well as ground water quality, not getting good quality of water for irrigation purpose is a big challenge all over the world. In addition to various climatic factors, irregular and insufficient rain, lacking of water reservoirs like ponds, lakes etc. for storage of rain water also playing pivotal role to encourage farmers to use treated/ partially treated/ untreated sewage as an alternative water resource for irrigation of crops in national and international level. Properly treated sewage (as per guidelines of WHO, CPCB and other national and international standards) is ideal for irrigation of fruit, vegetables and other agricultural crops and is already being widely using worldwide. But if farmers use untreated/partially treated sewage for irrigation of fruits and vegetables crops, such crops may affect our metabolic pathways and ultimately causes different types of acute and chronic diseases as untreated sewage contains many pesticides, heavy metals, bacteria, viruses, protozoans, nematodes and theirs cysts/spores etc. beyond the permissible/ tolerable limits, which gets removed during treatment process of sewage water and after proper treatment the water may be used for irrigation purpose without any major side effects.

Composition of sewage/waste water

- Water
- Organic contaminants
- Inorganic contaminants
- Pesticides (Aldrin, DDT, BHC, Atrazine etc.)
- Heavy Metals (lead, cadmium, mercury etc.)
- Pathogenic bacteria, viruses, fungi, algae, protozoan's, nematodes & their spores etc)
- Poisonous gases (H2S, CH4, CO2 etc.)

Problems due to long term use of swage treated fruits and vegetables:

1. Although this water is boon for farmers in Delhi due to higher concentration of nutritional value but in other side these vegetable are very harmful for their metabolic system and if few consumers know about side effects of these vegetables but they are helpless due to unavailability of other vegetables irrigated by fresh or properly treated water or due to some other unavoidable reasons.
2. These vegetables affect our metabolic system like nervous system, digestive system, circulatory system, endocrine system, skeleton system, muscular system etc. due to presence of toxic/ heavy metals in untreated / partially treated sewage; resulting different

1. type of acute and chronic aberration developing in human, plants and other animals.
2. Due to excess quantity of heavy metals or other organic and inorganic contaminants Growth retardation, kidney stone, cancer, joints pain, Immunological and hormonal disorders etc. observed in human being, plants and other animals.
3. Psycho-social behavior abnormality also observed in society.
4. Due to presence of different type of pathogenic microorganisms like bacteria, viruses, nematodes, protozoan's etc. in sewage causes Diarrhea, Salmonelosis, Shigellosis, cholera etc.
5. This sewage water also affects the health of the farmers who are working in these fields due to presences of microbes, nematodes spores and other toxic metals.
6. Due to lack of aeration in sewage (due to logging of soil pores) sewage produces Hydrogen-Sulphide (H2S), Methane (CH4), CO2 etc. gases which creates unhygienic environment.

Solutions/Precautions to be taken for mitigation of effects of above crops on metabolism:



1. Always use these leafy vegetables after proper washing with chlorinated water to avoid any types of microbial contamination.
2. Always preference may be given to eat these vegetables in cooked or semi cooked (steamed) conditions.
3. Adopt practicing of kitchen gardening in roofs or other small places like balcony, terrace, stairs in pots, hydroponics, green house, or other advanced and sophisticated modern techniques to grow vegetables in very minimum space and for irrigation of these vegetables, waste water of kitchen and sink may be used after collection in a tank.
4. To avoid all the above mentioned problems sewage water (grey and black sewage) must be treated as per central pollution control board (CPCB) norms-2016 or other International Standards before using this sewage water for irrigation of vegetables and other fruit crops (especially leafy and herbaceous crops).This practice will improve the health, wealth and sanitation of consumers of Delhi as well as environment and help to attain the goal of healthy, wealthy long life.

About the Author

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

He is the recipient of Best Employee Award for the year 2019-2020 for Delhi Jal Board by Chief Minister of Delhi.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at:
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WATER PRODUCTIVITY ASSESSMENT OF VARIOUS MAJOR FODDER PRODUCTION SYSTEMS OF INDIA USING IRRIGATION WATER METER

By Mridusmita Debnath, Scientist, Land and Water Management Division, ICAR-Research Complex for Eastern Region Patna



Urbanization and economic growth in India has led to change in food habit from vegetarian to non-vegetarian food. Livestock production requires a significant amount of water for the production of animal feeds and fodder crops. The declining water resources of the country have made irrigation water meter implementation more popular for measuring irrigation water. Fodders mainly grown in India includes: Maize, Oats, coix, NB hybrid, Guinea grass, leguminous berseem, cowpea. Water productivity of fodder crops varied from 3 to 32 kg/m^3. Water Productivity across feed and fodder classes and within a feed is highly variable. Feeding recommendations should be made according to water available in the region. Changing life style and its related day-to-day activities has major impact on environment. Along with change in daily activities, production and consumption patterns of food habit are changing profoundly due to rise in urbanization, economic status, and population. Developing countries is experiencing rapid growth in the consumption and production of non-vegetarian food with income growth.

For India about 60% of population consumes non-vegetarian diet. From the recent report published by National Council of Applied Economic Research (NCAER), New Delhi, there is gradual decline of 14%, 7% and 2% in the per capita rice, wheat and pulses consumption in urban households. On the other hand, there is a 28% and 25% increase in milk consumption in the same survey period so is the poultry meat consumption with an increase about 816% in urban households. Per capita consumption of eggs increased 2 times in urban during the same period. This inflation will thrust an increase in more fodder crops per unit of cultivated land to supply feed for animals as only 4.4% of the total cultivated land is under fodder crops (Mathukia et al. 2006). At the same time it is projected that by the year 2025 water

Table 1: States producing various fodder crops and their yield

Types of forages	Fodder crops	States	Green Fodder yield (t/ha)
Cereal Forages	Maize	Andhra Pradesh, Karnataka, Rajasthan, Uttar Pradesh and Bihar	65
	Oats	Punjab, Haryana, Madhya Pradesh, Uttar Pradesh, Jharkhand, West Bengal, Orissa and Assam plains	50
	Coix	Gujarat, Assam, Orissa, Jharkhand, West Bengal, and Bihar	35
Graminacious Forages	NB hybrid	Jammu & Kasmir, Himachal Pradesh, Punjab, Haryana, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Bihar, Orissa, West Bengal, Assam	288
	Guinea grass	All states of India	90
Leguminous Forages	Berseem	North East India, Bihar, Orissa, WB and Eastern Uttar Pradesh, Madhya Pradesh, Punjab and Haryana	53
	Alfalfa	West Bengal, Gujarat, Tamil Nadu, Maharashtra, Punjab	95
	Cowpea	Jammu & Kasmir, Himachal Pradesh, Punjab, Haryana, Uttarakhand, West Bengal, Orissa, Assam	32
	Rice bean	Madhya Pradesh, Himachal Pradesh, Uttarakhand, West Bengal, Orissa, Chattisgarh, Assam	37

availability per capita would lessen to 30% of the water available at independence. Increasing water use efficiency of the various fodder crops is of utmost importance. Opportunities for quality food and productive use of water and other nourishing resources are needed for policy and development actions. Based on the current trends, there will be a need to harness the water resource potential through better understanding, quantifying and assessing water use and its productivity in different food production systems.

Water used in the livestock production is consumed to produce feed such as fodder crops, cleaning, cooling, and drinking livestock. However limited water and land resources to farmers urge the farmers to produce only food crops rather than fodder crops. For example, the eastern region of India has vast resources of livestock and poultry, mostly of indigenous type, which play a vital role in improving the socio-economic conditions of the rural masses. The region has high density of cattle population, 22.67 per 100 human against the national average of 19.25 (Anon, 2003). Thus there is an acute shortage of green fodder prevails in the eastern part of India that varies from 82 to 89%. Moreover, majority of farmers were not produced fodder due to small land holding, hence, most of them collected fodder from nearby community land. Also a mixed crop-livestock systems are more prevalent which requires large amount of fodder. Fodders are of three types: Cereal forages, graminacious forages and leguminous forages. Fodders mainly grown in India includes: Maize, Oats, coix, NB hybrid, Guinea grass, leguminous berseem, cowpea (Table 1)

Estimation of crop water requirement is important in determining crop water use for efficient water management as shown in Table. The efficiency of water used by the crop can then be expressed as water productivity (WP):

$$WP = \frac{Yield(\frac{kg}{ha})}{Water\ requirement(\frac{m^3}{ha})}$$

Yield mainly implies the green fodder yield. The use of irrigation water meters are used for measuring the amount of water diverted for irrigation in the field. It ensures farmers so that they can measure water diverted to the crop field and effectively manage the water available (Fig. 1). WP indicators express the benefit derived from water consumption and can be used to assess the impact of on-farm strategies under water-scarce conditions. They provide a good vision of where and when water could be saved. WP indicators are also helpful for looking at the potential increase in crop yield that may result from increased water availability (Singh et al., 2006). Water productivity as shown in Fig 2. varies from 3 kg/m^3 to 32 kg/m^3. Animal feeds are of three types: green fodder including pasture grasses, hays, silage, root crops, protein feeds that are high-protein oil meals or cakes and by-products and energy feeds that are rich in energy value, including fat, cereal grains and their by-products (Table 2).



Fig 1: Irrigation flow meter installed in fodder field

Table 2: Crop water requirement of fodder crops (Source: Panday and Roy, 2011; Brouwer and Heibloem, 1986)

Green fodder	Water (m^3)	Protein feeds	Water (m^3)	Energy feeds	Water (m^3)
Berseem	2000	Groundnut	6000	Wheat grain	5500
Lucrene	4000	Soyabean	5750	Maize grain	6500
Oat	5500	Mustard	2500	Barley grain	5500
Sorghum	5500	Linseed	2000	Oat	5500
Cowpea	4250	Ricebean	12500		
Alfalfa	12000				
Coix	9000				
NB Hybrid	12000				
Guinea grass	12000				

In the case of fodder the water productivity is calculated not only for yield but also for metabolisable energy (ME) and protein yield which is available to the animal for maintenance and productive purposes such as milk and meat (Blummel et al. 2009). For the production of one mega joule of ME from alfalfa required 0.013 m^3 of irrigation-derived water in south Gujarat but 0.050m^3 of irrigation-derived water in north Gujarat. Wheat straw in south Gujarat required 0.020 m^3 of irrigation-derived water for 1 MJ ME and was in this instance less water use efficient than alfalfa. Water productivity for forage (15.25), DM (2.10) and protein (0.35) yield (kg/m^3 water) was recorded in berseem crop. Protein yield per m^3 water for berseem is highest than maize and oats in summer while in winter season cow pea has the higher protein yield than multi cut sorghum (Gupta, 2020)

The method of irrigation also plays an important role in the amount of water used to produce fodder crops. Bed-furrow irrigation reduced water requirement by 19.78 and 21.14%, comparable with traditional farmers' traditional irrigation practice, respectively. Thus, the bed-furrow irrigation scheme resulted in higher water productivity values on total fresh and dry berseem clover yields. Timing of water application influences yield and hence the water productivity. The farming community is thus recommended to apply irrigation, to maize

fodder crop, with 7 day frequency in order to get maximum fodder yield. The Zero Tillage system increased millet yields and its WP with farm yard manure and without inorganic fertilizer.

Conclusion:

Forage crops can be an important tool for producers, provided the right crop is selected careful management is required to ensure that the crop is fully utilized in its most productive and nutritious phases of growth. There appears to be a tremendous potential for its cultivation as Forage crops provide the bedrock to sustainable agriculture enhancing crop diversity, wildlife habitat, and soil ecosystem services. Further, water use efficiency across feed and fodder classes (for example crop residue v. planted forages) and within a feed is highly variable. Feeding recommendations should be made according to water available in the region.

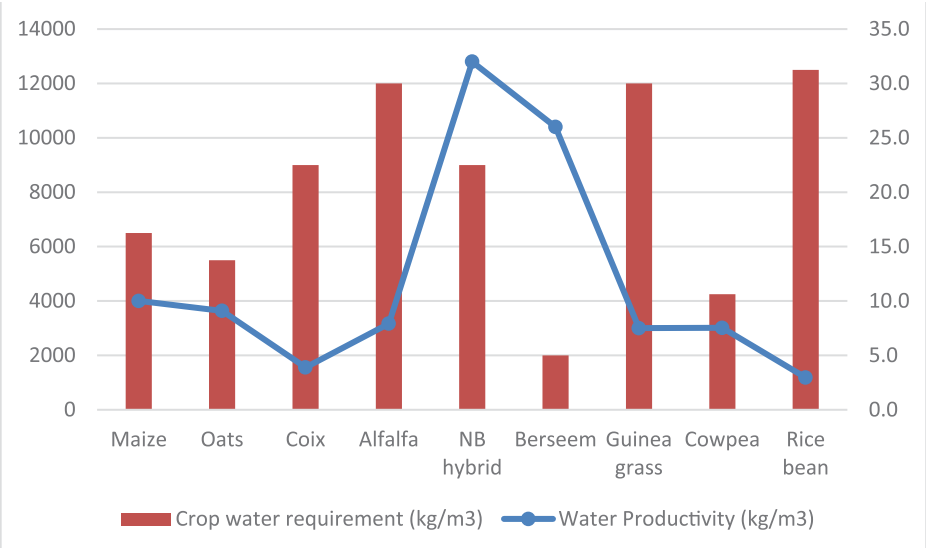


Fig 2: Water productivity and crop water requirement of major fodder crops grown in India

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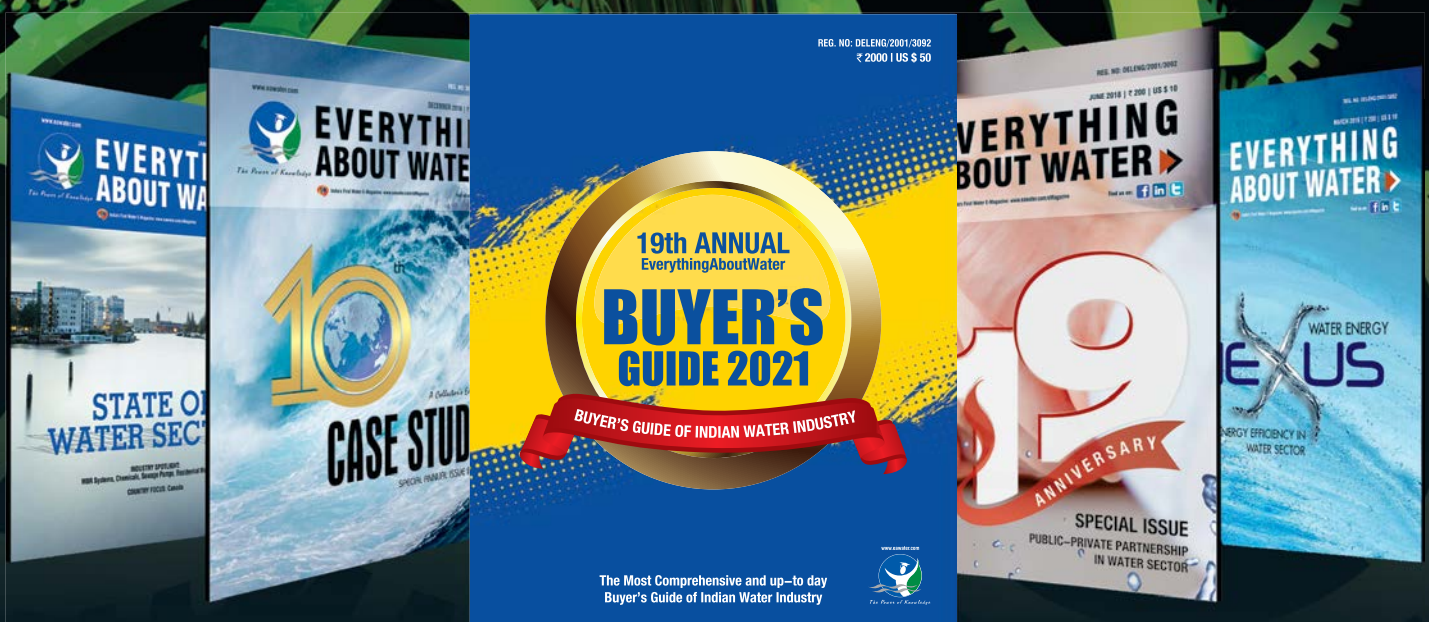
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AMELIORATION: PE PIPES APPLICATION IN PLACE OF MS, CONCRETE & PVC

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



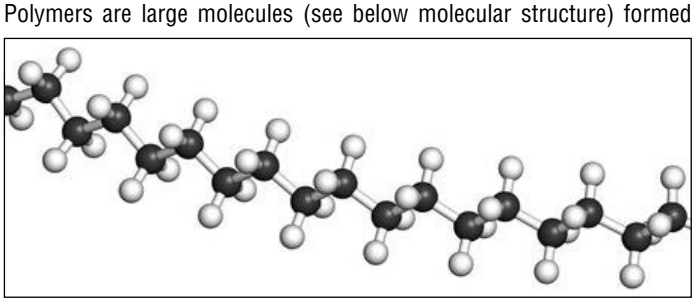


Introduction

(PE) Polyethylene compound was first developed in 1933 as a flexible, low density coating and insulating material for electrical cables. It played a key role during World War II - first as an underwater cable coating and then as a critical insulating material for such vital military applications as radar insulation. Since its discovery, PE has grown to become one of the world's most widely used and recognized thermoplastic materials because of high level of permeability, stronger molecular bonds & compatible engineering properties and is most suitable to replace ageing Concrete or PVC or MS piping system. Being a flexible (not rigid), it is used & popular to transfer the water, oil, chemicals, gas and various applications such as city & rural water supply, Sewer as well as duct for optic fibre cable, electrical cable, fire system, storm water, drainage system in the globe.

PE materials

Polymers are large molecules (see below molecular structure) formed by the polymerization of repeating small molecular units. To produce PE, the starting unit is ethylene, a colourless gas composed of two bounded carbon atoms and four hydrogen atom.



Raw materials of PE grades available as PE63, PE80 & PE100. The raw material is manufactured in form of granules and the first generation grades of PE63 & PE80 raw materials were manufactured by UNIMODEL method. Subsequently PE100 grade was introduced with BIMODEL method of manufacturing, the PE80 grade also was included in BIMODEL method. This BIMODEL method of manufacturing the PE granules both in PE80 and PE100 grades, improved not only the minimum required strength but also the pipe performance by increasing Notch Resistance as well as Resistance to Crack propagation. The increase in MRS also reduced the wall thickness for a given pressure class thereby increasing the internal diameter resulting in better fluid flow with reduced cost of pipe.

Engineering Properties

Property	Value	Unit
Density	940 - 965	Kg/m^3
Melt flow index (190^{0}C)	0.2 - 1.1	9/10 minutes
Crystalline melting Range	130-133	^{0}C
Viscosity Number	390	cm^3/g
Hardness	56-65	Shore 'D'
Tensile Strength at yield	20-26	Mpa
Ultimate Tensile Strength	30	MPa
Elongation at break	> 600	%
Elastic modulus	800 - 1200	MPa
Flexure Stress	13.8 – 20.3	Mpa
Carbon black content	2 - 3	%

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

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

advantages are listed as under.

1. Longevity
PE pipes have the long track record of excellent performance, approaching to 100 years.

2. Corrosion Resistance
PE is basically chemically inert. It does not rust and corrode as like metal pipes.

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

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

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

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

7. Resistance to geological conditions
PE system have inherent resistance to ground temperature fluctuations and earth instability because of high impact and breakage resistance.

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

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

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

FAQs – Frequently Asked Questions about PE pipes.

- **What HDPE stands for?**

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

- **What are the different applications of Pipes?**

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

- **Is HDPE piping system a green solution for piping?**

Manufacturing process& installation process of PE pipes are environment friendly and do not emit CO2 .

- **How are the HDPE Pipes jointed to uPVC, MS, DI or CI pipes?**

Method of jointing HDPE pipes to uPVC, MS, DI, CI pipes vary with the size and ends of pipes. Common method is 'flanged joints' more preferred which has equivalent strength of pipe materials.

- **Does HDPE Pipe require cathodic protection?**

Basically PE materials is bad conductor of electricity. That's why it is used as insulation to electrical cable and devices. HDPE pipes does not undergo for galvanic corrosion so there no need to provide cathodic protections.

- **What is meaning of SDR?**

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

- **Is it possible to do but weld for different SDR pipes together?**

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

- **What are effects of thermal expansion or contraction to HDPE pipes?**

Basically temperature effects are of no concern to buried HDPE pipes of water or sewer. The soil cover around the pipe provide restrain cushion for the movement of pipe. However, thermal effects must be considered when applications are above ground.

- **How HDPE pipes are located in ground?**

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

- **Is PE pipe affected by exposure to UV light?**

PE80 & PE100 materials are normally compounded with uniformly dispersed special additives including UV Stabilizers which protects the pipe

from degradation caused exposure to UV radiation.

- **In what lengths HDPE pipes are available?**

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

- **What are the relevance of PE63, PE80 & PE100?**

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

Grade of PE	MRS (MPa)
PE 63	6.3
PE 80	8.0
PE 100	10.0

Various application & substitution of HDPE Pipes.

1. Irrigation & Agriculture
   - Replacement of Open canal to HDPE pipe.
   - Lift Irrigation.
   - Distribution network.
   - Drip (Micro) Irrigation System.
   - Sprinkler Irrigation System.
   - Water Transport pipe at Cold Climate (Himalaya).

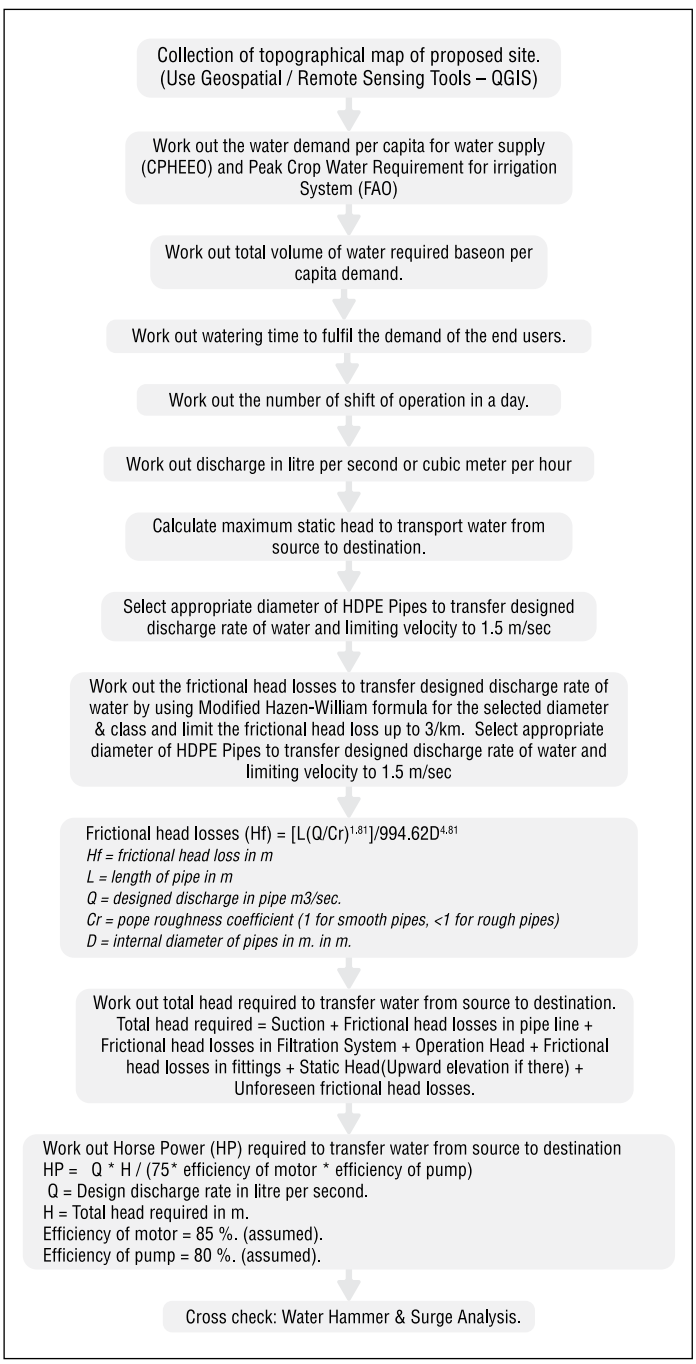
2. Water Supply
   - Drinking water pipeline.
   - Pumping main and gravity main.
   - Waste water Treatment plants.
   - Infiltration gallery.
   - Bore well pipes.

3. Sewerage & Waste Water
   - Pumping main for sewerage.
   - Gravity conveyance for sewer.
   - Rehabilitation of Sewer lines.
   - Untreated and Treated effluent.

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

- **Design Algorithm - HDPE pipes for water supply / irrigation purpose?**

Following design algorithm for use of HDPE pipes for water supply / irrigation purpose is provided as a guideline for the design engineer. However, design algorithm of HDPE piping system is the skill of individual design engineer as per the need of the project.



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

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

7. Ports and Highways
   - Stay cable pipes for cable stayed bridge.
   - Culverts and storm water drains.

8. Power Generation
   - Thermal and nuclear power station.
   - Hydel power plants.
   - Fly-Ash Slurry and others.

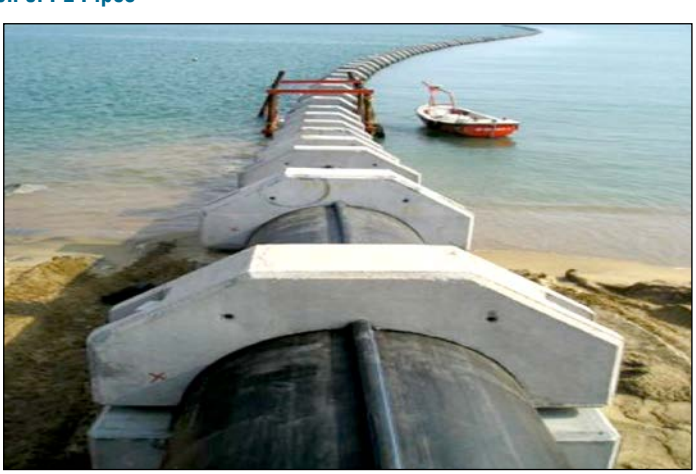
Comparison: HDPE pipes and other pipes.

Description	HDPE Pipes	PVC Pipes	Concrete Pipes	MS/DI Pipes
Pipe Density	0.95	1.2	2.4	7.89
Pipe weight	Light weight	1.5 times than HDPE Pipes	@ 2.4 times than HDPE Pipes.	@ 7 times more than HDPE Pipes
Transportability	Easy to transport in any length or coil.	Easy to transport but length is straight	Limited length to transport	Max length 12 m
Flexibility	Can be bend in radius equal to 25-40 times of dia.	Cannot bend & Not recommended to bend	Not possible	Not possible
Hazen Williams 'C' factor	C = 150	C = 150	C = less than 100	C = 100
Chemical resistance	High resistant to acid & base	Not resistant to few chemicals	Non resistance	Non Resistance
Jointing method	Butt welding, Flange joints, Compression fittings	Rubber ring or solvent jointed.	Rubber jointing or cement putty jointing	Rubber jointed or welding.
Service lift	50 + years	Up to 50 years	Upto 20 years	Upto 30 years
Seismic Resistance	Yes	No	No	No
Surge Pressure	Can sustain to surge pressure	Cannot sustain to surge pressure	Cannot sustain to surge pressure	Cannot sustain to surge pressure
Performance in sandy or loose soil strata	Pipes/Joints remain in position irrespective of settlement in sandy Loose soil.	Cannot remain in position & joints get displaced because settlement in sandy/loose soil.	Cannot remain in position & joints get displaced Because settlement in sandy/loose soil.	Cannot remain in position & joints get displaced because settlement in sandy/loose soil.

Actual Application of PE Pipes



PE pipes resist water freezing sub-zero temperature 14000 ft altitude. Himalayas region



PE Pipes installation in sea desalination plant at Chennai Municipal corporation



Installation large diameter pipe



PE pipe used for irrigation/agriculture

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.

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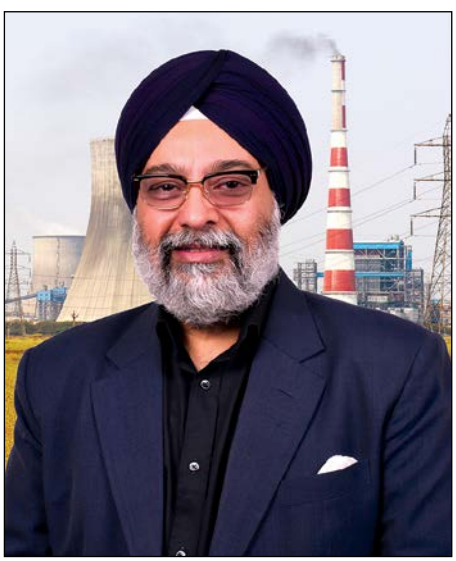


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AIR CONDITIONING USING GREEN 'HYDROGEN' AS ENERGY SOURCE FOR SMART CITIES

By Dr. Jagjit Singh Sehra, President, CST Associates



As we excel in the era of technology our demand for clean living conditions is becoming our priority. When modern societies are being built expectations by customers are going high day by day. Clean & comfortable environment, 100% uninterrupted power supplies, world-class security systems, and such facility is the demand of the young generation.

There are many societies across India that offers these kinds of facilities where the resident societies are like mini-cities. These societies have their own gym, swimming pool, restaurants, coffee shops, theater, business centers & shopping for daily need things. The large population is migrating to such places. Result of this stiff competition in between the builders to provide smart solutions to all the needs.

To run above all the facility great power and water is required. In recent times, many builders have tried to match the energy standards. Lots have been done in the past and lots need to be done. If we need to further improve our life better, there is something more to be done.

Present Problem in Today's Buildings

To make life comfortable first of all be except conditioned air that suits our body. In winter we need heating & in summer we need cold air. Also, this conditioned air has to be free from bacteria and fine dust. With the recent situation of Covid, the situation has become more worst. The quality of air needs to be treated well, fresh & clean air has a direct effect on our heart and brain. Our brain's main requirement is fresh air, if we have fresh air we have positive thinking. A positive thinking population is good for the country and also for the world.

In the present building, builders use maximum space and ignore many important issues like adding fresh & healthy air to the apartments. The same situation is with the water. Although many builders have tried to utilize maximum water conservation, many ideas are yet to be implemented.

Following is the thought process based on the study at different sites.

Producing Green Hydrogen for Running Air Conditioners.

First, let us understand the concept of Green Hydrogen. To produce Hydrogen gas we need a device called HHO Generator. There are three very parts of the HHO generator, first is pure water, catalysis, and fuel cell. Once the water is filled in the HHO generator & electricity is passed water gets split into hydrogen and oxygen. The catalysis is sodium hydro oxide in most cases. Since water contains two atoms of hydrogen and one atom of oxygen therefore hydrogen generation is two times more than oxygen. If we talk about the quantity a fuel cell using 9 KW of electricity can produce as good as 3000 Kg of hydrogen & 1500



Kg of Oxygen per hour.

When the electricity is generated from the solar cell it is called green hydrogen as no external electricity is used. Some people have reservations about using hydrogen gas, as they believe that hydrogen is very dangerous to use. It is off-course dangerous as a blast can occur once is it catches fire, similar to any other gas. But if it is produced and used immediately then the blast factor is also eliminated.

Coming back to our topic of running an air conditioning system from hydrogen. The gas produced from the HHO generator fires a burner. This open burner heats the water in a tank to 95 Deg. C. Further, this 95 Deg. C of water is used to run the Vapour Absortion machine (VAM). These machines typically use the waste heat to boil the Lithium Bromide water solution. These machines produce chilled water at 7 Deg. C in turn. This chilled water is further fed into the fan coil & air handling units. Which produces cold air to cool the ambient air. The further benefit of using the water system is that in the winter we can directly use the hot water to heat the air. So there are dual benefits of the system.

Another important factor is the cooling tower. We can use the building sewage water to treat it to a level where this water can be used in the cooling tower. Which will save a great amount of water too. We can also use this water in HHO to produce hydrogen.

If we study the above example of 3000 Kg/hr gas can run boiler that would produce thermal energy of 375 KW. This energy is sufficient to run a VAM of 100 Tr (341 KW). This concept can be easily be understood from Figure I.

So smart buildings in the smart cities will not use any external heat to the ambient as conventional air conditioning is doing it. This is a typical example of green energy.

Some of the benefits are listed below:-

1. Green Hydrogen, means no electricity is used that is generated using fossil fuels.
2. Li-ion batteries are used in the system to store the electricity to run the system 24 X 7.
3. Simple system using least components.
4. The system can also be used with the adiabatic cooling towers.
5. True example of water and solar as sources of energy.
6. Simple and very safe way of using producing air conditioning.

Further, this kind of system can also be used in the following industries

1. Food processing industries.
2. Can do the Dehumidification of the process air.
3. Plastic processing Industries.
4. This is a complete solution for replacing the electric chillers.

This is a very new concept in the world. As we excel there will be further improvements in the technology. If anyone wants more details on the subject you can contact the author anytime.

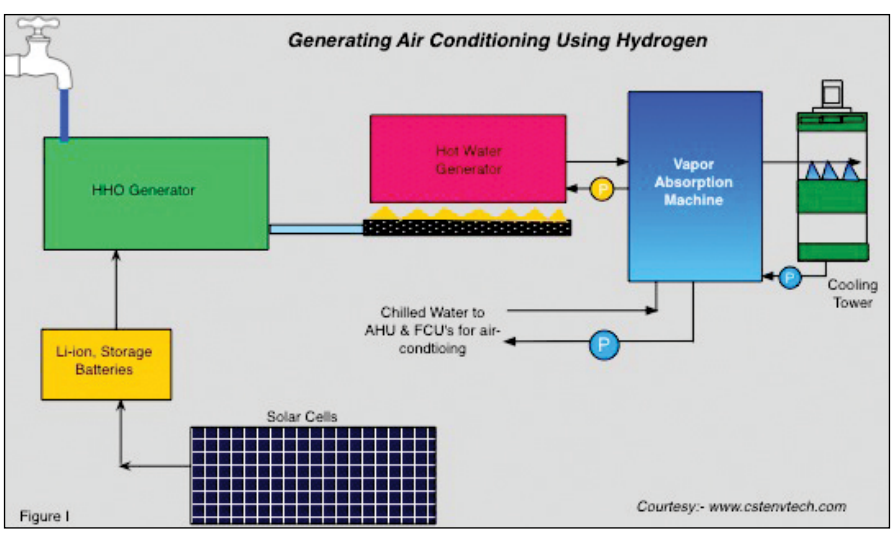


Figure I

About the Author

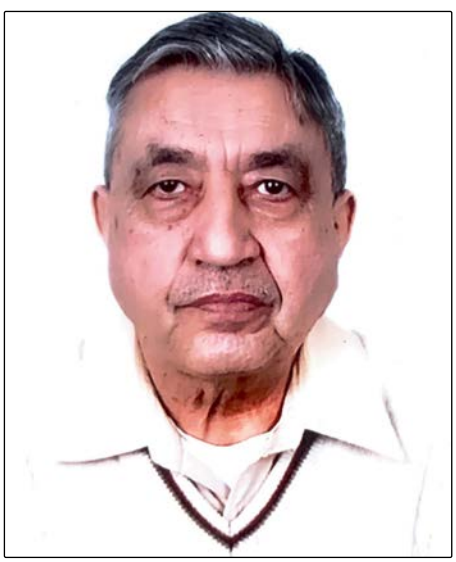
Dr. Jagjit Singh Sehra, is a science graduate and PDBA from 1980's. Last year he was honored with doctorate degree in the field of Water and Energy. He has served many companies involved in designing and manufacturing related equipment. This is for both domestic and international. He has vast experience of thirtyseven years in field of thermal energy. He is known face in the industry and works very close with many companies like NTPC, BHEL, Maruti - Suzuki, CAT, Perkins, Camfil Farr, MAN Diesel, PDO Oman, Cummins, just to name few.

Dr. Jagjit Singh Sehra's life was moved by two personalities, one Sikh's first Guru Nanak Dev Ji & Other Dr. Abdul Kalam, ex-President of India. Guru Nanak Dev Ji wrote a shalok in Japji Sahib 'Pawan Guru, Pani Pita, Matta Darat Mahat', which means Air is teacher and water is a father and they both are nurturing mother earth. Till mankind takes care of these resources nothing will happen on earth.

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EXPLORING PANJAL TRAPS BY DTH DRILLING TECHNIQUE WITH ODEX ATTACHMENT WITH QUANTUM OF DISCHARGE "A CASE STUDY"

By S.K. Juneja, Ex Scientist D & Head of Office, Central Ground Water Board, Delhi



Traps are highly fractured & constitute highly productive aquifers of good quality, yielding as much as 2640 lpm of water. More it is important to mention that Iron content, which is normally very high in the valley, is very low in these wells.

Present paper deals with the results of EW in hard rocks of Panjal Traps, surrounding the Valley in Srinagar District. The result of the exploration shows that Panjal Traps are highly fractured & constitute highly productive aquifers yielding as much as 2640 lpm of water with good quality drinking water.

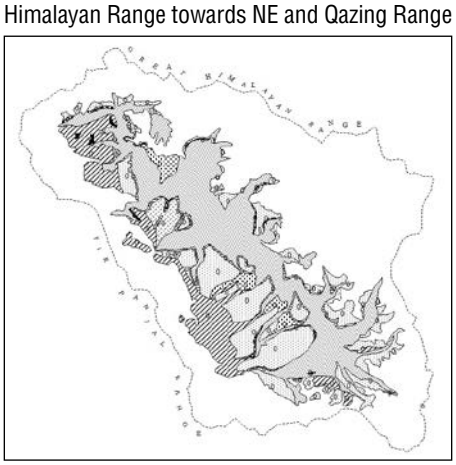
Key words: Karewas, Andesitic flow, Panjal Traps, DTH Method without Odex, EW, Discharge, lpm

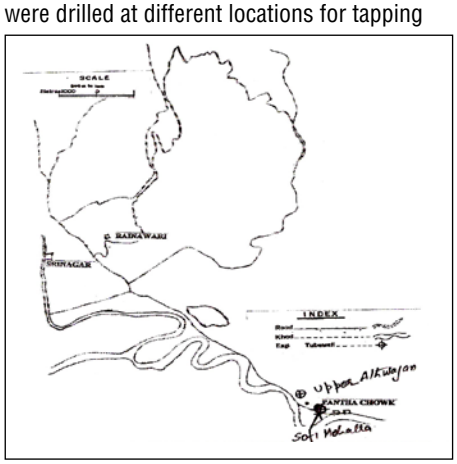
INTRODUCTION

Water is the most important commodity for sustenance of life. The surface water schemes may take time to be implemented. In this regard, the ground water has its unique place due to its fast exploitation. To harness the ground water, it is most important to assess quantum as well as quality of ground water in an area. In the Kashmir Valley ground water exploration by the Central Ground Water Board was confined mainly to the soft rock formations comprising of Karewas. However PHE departments have drilled number of boreholes for the installation of hand pumps in the hard rocks surrounding the Kashmir Valley. It was for the first time in the year 2008 Central Ground Water Board constructed four exploratory wells in the Panjal Traps comprising of andesitic flows in the Srinagar district. It was for the first time in the Kashmir region two of these four wells were drilled by direct DTH method without using the Odex system. The result of the exploration shows that Panjal

Study Area

Kashmir Valley (Jhelum Basin), one of the many NW-SE oriented depressions of regional dimensions of Himalayan mountain system, is an intermountain valley bounded by Pir Panjal range toward SW, Saribal Range SE, Great Himalayan Range towards NE and Qazing Range towards NW (G.Jeelani). Besides the ground water is mostly associated with methane gas. The groundwater in these areas has signatures of interactions with carbonates reflecting Triassic lime stone as a reservoir. In the study area, the soft rocks are surrounded and under laid by hard rocks, which can be broadly divided on the basis of their distribution and dimensions into two broad divisions, Panjal Traps and Trisaaic Limestones. The Panjal Traps are upper Middle Carboniferous to Permian basic volcanic rocks of Kashmir. These are fine grain, generally light colored, massive and hard block lavas with columnar and conjugate joints (Middlemiss,1910; Bhat et al.,1881). The Panjal Traps are extensively developed with estimated thickness of about 2500 m.





The Geological succession is as follows:

Alluvium	Sub Recent - Recent
Karewas	Plio - Pliestocene
Lime stone	Triassic
Panjal Volcanics	Palaeozoic

Methodology: A total of four exploratory wells were drilled at different locations for tapping

different aquifers varying in depth from 37.50 m to 76 m in Srinagar District. DTH drilling technique without ODEX system was used for drilling in the area. A Preliminary Yield Test (PYT) was conducted for 60 minutes by lowering 1 inch airlines. Then Aquifer Performance Test (APT) was conducted for 5 hours at constant discharge. From the data, T values were estimated by Jacob and Theise Method.

DISCUSSION

DTH Drilling Method

DTH with ODEX:

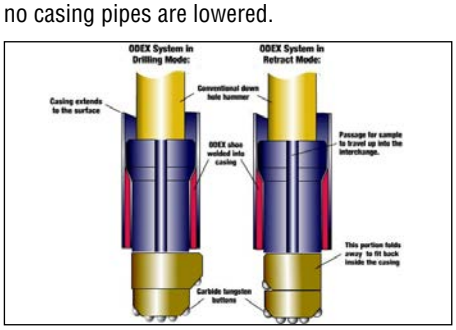
In DTH with Odex drilling is carried down both in hard rock as well as alluvium, by simultaneously lowering a casing pipe in the borehole. In this type of drilling the Odex attachment i.e. the drilling bit closes down through the casing pipe and comes out of the casing pipe and opens itself to a diameter slightly more than the diameter of the casing pipe.



DTH Rig

DTH without ODEX:

In DTH drilling, the drilling is carried down in hard rock formation, where the drilling bit cuts through the hard rock and creates a hole, in the hard rock which in itself acts as a pipe or casing for the borehole. In this type of drilling no casing pipes are lowered.



ODEX System

Exploration in Valley

Earlier ground water exploration by the Central Ground Water Board was confined mainly to the soft rock formations comprising of Karewas. In 2008, Central Ground Water Board drilled at Upper Athwajan, Upper Ishber, Pohal Brein and Sofi Mohalla in Srinagar District. Stat graphically, two of the EWs viz. Upper Athwajan and Sofi Mohalla are in andesitic flow of Panjal Traps. The lithology of the Exploratory Wells and salient features of pumping test analysis are herewith discussed.

RESULTS

Lithology and Pumping Test analysis of the EWs in Panjal Traps

In Upper Athwajan, drilling was carried up to 76 m. Similarly, in Sufi Mohalla, drilling was carried out up to 37.50m. Further drilling was not possible sue to high hydrostatic pressure. Below the top soil of about 2m, up to the drilled depth, hard rock of Panjal Traps were encountered having lithology of alternate layers of Andesite grayish hard and grayish-yellow fractured in both the EWs. The exploratory borehole data reveals that the Panjal Traps are having secondary porosity. The results show that in spite of being hard rocks, Panjal traps of the study area are highly fractured which leads to secondary porosity in hard rock, which is very good for ground water point of view. The result of the exploration shows that Panjal Traps are highly fractured & constitute highly productive aquifers yielding as much as 2640 lpm of water

To get a rough estimate of the yield of the EWs, a PYT was conducted at a depth of 60 m and 30 m. Then APT was conducted for 300 minutes. The cumulative discharge was measured. Subsequently, recuperation of water level (drawdown) was observed. Based on pumping test data and recovery data, T values of the aquifers of Panjal Traps were estimated and then results were compared. The Transmissivity of Upper Athwajan is 60.35m^2/day and the Transmissivity of Sufi Mohalla is 1918 m^2/day.

CONCLUSIONS

- Panjal traps are highly fractured especially at the contact with the Karewas
- Yield of Exploratory Wells is very high upto 2640 lpm

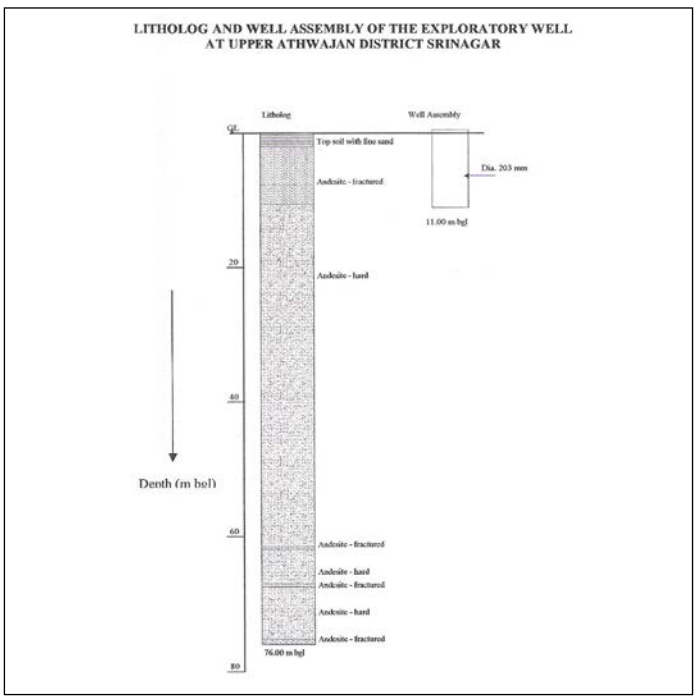
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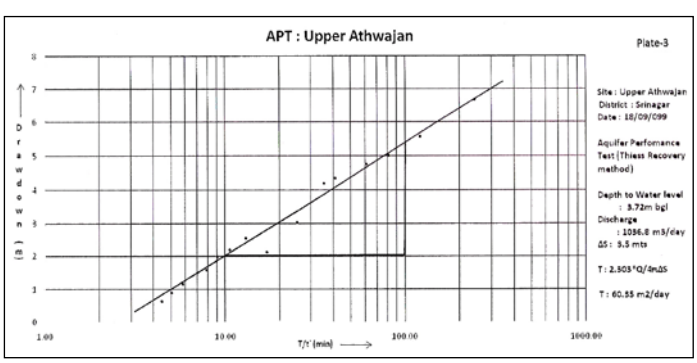
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Salient Features of Pumping Test at Exploratory Wells

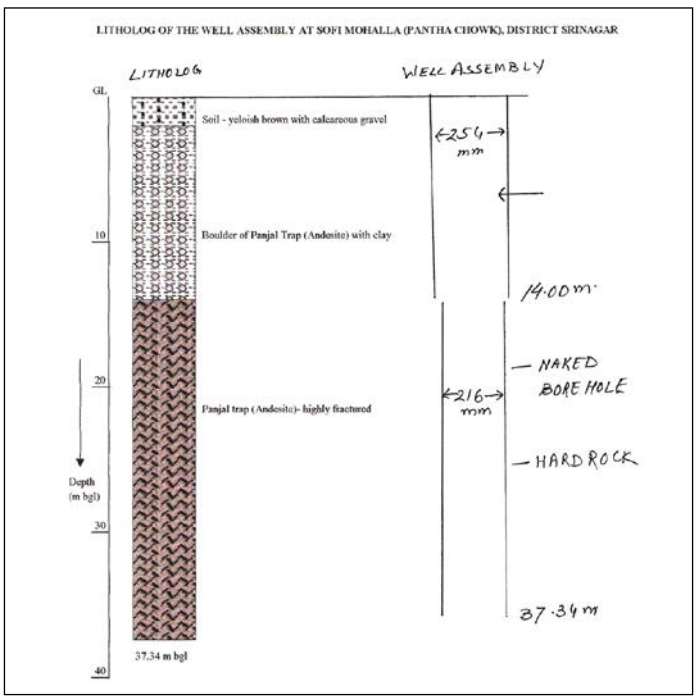
Upper Athwajan

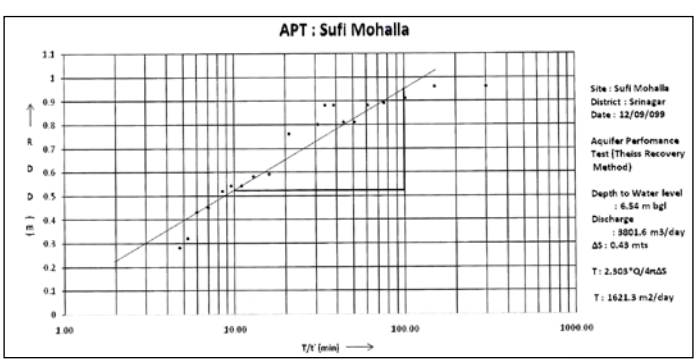




Static water level	:	6.50m bgl
Measuring Point	:	0.64m agl
Discharge	:	2640 lpm
Duration of test	:	300 min
Draw down	:	1.09 mts
Specific Capacity	:	2422 lpm/mts
Transmissivity	:	1918m²/day
Hydraulic Conductivity	:	80m/day

Sufi Mohalla





Static water level	:	3.72m bgl
Measuring Point	:	0.50m agl
Discharge	:	720 lpm
Duration of test	:	240 min
Draw down	:	18.95 mts
Specific Capacity	:	37.994 lpm/mts
Transmissivity	:	60.35m²/day
Hydraulic Conductivity	:	15.08m/day

About the Author

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"BHASMI-JAL"
AN INDIGENOUS HEALTH DRINK

By Dr.-Ing. Jeoraj Jain, Renowned Water Expert



Potable water supplied by town water treatment plants showed presence of appreciable amount of chloroform, which promotes the risk of cancer among its users. It is also sometimes acidic in nature.
We established that normal potable tap water becomes alkaline, when treated with Cow Dung Ash powder. The main advantage is the removal of toxic chemicals like chloroform and reduction in acidity level, with many other health benefits.

Some case studies are described. The ash is universally available and the treatment is cheap.

Keywords: Potable water, Chloroform, Cow Dung Ash Powder - Bhasma, Alkaline water.

1. Introduction

City water treatment plants invariably use chlorination for disinfection of drinking water, before feeding it into the pipelines [1]. However, this water contains chloroform, which promotes cancer, because it is a carcinogen. Sometimes it is also acidic in nature. It also contains free radicals like superoxide anion, and hydroxyl radicals [Annex-1]. The acidic chlorinated water with free radicals has been known to have long-term adverse health problems like bone and tissue damage etc.

Studies undertaken by Indian Institute of Technology, ISM Dhanbad [2], India, of 5 major cities of India, viz Kolkata, Ranchi, Jamshedpur, Dhanbad and Ramgarh, revealed that water released from their treatment plants contain chloroform, a potential Group B2 human carcinogen (Annex-2) at concentrations significantly higher than the permissible limits. This increases appreciably the risk of Cancer among the users. It is known that chloroform is a byproduct of chlorination. This process is used by city water treatment plants for disinfecting water.

The actual levels were found to be around 0.5mg per liter of water as against the max permissible safe limit of 0.08 mg ofchloroformper liter of water, as specified by the US Environmental Protection Agency [2].

Since Chlorine- dose depends on the organic contents, like dust, leaves etc in raw water, it is difficult to monitor on-line the contents and dosing for the ordinary treatment plants. A very sophisticated system is required to do that. A few plants are doing that monitoring in developed countries. But in India, where even the ordinary standard treatment plants are not available in most villages, the costly sophistication cannot get a priority.

It is, therefore essential in India to innovate and find on war footing, either some alternative technology to chlorination or some affordable supplementary technology and method to minimize the content of the carcinogen below the maximum permissible limit of chloroform.

Moreover, the problem of the free radicals, present in the potable water, also needs to be addressed urgently, because of its long-term health hazard in terms of tissue and bone damages.
S.B. Somani et.al studied the alternative approach to chlorination for disinfection of drinking water. The methods discussed are Ozone treatment, U-V treatment, boiling etc. This paper has shown the drawback of using chlorine as disinfectant and concluded that technological advances are necessary to develop alternative disinfection process [3].

Ojedokun et.al mainly discussed one of the properties of cow dung ash as an adsorbent for the removal of heavy metal ions from aqueous solution. The heavy metals are chromium (Cr), lead (Pb), mercury (Hg) etc. They have also given the chemical composition of cow dung ash as Calcium Oxide (12.48%), Magnesium Oxide (0.9%), Calcium Sulphate (0.312%), Aluminum Oxide (20%), Iron Oxide (2%) and Silica (61%). They have also explained the effect of contact time which is applicable in disinfection process of water by using cow dung ash [4]. But the contents of chloroform and free radicles have not been studied.

Qilin Li et.al discussed the appropriate disinfection without forming harmful disinfection by-product by conventional chemical disinfectants, as well as the growing demand for decentralized water treatment and recycling systems. It calls for new technologies for efficient disinfection and microbial control. It reviews the antimicrobial mechanisms of several nano-particles and discusses their merits, limitationand applicability for water disinfection and bio-fouling control. It highlights research needs to utilize novel nano-materials for water treatment application. [5]

Hardikkumar, V. Shrimali mainly discussed the need of disinfection by Reverse Osmosis system and its future scope. RO provides a cost-effective solution that has the potential to improve the drinking water, containing high levels of contaminants. Being economical, eco-friendly and versatile, membranes are leading choice for water purification applications and should continue to be used for many years to come [6]. However, it removes the beneficial minerals from

the water. It also wastes a lot of water.

G Katara et.al focuses on the checking efficiency of germicidal UV light. U-V light can have efficient inactivation of bacteria up to a distance of 3 meters on either side. An exposure time of 30 min is adequate. 400KHz frequency of U-V waves has been demonstrated to provide sterilization in 60 min. [7]. Other health hazards of contents have not been considered.

M. G. Das discusses the purifying properties of Cow Dung Ash powder. But there are no experimental results or quantitative data for its addition in water [8]. Ajinkya et al also found that treatment of raw water with CD Ash-powder is capable of removing heavy metals from it [9]. Bhagavanulu DVS has studied scientifically the effect of different Ashes on the properties of Turbid Water and found that the Cow Dung Ash-powder (CDAP) is more effective in removing the turbidity of water than the Rice Husk Ash powder. [10]
Although several researchers have tried different techniques to improve the Quality of Potable water, but none has given a simple, practical and affordable solution to provide quality drinking water, free from Carcinogens and free radicals. It transpires from the literature that the Cow Dung Bhasma may have great potential to meet our varied requirements. As such extensive and proper experiments must be conducted to determine its Quantitative and Qualitative effects on the potable water for developing an appropriate technology for removing the major hazardous Carcinogens and radicals.

3. Status of Alkaline water

Several researchers in developed countries were also engaged in finding an appropriate solution to these problems of chlorination. Japanese website Kangen on internet [11] etc. reports that alkaline water is extremely beneficial for human health by solving the above noted problems. It (pH value more than 7.5) helps in reducing acidity-producing wastes from the body. The website claims that alkaline water neutralizes carcinogens and acidity, promotes pH balance in Urine, binds to toxins, maintains strong bones and is easier to absorb by the body. Kangen waters reduce acidity to alkalinity and increases Redox Potential.

The above type of alkaline water promotes conversion of free radicals of potable water into singlet oxygen ($^1O_2$) and normal oxygen molecules [11]. That means it also works as scavenger to remove harmful free radicals from potable water. Consequently, it prevents mutagenic changes and its associated disorders.

Kangen Water offers a small machine, which can convert the supply water into alkaline water. It can be fitted with the kitchen tap. Such Japanese machines are now available in India also. However, they cost more than Rs. 2 lakhs per machine. As such the Villagers and most urban dwellers in India cannot afford to buy these costly machines.
Hence an appropriate, simple and affordable technology and method have to be developed to produce Alkaline water for the masses.

4. Experiments on potable water and Discussions:

Instead of finding an alternative disinfection technology, we have concentrated on the use of Cow Dung Ash-powder, termed as Bhasma, which is known to be alkaline in Indian villages, for improving the quality of chlorinated supply water. We sourced CDA-powder of 100 mess size for our experiments (Annex-3).

In the preliminary experiments, the sieved CDA-powder, (termed as Bhasma powder), was dissolved thoroughly in potable water in such quantity that the excess Ash-powder settled down in still water. After 30 minutes, it was decanted and filtered through a fine smooth white cloth for storing it in the pot for drinking.
The treated water was found to be free from chloroform and always got converted into Alkaline water due to the alkaline nature of CDA-powder.
It means qualitatively, the worrisome problem of Chloroform Cancer, as highlighted in Dhanbad Report, can be resolved by this affordable domestic treatment.

A fresh series of experiments with CDA-powder was conducted on Potable Water to optimize the parameters. Different amount of CDA-powder was used to make the water alkaline. The pH value of water was measured by pH strips available in the market. This value was taken as a measure of alkalinity. Its value varied from 7.2 to 9, depending on the amount of CDA-powder used. The contents of B- Colie were tested in Water Laboratory.

5. Standardization of Technology and Discussions

In several experiments, it was found that the acidic tap water (pH<7), containing chloroform and some bacteria has become alkaline and bacteria-free. As per Kangen [11], the optimum pH values of potable water for good health should be between 8.2 to 8.5. It was established that the colloid formed by dissolving thoroughly 4g of Bhasma of 100 mesh size in one litre of supply water, will have pH value in this range. It always tested alkaline in nature. A sample of such treated water was also found to be bacteria-free in Lab test (Annex-4).
Thus the parameters have been fine tuned to achieve optimum treatment results. It quantifies the best possible additives to achieve the required qualitative requirements for potable water with a simple technique of treatment.

To optimize the parameters for treatment of water, supplied by Water Treatment Plants on all India basis, experiments were conducted at major Towns, which are geographically dispersed across the country. Ahmedabad (Gujarat), Bengaluru (Karnataka), Jodhpur (Rajasthan), Durg (Chhattisgarh), and Jamshedpur (Jharkhand) were selected to treat the local supply water with CDA-powder on the same day.

The local participants were properly explained the objective and the standard method of the experiments. The standard method used in the experiments was as follows:-

The CDA-powder used was locally obtained and was sieved through a white rough cloth piece for maintaining its particle size. The treatment of the local Corporation Water was done with this CDA-powder by thoroughly mixing and dissolving it @ 4 g per litre of water in a pot containing 10 litres of water. The solution was stirred well for one minute. Then the solution was left standstill for 30 minutes for allowing the excess powder to settle down at the bottom. It was then decanted and filtered through a white fine cloth piece for storing the same in a pot. This water is called as Bhasmi-Jal.

The pH value of this treated and filtered water was measured as mentioned earlier with pH strips. The pH values were found to be in the range of 8.0 to 8.5. It also means that the quality of supply water in India does not fluctuate much. The plants adhere to the specifications laid down in the 'Manual on Water Supply & Treatment' [1].
In practice for households, the process is simplified and established by defining a tea

spoonful of CDA-powder to be about 4g. Thus the required alkaline water can be prepared for the family's consumption for the whole day. The residue is easily washed away from the filter cloth.

6. Availability and quality of consumable:

i. CDA-powder is easily available, almost free of cost, in every village as a by-product of cow dung fuel. It is to be sieved through a rough cloth piece and stored. It is also widely known in India that CDA-powder works as antiseptic powder in households. It is also used as preservative for grain storage in villages. People have respectful attitude towards CDA-powder. Hence this treatment with CDA-powder can be easily accepted in the villages.
ii. The quality of CDA-powder may vary as per the type of cows and their feed. The composition of CDA-powder used at Jamshedpur was analysed in 2010 and is given in Annex-3. As such to understand well the effect of variation in the composition of any local CDA-powder on the treatment of water, it is advised that the composition of CDA-powder should initially be experimentally determined. Since the source of CDA-powder is Gaushalas, it is recommended that each gaushala determines the quality of its CDA-powder. Logically, if the feedstock of a Gaushala contains arsenic, the CDA-powder is also likely to contain it.

7. Summary of Benefits of CDA- powder treated water

i. Since chloroform in potable water gets removed from the treated water, the potential risk of Cancer by chloroform to the masses is thus fully eliminated by this treatment.
ii. Anti-oxidative,
In Indian Towns, where people are supplied chloroform bearing water, also contains free radicals of Oxygen. Due to CDA– powder treatment, the radicals get reconverted back into molecules. Drinking such water minimizes erosion of bones and tissues.
iii. Every house hold can prepare it by using a simplified standard process on daily basis with the traditionally available CDA-powder in villages at negligible cost. Bhasmi-Jal being alkaline and radicals-free, people drinking it may not require any anti-oxidants to be taken.
iv. It is also reported [11] that the use of alkaline water removes toxin matter from the body. Its regular use helps in reducing urine acidity. Higher urine pH is associated with less risk of developing metabolic syndrome irregularity.
v. Caution: Tests of water, treated with Fly ash powderfrom Steel Plants, like Tata Steel (Jamshedpur) and Bhilai Steel Plant (CG) revealed that the quality of potable water is affected adversely. In fact, the quality of fly ash itself is not standard. In most cases, it was found to be even more acidic. Hence, it is detrimental to health and must not be used for treating potable water.

8. Secondary benefits:

Improvement in Quality of Life:
Since this technology is simple and easier to treat the potable water by individual households on daily basis, this manual treatment process can be readily accepted by any family, particularly by the families of low and middle income group people in villages. It easily meets the growing demand for Decentralized Quality improvement [5] facility at user end.

Change of attitude from negligence to respect:
Preparing this health drink would require budgeting of water on daily basis by individual families for treating it before hand (preferably early in the morning) for their whole day's requirement. The involvement of family member with conviction of benefits of such elixir-like Bhasmi-water, on daily basis would facilitate inculcating respect for water. Since families would budget their daily requirement and adopt the simple treatment as a routine, they would take the campaign, "Save Water" on "World Water Day" seriously as a matter of habit and would not tend to indulge in any wastage of elixir-like potable water, prepared by their own hands with dignity. The campaign, "Save Water" also becomes very popular. See chart-1

Conservation of Water:
The author has also found in a survey that people, using CDA-powder treated potable water for more than 5 years did not report or show any long term adverse effect on their health. But they all exhibit a strong attitude of respect towards water and habit of frugality in its consumption. Such an attitude can be a major contributor or driving force for achieving sustainability of Eco-Balance on our Earth.

Low-cost and eco-friendly:
This technology can be adapted and achieved by households at unit family level in the villages with easily available materials. The CDA-powder treated potable water has been found to be a low-cost and eco-friendly practical solution for winning alkaline water, which is considered to be so useful for improving the health of masses.

Social Benefits:
Regular use of Bhasmi-Water (Jal) in households will reduce the problem of plastic bottles, a waste residue of packaged water. People would take pride in carrying with them their own treated water.
If these research findings could be taught in the schools, the tender hearts of children would easily accept the use of health drink of enhanced quality and become frugal in its consumption. In the decentralized quality improvement model [5], it does not need any additional investment on Water Treatment Plants for making Bhasmi-Jal.

9. Treatment of Raw Water

Raw water from rivers is mostly turbid. This should first be treated with minimum amount of Alum to remove turbidity. All dirt will settle down. But it is now acidic in nature. It can then be treated with Lime water or better with CDA-powder to make it alkaline and potable. CDA-powder treatment would also add some useful minerals in it. However, the additive quantities should be determined by experiments, before this process can be standardized for a particular location.

10. Conclusion

Normal City potable water contains cancer causing chloroform and osteoporosis causing free radicals. Value added potable water, prepared by treatment with CDA-powder, has several important advantages over the plain city potable water. The bhasmi-water is cost effective, alkaline and is devoid of chloroform, free radicals and most microbes.
The technology to prepare it is also very simple and easily acceptable by the villagers and urban households, as a part of decentralized quality improvement system. Bhasmi-Jal offers great advantages in changing the attitude of health

conscious users. The daily manual treatment of water helps inculcate frugal habits and sow the seeds of respect and compassion towards water. This would also be a strong driving force for achieving "Save Water" targets and sustainable eco-system.

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Annex-1: Free Radicals

Annex-2: Chloroform & its Physical Properties

Annex-3: Cow Dung-Ash powder (Bhasma)

Annex-4: Local Tests and Test Reports of Bhasmi-Water at two Locations. (Mumbai and Jamnagar)

Annex-1

Free Radicals

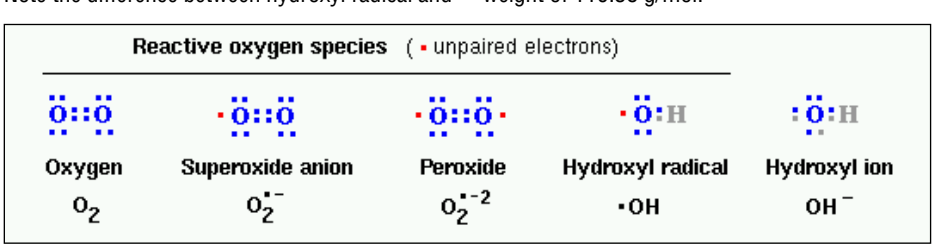
The atmospheric air has 20.9% (209 ml /l) of oxygen. Relatively the amount (volume) of DO in water is much less, 5.3 ml in a liter of air-saturated water at 30°C i.e. about 0.5% - by weight the proportion is still less - 7.6 mg in a liter or kg of water(see Fig. below)

2. Formation of Reactive Oxygen Species: There are many types of radicals, but those of most concern in biological systems are derived from oxygen, and known collectively as reactive oxygen species. Oxygen has two unpaired electrons in separate orbitals in its outer shell. This electronic structure makes oxygen especially susceptible to radical formation. Sequential reduction of molecular oxygen (equivalent to sequential addition of electrons) leads to formation of a group of reactive oxygen species:

- **superoxide anion**
- **hydroxyl radical**

The structure of these radicals is shown in the figure below, along with the notation used to denote them.

Note the difference between hydroxyl radical and hydroxyl ion, which is not a radical



3. Another radical derived from oxygen is singlet oxygen, designated as $^1O_2$. This is an excited form of oxygen in which one of the electrons jumps to a superior orbital following absorption of energy.

Free radicals can cause damage to the parts of tissues, such as proteins, DNA, and cell membranes by stealing their electrons through a process called oxidation. Numerous studies indicate [11] that increased production of free radicals causes or acceleratesnerve cell injury and leads to disease.

Ref:https://www.lenntech.com/faq-air-chemistry-physics.htm#ixzz6PnG3J9JT

Annex-2

Chloroform & its Physical Properties

Chloroform may be released to the air as a result of its formation in the chlorination of drinking water, wastewater and swimming pools. Other sources include pulp and paper mills, hazardous waste sites, and sanitary landfills.

The major effect from acute (short-term) inhalation exposure to chloroform is central nervous system depression. Chronic (long-term) exposure to chloroform by inhalation in humans has resulted in effects on the liver, including hepatitis and jaundice, and central nervous system effects, such as depression and irritability. Chloroform has been shown to be carcinogenic in animals after oral exposure, resulting in an increase in kidney and liver tumors. **EPA has classified chloroform as a Group B2**, probable human carcinogen.

Epidemiologic studies suggest an association between cancer of the large intestine, rectum, and/or bladder and the constituents of chlorinated drinking water, including chloroform.

Physical Properties:

Chloroform has a pleasant, nonirritating odor; the odor threshold is 85 ppm. The chemical formula for chloroform is CHCl3, and it has a molecular weight of 119.38 g/mol.

The vapor pressure for chloroform is 159 mm Hg at 20 °C.

SiO_2 = 64.4%	P_2O_5 = 4 %
CaO = 10.8 %	K_2O = 3%
MgO = 4.4 %	SO_3 = 2.8%
Al_2O_3 = 4 %	CL^- = 2.4 %
Fe_2O_3 = 2 %	Na_2O = 1.4 %

Annex-3
Cow Dung-Ash powder (Bhasma)

Scope

i. CD-Ash powder (Bhasma) is used in supplementary treatment of tap water to increase its pH value and to reduce the free radicals.
ii. Properties: CD-Ash powder is Cheap, Easily available, Eco-friendly, Economically stable, Full of useful and assimilable Minerals, Disinfectant (Bacteria killing), Due to its High percentage of Silica content, it has high affinity for metal ions, enabling it to remove Heavy Metal Ions.
iii. General Composition of CD-Ash powder used: (It is a Low cost adsorbent, a bio-organic waste. Source : Jugsalai, Jamshedpur Gaushala)

Annex-4
A) Local Tests and Test Reports of Bhasmi-Water at two Locations. (Mumbai and Jamnagar)

i. Test samples were prepared by treating supply water with CD-Ash powder @ 4 gm per litre and allowing 30 minutes of settlement time for it.
ii. Tests conducted: pH test, Total Hardness, Turbidity, TDS, Calcium, Chloride etc (mg/l) Test, MPN-Bacteriology Tests.

Test reports revealed the following quality of treated water:

a. Content of carcinogen Chloroform is fully nullified in potable water.
b. Water is made Alkaline. pH value goes up to 8.3.
c. Turbidity is reduced.
d. Bacteria are killed.

A) pH value of treated water

i) To optimize the parameters for treatment of water, supplied by Water Treatment Plants on all India basis, experiments were conducted at major Towns, which are geographically dispersed across the country.
Ahmedabad (Gujarat), Bengaluru (Karnataka), Jodhpur (Rajasthan), Durg (Chhattisgarh) and Jamshedpur (Jharkhand). Locations were selected to treat the local supply water with CDA-powder on the same day.

ii) Samples at Durg (13.08.16)
1. It was municipal water w/o any filter.
2. It was not through r.o. or u.v.
3. pH value was taken after 30 minutes of treatment.
4. pH value was taken by using pH strips.

iii) Samples at Jodhpur (18.08.16)
Bhasma as per norms was dissolved in tap water from domestic overhead tank. pH was measured with a pH meter after about 30 minutes.

Findings are as under:

Water		pH
Normal 7.7	:	7.7
3 gm	:	8.6
5 gm	:	8.9
8 gm	:	9.1

iv) Tests at Bengaluru (18.08.16)
pH varied between 8.6 - 9.1

Summary of Results is shown below:

DUG Bengaluru JDP
pH Value pH Value pH at JDP

Tap Water	7.0	7.0	7.7
Bhasma 3g	8.4	8.5	8.6
Bhasma 5g	8.7	8.9	
Bhasma 8g	9.0		9.1

Test reports of Bhasmi-Water at different Labs, arranged by Mr. P Dedhia, a prolific volunteer for conservation of Water:

i). Test Report of Bhasmi-Water by Jamnagar Lab (For pH value)

Phone No. : - (0288)2550253 e-mail :- distlabjam@gmail.com / dist_jam@gsnl.in

DISTRICT LABORATORY
Gujarat Water Supply &Sewerage Board
JAMNAGAR

REPORT ON SHORT CHEMICAL EXAMINATION OF DRINKING WATER

Senders Ref.No : Nil
Name & Address:- Shree Prafulbhai Dedhiya, Ranjitnagar, JAMNAGAR
Date : 13-04-11
Date of Collection: 13-04-11
Date of Arrival : 13-04-11
Lab.Ref.No. JCW : 24
Source of Sample: Municipal Tap water(Ash treated) Collected by : Sender
L. C. No. : 41012000
Village : JAMNAGAR Taluka : JAMNAGAR District : JAMNAGAR

	CHARACTERISTIC	IS-10500:1991(F.R) Desirable	Permissible	Analytical Value
1	Colour Hazen Units	5	25	Colourless
2	Odour	U.O.	U.O.	Unobjectionable
3	Turbidity NTU	5	10	5
4	Dissolved Solids mg/l	500	2000	306
5	pH	6.5 to 8.5	--	8.47
6	Total Hardness (as CaCO3) mg/l	300	600	64
7	Calcium (as Ca) mg/l	75	200	13
8	Magnessium (as Mg) mg/l	30	100	8
9	Chlorides (as Cl) mg/l	250	1000	100
10	Sulphates (as SO4) mg/l	200	400	12
11	Nitrates (as NO3) mg/l	45	--	1.67
12	Fluorides (as F) mg/l	1.0	1.5	0.10
13	Alkalinity (as CaCO3) mg/l	200	600	124

OPINION for Potability → FIT

N.B : Excessive Turbidity, if any, may be removed before use.

DL// 393 /2011 Date: 19 - 4 - 2011
DISTRICT LABORATORY,
"Jal Bhavan", Saru Section Road,
JAMNAGAR - 361002

LABORATORY ASSISTANT

ii). Test Report by Hospital Lab at Mumbai (For Coliform Bacilli)

Seth GS Medical College & KEM Hospital
Department of Microbiology
Clinical Bacteriological division

17.4.2010

Blinded testing of water samples received from ISKCON Chowpatty, Mumbai.

Sample 1: coliform bacilli grown in culture

Sample 2: No coliform bacilli grown in culture

Uncoding after testing –

Sample 1 - well water

Sample 2 - well water with cowdung ash

Conclusion: Well water is not suitable for drinking. It has to be treated. Cowdung ash has to be further tested for its antibacterial properties.

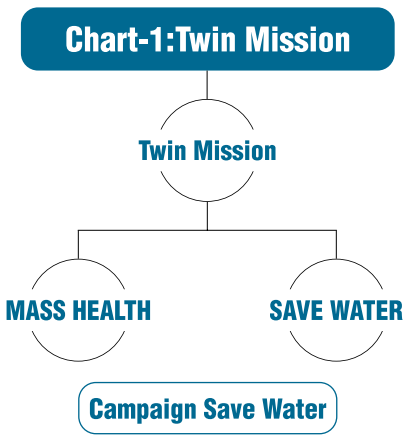
Dr Gita Nataraj
Professor and Incharge

पानी टेस्टिंग के नमुने नमूना नं. १ : अनुपयोगी (बिन वपरासी) कूएँ का पानी
नमूना नं. २ : अनुपयोगी (बिन वपरासी) कूएँ के पानी में राख डाला हुआ पानी

नमुने का संशोधन का परिणाम (रिपोर्ट)

नमूना नं. १ : अनुपयोगी (बिन वपरासी) कूएँ का पानी के रिपोर्ट में भयंकर बीमारियाँ फैलाए ऐसे कीटाणु दिखाई दिए, जो फेफडों, आँतों और खून को जहरीला बना देते हैं।

नमूना नं. २ : अनुपयोगी (बिन वपरासी) कूएँ के पानी में राख मिलाया हुआ पानी : उस पानी की रिपोर्ट में पाया गया कि यह पानी सभी कीटाणुओं से मुक्त है।



Students taking Vow to Prepare And Use only Bhasmi-Water



About the Author

Dr.-Ing. Jeoraj Jain is a Gold Medalist of Rajasthan University. He obtained the Degree of "Doctor of Engineering": (Dr.-Ing.) from Germany in 1968.

After working for 21 years with Tata Motors, he worked as Technical and Investment Consultant for 12 years. He was almost First in the world to design and produce Fabricated Axles for heavy Vehicles at Pune, involving Innovative Welding Design. He won National Award for fabrication Technology.

Since 2002, he is engaged full time on Research on Physical Sciences, like single sensed Living-Beings, Conents of the Universe etc.

He has been a contributor to the water industry and has some path breaking discoveries and innovations in the field of water and cosmology to his name. He identified scientifically the 4 Basic Minimum Characteristics of Living-beings and presented for the first time in the world, the Theory of Living-Water. He discovered a novel concept of shelf-life of non-living water.

He discovered the ancient "original method" of describing contents of the Universe. It can decipher ancient scriptures to enrich immensely the modern Cosmography. He received the "Vigyan Ratan Award" from Gyan Sagar Science Foundation, Delhi, 2017. He also authored 3 books on Water and Cosmography.

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



SMART WATER TREATMENT PLANTS (WTPs) - CHEMICAL FREE & SLUDGE FREE "A TALE OF TWO CITIES" MADURAI, INDIA & NORTH BAY, CANADA

By Dr. S Saktheeswaran, Er. D. Harsha and Dr. S Sundaramoorthy

Abstract

Two contrasting case studies, one at Madurai, India with Lime-Alum-Sludge technology of 250 million liters daily (MLD) and the other at North Bay, Canada with chemical free & sludge free technology of 79 MLD are presented, both with similar raw water quality and a pointer is brought out for India moving over from Lime-Alum in the future.

1. The Madurai Case Study

1-1. The Raw Water Quality

The semi-arid city at 42 & 16 degrees C extremes is at 9.93°N 78.12°E, 101 m above MSL and annual rainfall about 900 mm in about 17 monsoon days and prides its native Jasmine flowers. The water supply is 45 MLD from early collector wells, infiltration wells and infiltration galleries and 120 MLD intakes from impoundment and a recent 120 MLD from another impoundment. The qualities of water specified in the documentation are in Table-1

Table-1
Quality of Raw Water of Earlier and New Impoundments and Desirable Drinking Water (1)

Parameter		Min	Max	Drinking Std	Parameter		Min	Max	Drinking Std
No	In respect of the impoundment for the 1992 and 2000 WTPs								
1	Colonies / ml agar, 37 deg C	720	1400	nil	12	Colour,	nil	nil	5 (*)
2	MPN of coliform / 100 ml	950	1150	nil	13	Turbidity	5	7	1(**)
3	Total dissolved solids	130	270	500	14	Odour	Fresh, earth		nil
4	Carbonate hardness, CaCO3	52	120	NS	15	pH	6.8	7.5	7.0
5	Non-carbonate hardness,	2	24	NS	16	Iron as Fe	0.05	0.15	0.1
6	Total hardness as CaCO3	70	136	200	7	Arsenic	nil	nil	0.01
7	Phe. alkalinity as CaCO3	nil	nil	NS	18	Nitrate-N	nil	1	nil
8	Total alkalinity as CaCO3	52	120	200	19	Nitrate -N	Traces		10
9	Fluoride as Fluorine	0.2	0.3	1	20	Phosphate	Traces		nil
10	Chloride as chlorine	14	22	200	21	EC, 20º C	190	380	NS
11	Sulphate as sulphate	Traces		200	22	Tidy's test	1.56	2.08	NS

In respect of the recent ongoing impoundment for the 2021 WTP (serial numbers as above)				
		Min	Max	Drinking Std
6	Total Hardness, as CaCO3	22	24	200
13	Turbidity, as NTU	2	4	1(**)
15	pH	6.63	6.79	7.0

(*) Platinum Cobalt Scale; (**) Nephelometric Turbidity units;

1-2. The Treatment Technology

The first WTP was 72 MLD with Lime-Alum technology (Fig. 1). Its upgrade to 120 MLD was designed by the authors by inserting tube settlers in clarifiers and converting the rapid sand filters to dual media filters (DMF) without increasing the footprint as in Fig. 2

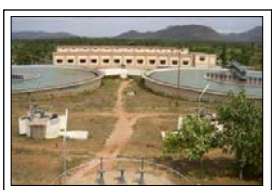


Fig. 1 The Old 72 MLD WTP

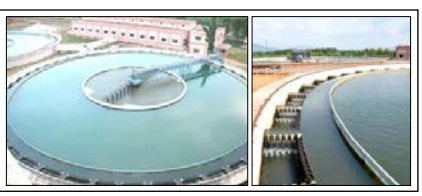
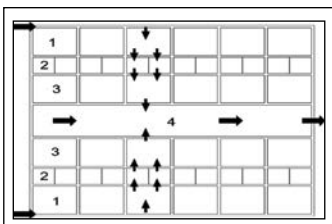


Fig. 2 Upgraded 125 MLD WTP Tube Deck & DMF

Subsequently a 120 MLD WTP is under construction and the Lime-Alum technology is mandated by the authority. The authors have designed this as modular units as in Fig. 3



1-Over & under baffled flocculators 12 of 8*7m 2-Tube Settlers with 60 deg hoppers 24 of 4*4m
3-Dual Media filters 12 of 8*7m; 4-10 m Gangway All units open for natural UV. Foot print 60 *60 m Battery carways for all units translucent roofed.
Flow Routing is only selectively shown for clarity



Left-Air-lift sludge Pump 75 *150 mm. Sludge suction is from bottom. Compressed air inlet at sides propels the sludge slurry. This portable pump is dropped into whichever hopper as needed. The delivery pipe is connected by clamp joint (similar to fire hoses clamps) to fixed sludge pipeline on walkway and to basket type bottom discharge centrifuge at right.

Fig. 3 Layout Proposed by the Authors for the 120 MLD WTP on a 60m*60m footprint

1-3. The Operational Issue of these WTPs

The addition of Alum to create positively charged Aluminium Hydroxide flocs to neutralize the negative charge of the turbidity suspensions and

supplemental weighting agent of Calcium Carbonate from added Lime is theoretically fine. However, the Alum is never a true solution but only a suspension. The raw water suspended solids concentration also varies. Thus unreacted Al can go into solution. To get over this, Sodium Aluminate or Poly Aluminium Chloride can be used as these are true solutions and injectable with equipment as in Fig. 4

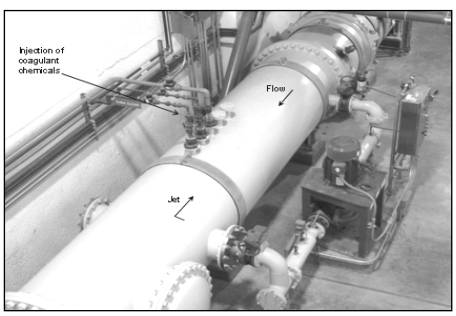


Fig. 4 The on-line Jet Rapid Mixing (2)

This needs on-line sensors of turbidity and bicarbonate alkalinity and linked to programmable logic controllers for iterated dosages of chemicals from solution preparation tanks. This also leads to logistic issues of storage, re-order level monitors and quality controls of samples vis-à-vis actual supplies.

Another issue is at a turbidity of 5 to 7, the sludge bleed from clariflocculators is never at the desired consistency and extended retention means the rising sludge flocs in clarifiers. All the same, it is held in sludge balancing tanks for disposal in light forestry and the moot question of Aluminimum leaching into soil in monsoons. It does not end there. Alum and Lime are both hygroscopic and the exact dosage is difficult. Due diligence of operator attendance in the night shifts becomes understandably a task to be put up with at this remote location.

There is hesitancy in change over from an operating technology and the point to ponder is the recent 120 LD ongoing new WTP whereas the simple low pressure ultra filtration membrane could have achieved this as illustrated in the case study below.

2. The Canadian Case Study

2-1. The Physical Setting, Water Quality Issues and Treatment Process

For over 110 years, North Bay had drawn its water from Trout Lake with chlorine disinfection as the only treatment required. The City has often proactively examined improving the same by either conventional treatment or membrane filtration or only UV disinfection. However, in April 2001, a heavy rainstorm caused raw water to rise above 5 NTU for over 12 hours and the city took to membrane technology as in Fig.5 (3)

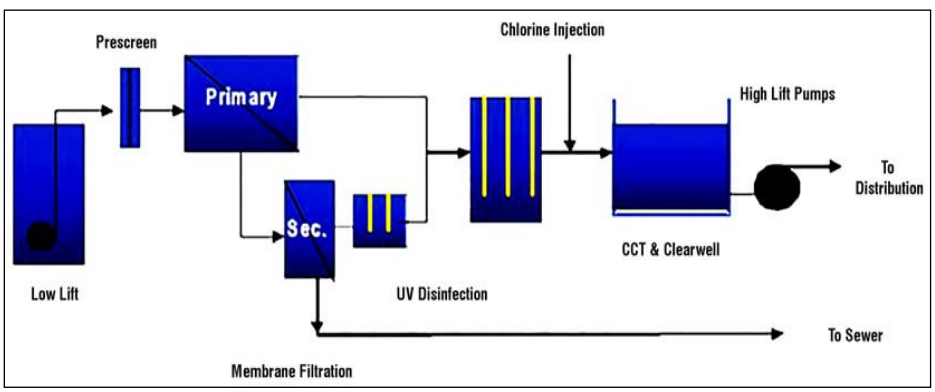


Fig. 5 The Water Treatment Process Scheme of the North Bay WTP

The completed plant in its interior with the membrane banks and exterior are shown in Fig. 6



Fig 6 The Interior and Exterior of the North Bay 300 MLD Membrane WTP

2-2. Treatment Aspects in Detail

This plant was commissioned in 2010 for a capability of 79 MLD. The primary barrier is Microfiltration system as an effective barrier to physically separate the various contaminants in North Bay's drinking water. The secondary treatment barrier is the UV disinfection system, using high intensity light that inactivates organisms such as Cryptosporidium and Giardia that The water is then injected with chlorine to kill off any viruses and bacteria that may bypass the previous systems. This minimizes the plant wastewater to less than 1% of feed volume.

3. The Lesson of it all

3-1 With the North Bay WTP in 2010, the Lime-Alum WTP in 2020 at Madurai could also have opted for membrane based chemical free and sludge less technology more so the nearby Bharat Heavy Electricals Limited (BHEL) Tiruchy, India has done it in 1997 by scrapping the 1960's WTP of Lime-Alum Technology at a scale of 14 MLD within a foot print of 14 m*12m for water supply to industry and township (4). The raw water from riverbed of Cauvery is soft enough for direct supply. The details are in Fig. 7. The plant is in continuous use ever since with no disruptions.

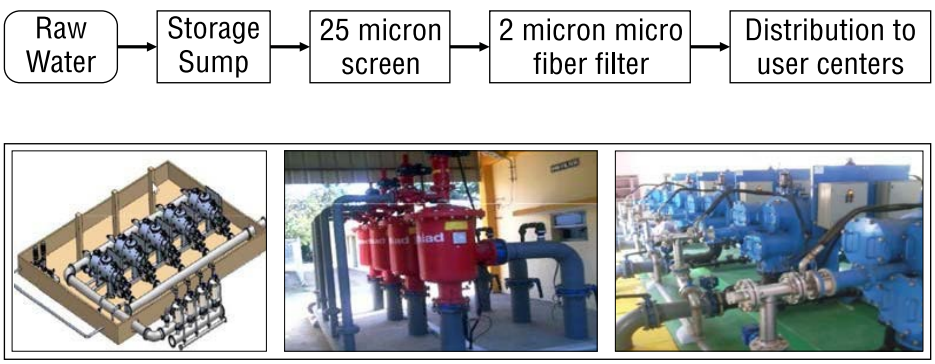


Fig.7. Schematic & Units of 14 MLD Chemical & Sludge free WTP at BHEL

3-2. There is the practical aspect of overcoming the Lime-Alum supply lobby who will go out of business but they can switch over to O&M of the membrane based WTPs.

3-3. In higher elevation mountainous region, WTPs are best provided with river intake by infiltration wells to abstract water without turbidity and then direct member filtration. It can eliminate the Lime, Alum and Sludge. The wall is of porous concrete usually between 10 to 15 %. The velocity at the porous exterior will be less than 1 / 100th m/sec and negligible. Built in air diffusion and frequent air sparging, the intake itself will eliminate the turbidity issues. The well designed by the authors for M/S L&T Shipbuilding at Chennai is shown in Fig.8.

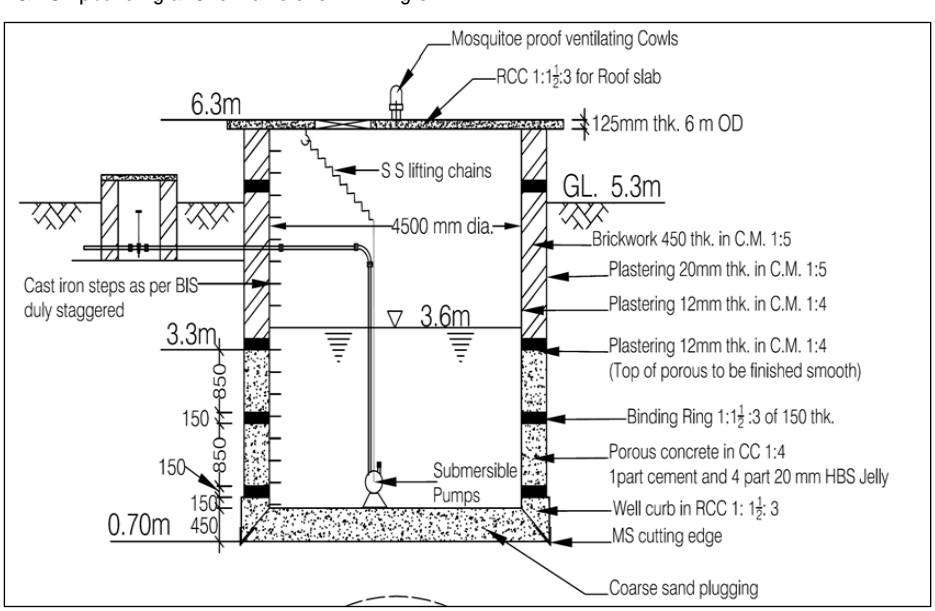


Fig.8. Infiltration well with Porous Concrete for Streams Avoiding Surface Turbidity

3-4. There are innumerable ground water wells as water supplies as in Kerala where, it is reported that 62% households depend on well water (5). The table-top and wall-mounted R O units are a common practice and the issue of disposal of the spent membranes are being addressed by the National Green Tribunal (6).

3-5. The economic gains and environmental benefits of recycled membranes will assume mammoth proportions (7) and a chronicled system is to be put into place.

3-6. Traditionally, the clarifier floor is a hopper with its sludge pocket at the center as in Fig.9. However, in the sparse raw water turbidity, the sludge settling in the hopper floor gets reverse-swept over the rotating sludge scraper blades and is not moved to the central sludge hopper. The Hydroplume, patented by Government of India (8) has a conical floor instead of the hopper as in Fig. 10. It has sludge suction manifolds in the radial sludge scrapers and the settled sludge on the floor is sucked directly and is ideal for these low turbidity waters.

Conclusions:

When a giant public sector as BHEL has pioneered the direct filtration technology by replacing the old Lime-Alum type WTP for 14 MLD for its industry and township water supply in 1997 itself and North Bay WTP for 79 MLD has used the membrane technology in 2010 itself, there is enough justification for future WTPs of this country to move over from the Lime-Alum technology and specifically the sludge issues.

The Madurai system could have been clear water mains of 55 km from WTPs to Madurai could have been raw water to underground reservoirs in the proposed 60 sub-zones in the city and the water pumped through membranes into the respective distribution zones. The rejects of 5 % can be sold for construction works. Thus the entire system can be controlled at the city itself instead of the remote control 55 km away in the foothills wilderness.
The Smart City philosophy relies on simplified operational procedures and remote monitoring and thereby Automated Neural Network based iterated O&M. Clearly, the Lime- Alum technology pre-empts itself in favour of low pressure ultrafiltration (UF) or microfiltration (MF) for future Smart WTPs.

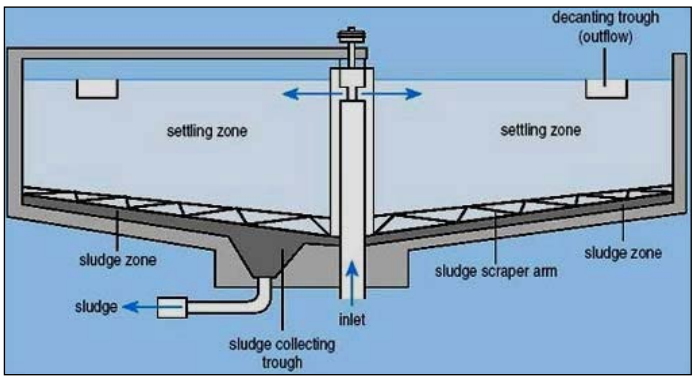


Fig.9. The Conventional Clarifier

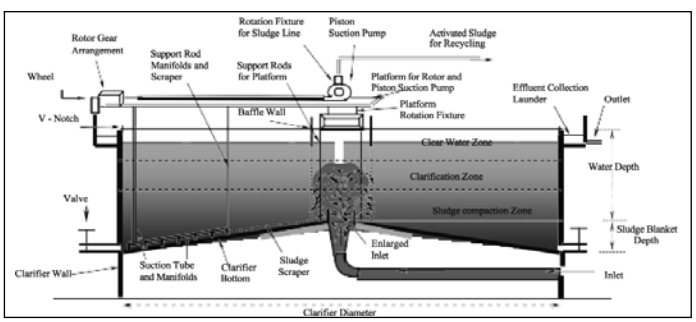


Fig. 10. The Hydro plume Clarifier

Acknowledgements:

The authors acknowledge the trust and belief placed on us by (a) M/S L&T Shipbuilding at Chennai by retaining our project management services for infrastructure services of water, sewerage, strom drains, rain water harvesting, zero liquid discharge of sewage and industrial effluent plants on their 60 acre submarine building yard off Chennai coast and (b) M/S P & C Projects who retained us as technical advisors for their WTP projects at Madurai cited here and (c) M/S amiad for their power point source of their plant at BHEL

1. *http://cpheeo.gov.in/cms/manual-on-water-supply-and-treatment.php*
2. *https://www.iwapublishing.com/news/coagulation-and-flocculation-water-and-wastewater-treatment*
3. *http://www2.canadianconsultingengineer.com/awards/pdfs/C-7_NorthBayWaterTreatment.pdf*
4. *PPT of M/S amiad on their WTP done by them for BHEL presented in seminar*
5. *https://www.indiawaterportal.org/articles/scarcity-midst-plenty-paradox-drinking-water-kerala*
6. *https://greentribunal.gov.in/sites/default/files/all_documents/ReportApplicationNo134- 2015._compressed.pdf*
7. *https://www.researchgate.net/publication/325125369_Environmental_and_economic_evaluation_of_end-of-life_reverse_osmosis_membranes_recycling_by_means_of_chemical_conversion*
8. *http://cpheeo.gov.in/cms/manual-on-sewerage-and-sewage-treatment.php*

About the Author

Dr S Saktheeswaran is former Urban Sanitation Expert of World Bank in India and former Waste Management Expert Swatch Bharat Mission in Ministry of Housing & Urban Affairs and CEO, M/S Creative Environmental Consultants (CEC), the project management firm mentioned in this article.

Er.D. Harsha is former Additional General Manager, Bharat Heavy Electricals Limited, Tiruchirapalli, a former consultant to the L &T Shipbuilding project from concept to commissioning and mentor to M/S CEC for its projects, visiting faculty at engineering colleges and management institutes and is presently a freelance consultant based in USA and India.

Dr S Sundaramoorthy is Former Engineering Director, Chennai Metropolitan Water Supply and Sewerage Board, Indian Team Leader and counterpart to Japanese team leader for GOI Manual on Sewerage and Sewage Treatment and Member, Expert Committee of Government of India for Revision of the Manual on Water Supply & Treatment.

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



USE OF LARGE DIAMETER PE PIPES AS A RISING MAIN

By Dr. Madhusudan D. Chaudhari , Senior Vice President,
Projects & Business Development, Jain Irrigation Systems Limited



Primer

This paper deals about the water management project for agriculture at 'Balh valley On-demand (24x7 system) Irrigation Project' Mandi, Himachal Pradesh, India on turnkey basis including SCADA for command area of 2355 ha. Himachal Pradesh is northern-western ranges of Himalaya, elevation 350 m to 7000 m above msl. Topography comprising of hilly and valley terrain and so difficult to walk without help of stick. Agriculture land holding is very small and entire agricultural was dependent on rain only. During summer season there is no for agriculture although water is there during rainy season.

The Balh valley is spread over 20 km in Mandi district. The source of income for the farmer is only agriculture. Since many years Govt. of Himachal Pradesh made efforts to construct canal for irrigation purpose, but not successful because of undulated terrain and soft soil. Govt. of Himachal Pradesh has took initiative and made water available at door of farm by using PE pipes. In this article, case study cum salient feature of said project is highlighted and will act as a proven example where water can be made reachable at difficult terrain also for welfare of agricultural community by using PE pipes.

Concept of Project

In this project various sizes of HDPE pipes (900 mm to 110 mm) & Pressure rating PN 4 to PN 25 (length @ 300 km) are used to deliver the water at the door of each farm. Project was initiated on Jan 2008, water was lifted from hydel canal and transported at various places. Water storage tanks were constructed at various places mostly at higher elevation. Taking the advantage of slope, water is further transported to various farm by gravity.

The Balh valley on-demand irrigation project in its initial phase was planned using open channel (also called as canal) as the main water conveyance. But considering hilly terrain the cost on cutting hills for maintaining gravity level required for channels was enormous. Also acquiring of land from individual farmers for construction of open channels was the main hindrance that was stopping the efforts initiated by Government of Himachal Pradesh at many levels. Hence an integrated solution is provided by Jain Irrigation by proposing underground pressurized PE piping system for conveyance of water with automation (SCADA system) to cater the irrigation need of farmers in Balh valley area.

This project is included under Accelerated Irrigation Benefit Programmed (AIBP) of Government of INDIA. Under the scope of this Project, it is proposed to cover 2355 hectare CCA (Cultural Command Area) by the conjunctive use of surface (hydel canal) and ground water (tube well water). The water requirement of the Project is 37.08 cusecs.

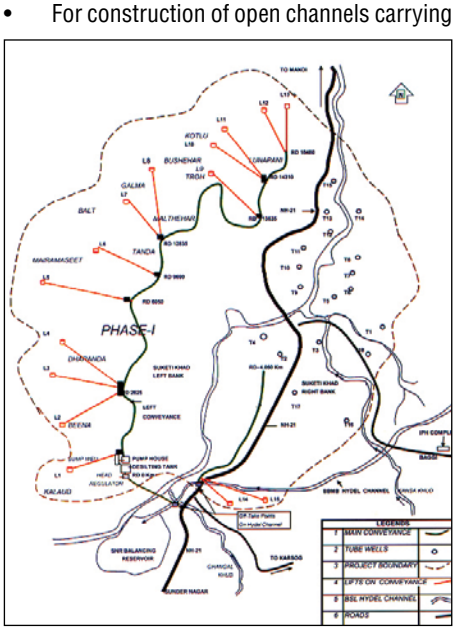
The underground rising main has been designed in such a way that it will remain always under pressure all the time and the lifted water is stored in tanks constructed at corresponding lift pump house in respective locality from where by pumping the water is taken to the distribution chamber constructed at the highest point of the command area from where the water is supplied to its respective command area by gravity as and when required. This project has been entirely automated using SCADA system, hence as per the water demand generated at farmer level, the water is lifted from the intake hydel canal (at head works), and the demand is fulfilled without any delay. This on-demand irrigation system is fulfilling and ensuring the demand of farmers round the clock.

Features of Project

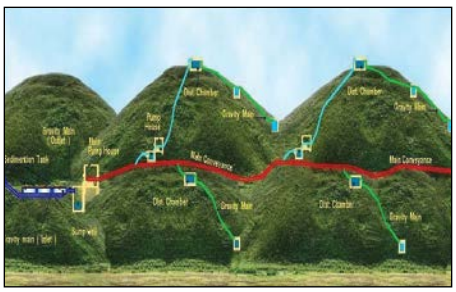
Considering the life (100+ years) of PE pipes and advantages as easy & fast installation at difficult terrain, no leakages & no wastage of water, withstand to sub-zero temperature, no repair & maintenance cost, no replacement cost, low capex & opex as compared to metal pipe or concrete pipes, PE has been proposed, designed, installed and working successfully.

- The project is completed in stipulated

- period, because of unique properties of PE pipes, like light weight pipes, flexibility of pipes, easy handling, fast installation.
- The on-demand irrigation system is functioning perfectly from last 11 years, due to perfect installation & use of PE leak-proof Pipes.
- Earlier Government department used to convey water through open canals, where @ 60% water just lost through evaporation, percolation & seepage.
- Another issue of theft of water and breakages of canal, which was very difficult to monitor and control. Because of PE pipes all those issue has been solved.
- On-demand fully automatic integrated irrigation system (using SCADA system) provides assured water for the agriculture needs as and when required (24 x7 system).
- Leak proof joints of PE pipes ensured ZERO leakages, thereby resulting in optimum utilization of available water.
- The area of Balh Valley (Himalayan region) is susceptible for earthquake vibrations and movement, wherein PE pipes can easily sustain the earthquake movements because of inherent stainability available within PE pipes and joints. Hence, PE as material of construction avoids post earthquake damages & post earthquake service is guaranteed.
- For construction of open channels carrying



Key plan of PE Piping Network (2355 ha)



Undulated terrain-PE pipe network.

of civil construction material (cement, sand, steel, aggregates, boulders, brick, water etc) at a altitude of 4000 feet in hilly terrain is very expensive and time consuming hence use of light weight-flexible PE pipes solved all the problems.

- In past, Government department used to convey water for such irrigation projects through open channels, where it is necessitated purchasing of desired strip of land for construction of open channels, whilst PE pipe installation is underground hence there is no need to purchase land for laying the underground pipelines.
- Smaller trench size is required for installation of PE pipes hence natural compaction of soil is maintained using PE pipe. This reduces the cost on excavation and soil displacements.
- Managing on site demand for change in layout of PE pipes raised because of immediate constructional requirements is also possible using on-site fabricated PE fittings.

Advantages of Large Diameter PE Pipes (HDPE) as a Rising Main

The project clearly demonstrates the inherent benefits and easy adaptability of PE pipe to adverse geo-climatic conditions. This can help engineers all over the world in selecting best piping material for rising main.

- ♦ PE pipes and joints resist forces generated as a result of earthquakes, landslides, soil-movements (typically observed in black-cotton soil).
- ♦ PE pipe is lightweight facilitating manual transportation of 6m pipe length and pipes in coil form on hill slopes besides easy maneuverability.
- ♦ PE pipe has longer service life span especially under varied hostile geo-climatic environmental conditions.
- ♦ PE pipe is lighter in weight, need less time for transportation and installation, ultimately reduces the overall project time and cost.
- ♦ Availability of local labor for efficient transportation of pipes and equipments in hilly region is a major problem, and by use of lightweight PE pipe results in savings in cost of labor.
- ♦ For PE pipe no coating/lining is required, which ultimately results in reduced operational overheads (short, medium and long term).

The above affirmative and positive results from this project paved the way for the installation of larger diameter pipelines in most difficult and hostile hilly terrain in any corner of the world. Engineers worldwide can aid and assist users worldwide by sharing the project success.

The Balh Valley on-demand irrigation project involving installation of large diameter PE pipes up to 900mm OD pipes as rising main under adverse conditions is an unique project. Many infrastructure industries worldwide will be



PE pipe installation on hilly area



PE pipe installation on difficult terrain

benefited by sharing the project adventures and challenges, which helps them to identify issues and obstacles long before they become a problem while executing similar projects, and refrain it users from blindly following the old methods, traditional materials of construction for their piping needs.

Conclusions

It has been noted from the success of the project and after 11 years of operation and maintenance period, that this project is truly exceptional in registering the sustainable pioneer endeavors undertaken by Jain Irrigation Systems Limited. This effort was through medium of PE pipe as a primary material of construction for rising (pumping) main, which is extremely comfortable under hostile (heavy rains/cold) weathering condition, as well as under undaunted geographical life in that area.

The use of PE pipes & fittings for using in on-demand irrigation projects as rising main over traditional use of open channel above-ground conveyance of water, where the losses of precious and depleting water resources is totally eliminated and this can facilitate engineers all over the world in justifying the deserving candidature for a special mention.

About the Author

Dr Madhusudan D. Chaudhari is Senior Vice President, Projects & Business Development. He is Ph. D. in Civil/Structural Engineering from IIT Bombay and Post Doctorate in Civil/Structural Engineering from University of Arizona, USA.

He has overall experience of 25 + years in Piping System/Civil Engineering-water supply, waste water, Desalination, irrigation projects in India and abroad. He has 9 + Technical publications at National/International Conference/Magazines.

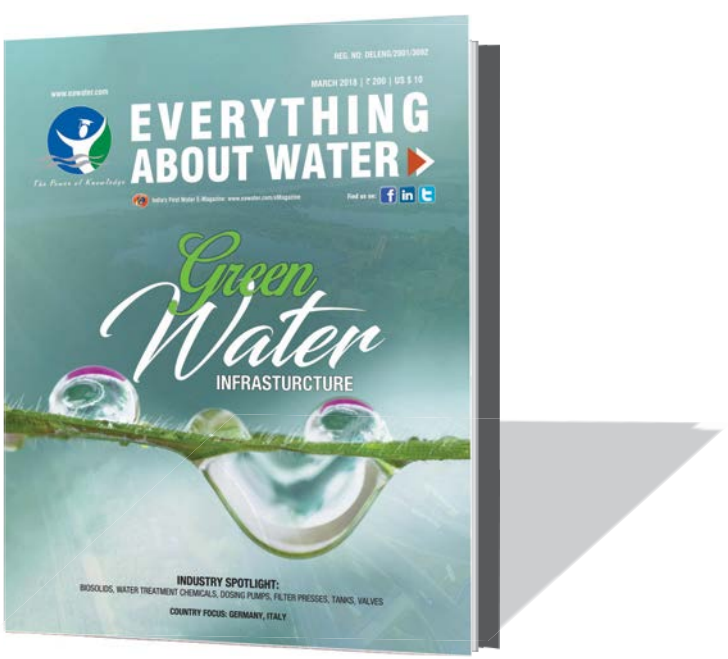
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CHAOYANG UNDERGROUND PUMPING STATION WILL IMPROVE WATER SUPPLY TO 1.5 MILLION RESIDENTS

Bentley's Collaborative 3D Modeling Applications Reduced Design Errors by 95% and Save CNY 10 Million

By Bentley India

Resolving a Water Distribution Shortage

The Chaoyang underground pumping station project aims to pressurize and transfer water to purification plants, which will improve water supply to 1.5 million residents in China's Liaoning province. After pressurization at the station, the water will flow through several pipelines to be treated at different facilities. Then, the water will be distributed throughout the region at a maximum capacity of 440,800 tons per day to help alleviate the water shortage for industrial and agricultural production, the ecological environment, and domestic use. The CNY 82 million water improvement scheme is expected to promote sustainable economic, social, and environmental development that will not only benefit the local area, but also boost the revitalization of Northeast China.

Liaoning Water Conservancy and Hydropower Survey and Design Research Institute served as the design unit for the project, which features numerous aboveground and underground structures, including a power plant buried 75 meters underground, a water supply tunnel, a substation, nine pumps, and aboveground management infrastructure. To ensure adequate water pressurization and distribution, they needed to connect and integrate these structures, and they faced technical, engineering, and coordination challenges managing 13 different disciplines amid a tight timeline.

Establishing Digital Engineering Processes

Located in a gully between the Daling River and low hills, the project area is narrow and presented complicated geological conditions, compounded by the underground plant requiring connection to the power distribution room in the aboveground management zone. The site also featured underground functional caverns, including a ventilation corridor, drainage corridor, and traffic hole,that impacted the tunnel layout, pipeline configuration, and structural connections between the buildings. "The Chaoyang underground pumping station project has a large number of aboveground and underground structures with complex geological conditions, interlaced underground caverns, and densely distributed pipelines for electro-mechanical equipment," said Jian Pan, BIM engineerwith the Liaoning Water Conservancy and Hydropower Survey and Design Research Institute.

Faced with these site and structural challenges, the institute realized that 2D traditional design processes were not sophisticated enough to adequately arrange the plant infrastructure on such a short design schedule, and would negatively impact construction and investment. They wanted to implement collaborative 3D digital solutions to efficiently coordinate the multiple disciplines and optimize design and construction while meeting schedule and budget demands. However, to achieve this lifecycle digitalization, they needed integrated BIM and reality modeling technology in an open, connected data environment.

Leveraging Bentley's Integrated Applications

The institute selected ProjectWise and MicroStation to develop a collaborative design management system, and leveraging Bentley's 3D BIM and reality modeling applications, facilitated coordinated design and information sharing among the 13 disciplines. Working in this connected data environment provided a unified engineering approach, enabling multidiscipline data management and design, streamlining workflows on the short design cycle. "Chaoyang underground pumping station has comprehensively adopted ProjectWise, 3D geology, oblique photography, 3D reinforcing, 3D virtual modeling, VR roaming and digital delivery to achieve all-around 3D co-design, defeating all difficulties encountered during the engineering phases," said Wang Yixin, director of the digital center.Using drones and ContextCapture, they collected data and images to generate a reality model of the 1.2 square-kilometer project area, and with OpenRoads applications, developed a 3D geological model for the deeply buried underground plant.

To address the complicated layout, avoid collisions between the cavern structures, and optimize configuration of mechanical and electrical equipment in the limited space, the institute relied on the clash detection features in OpenBuildings Designer and Navigator. Through the innovative application of LumenRT, they vividly visualized the entire facility design to identify errors and design deficiencies, improving overall design quality. Leveraging Bentley's integrated software applications, the institute established collaborative digital engineering processes, performed construction simulation, and achieved 3D mixed-reality solutions that allowed them to fully grasp the site conditions and overcome the geological, coordination, and technical challenges of the project.

Digitalization Promotes Industry Transformation

"Bentley's software has laid a solid foundation for refined design, standardized construction, and reasonable management, as well as created favorable conditions for improving project quality, accelerating design progress, and reducing project investment," said Pan. Working in a connected data environment using ProjectWise as the collaborative platform simplified workflows and streamlined coordination and communication among the various disciplines, shortening the design cycle from 70 days to 50 days. Using Bentley software to perform clash detection and construction simulation reduced engineering construction costs by CNY 10

million. Compared to traditional design methods, Bentley's collaborative 3D modeling and visualization application increased design efficiency by 40% and reduced design errors by 95%.

Through the integration of BIM, reality modeling, and virtual reality technology, the institute clearly and intuitively expressed design intent and achieved digital deliverables that can be applied and extended into the construction, management, and operations of the plant. They developed mixed reality solutions that support coordinated engineering and visually demonstrate the design and construction processes, improving quality and efficiency and resolving on-site issues to achieve design optimization, cost savings, and technological innovation. Based on the success of this project, they have developed corporate collaborative BIM standards and are taking the lead in applying Bentley's advanced digital workflows to future projects, driving digital transformation within the water conservancy industry.

Project Summary

Organization: Liaoning Water Conservancy and Hydropower Survey and Design Research Institute Co., Ltd.
Solution: Water, Wastewater, and Stormwater Networks
Location: Chaoyang, Liaoning, China

Project Objectives:

- To apply BIM technology to overcome challenges designing the Chaoyang underground pumping station.
- To develop mixed-reality solutions that can be extended into construction, operations, and maintenance stages.

Project Playbook: Context Capture, LumenRT, Micro Station, Open Buildings, Open Roads, Project Wise

Fast Facts

- The Chaoyang underground pumping station will help improve water distribution to 1.5 million residents in Liaoning province.
- Project Wise and Micro Station provided a collaborative environment for coordinated modeling and information sharing among the 13 design disciplines.
- Bentley's open BIM and reality modeling and visualization applications enabled them to fully grasp site conditions and perform clash detection.

ROI

- Using Bentley modeling, visualization, and construction simulation applications shortened the design cycle by 20 days.
- Working in a connected data environment streamlined the design process, improving design efficiency by 40%.
- The digital mixed-reality solutions reduced design errors by 95% and saved CNY 10 million.



The Chaoyang underground pumping station will help improve water distribution to 1.5 million residents in Liaoning province. Image courtesy of Liaoning Water Conservancy and Hydropower Survey and Design Research Institute Co., Ltd.



ProjectWise and MicroStation provided a collaborative environment for coordinated modeling and information sharing among the 13 design disciplines. Image courtesy of Liaoning Water Conservancy and Hydropower Survey and Design Research Institute Co., Ltd.

About the Company

Bentley Systems (Nasdaq: BSY) is the infrastructure engineering software company. We provide innovative software to advance the world's infrastructure - sustaining both the global economy and environment. Our industry - leading software solutions are used by professionals, and organizations of every size, for the design, construction, and operations of roads and bridges, rail and transit, water and wastewater, public works and utilities, buildings and campuses, mining, and industrial facilities. Our offerings include Micro Station-based applications for modeling and simulation, Project Wise for project delivery, Asset Wise for asset and network performance, Seequent's leading geosciences software portfolio, and the iTwin platform for infrastructure digital twins. Bentley Systems employs more than 4,000 colleagues and generates annual revenues of more than $800 million in 172 countries. To know more about the company, please visit them at www.bentley.com.

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

GSSE set to make a resounding splash with its debut

Intro:

An immersive, international B2B exhibition-cum-conference powered by Jindal Stainless, the Global Stainless Steel Expo by Virgo Communications & Exhibitions, is an exceptional event that water sector stakeholders would not want to miss.

The tides seem favourable for the water supply sector where Financial Year 2022-23 is concerned with the inaugural edition of an extremely relevant new trade expo set to make waves in the beginning itself! Yes, the water sector stakeholders can look forward to exciting business and networking opportunities at the Global Stainless Steel Expo (GSSE). Launched by the reputed tradeshow organizers, Virgo Communications & Exhibitions, their latest offering, which is quite important for the water industry, will be held at Jio World Centre, BKC, Mumbai from April 12-14, 2022.

The 3-day international event, which is on the fast track towards an immensely successful debut considering the leading industry brands and associations participating, has been envisaged as a dedicated international B2B exhibition-cum-conference that will be providing a single-point source, an exclusive platform where all the stainless steel stakeholders - manufacturers, buyers, influencers, regulators, various industry associations and media – from across the globe can converge.

G Raghu, Director of Virgo Communications & Exhibitions, said, “GSSE will serve as the largest face-to-face meeting point for the stainless steel industry to achieve trade objectives and generate business. The event will be hosted by strictly adhering to all safety measures concerning



GSSE
GLOBAL STAINLESS STEEL EXPO 2022
12-14 APRIL | JIO WORLD CONVENTION CENTRE | MUMBAI
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COVID-19. The new state-of-the-art venue, Jio World Convention Centre will provide an international experience to all exhibitors and visitors. The exhibitors are more than eager to meet with their industry peers to forge new collaborations and enhance usage of stainless steel in 200+ sectors”.

What makes GSSE 2022 a must-attend event for the water supply sector players is the fact that stainless steel offers lightweight, durable design solutions to the water industry. The metal also contributes to environmental benefits through lack of contamination of drinking water, reduced environmental impact of the water industry, and recyclability. It is an ideal material for the water industry. Moreover, stainless steels provide excellent corrosion resistance, tolerance of high flow rates, good strength and ductility, easy fabrication, ready availability in a wide range of forms, very low leaching levels into water, excellent durability, and full recyclability.

Globally, the water industry is investing billions of dollars to meet increasing standards and increasing demand. Choosing stainless steels for an application ensures that it will be produced in a responsible way, with an extremely low life-cycle inventory, have low, or close to zero, maintenance costs during its long life, and that it will be reused indefinitely because it is easy to recycle without any loss of quality nor material integrity.

Stainless steel has proven to be the ideal material



to ensure safety and purity of water across the world. Water pipes made up of plastic and poor quality steel tend to leak or rust leading to the contamination of treated water. It is estimated that about 37.3 million lives are affected annually in India due to water borne-diseases. An integrated waste water treatment plant can lead to reclamation, recycling and re-treating of water. World over, stainless steel is therefore being increasingly used for water management.

Ergo, the rising trend is making waves with each passing year. It is more than evident that stainless steel is the material of the future for all sectors, with the water sector being a key demand driver and one of the largest consumers. Therefore, every single stakeholder involved has much to gain from attending this landmark sourcing event.

Explaining the importance of this element and the event, Vijay Sharma, Director, Jindal Stainless, said, "As the exclusive Title Partner of GSSE, we are looking forward to meet fellow stakeholders in the stainless steel ecosystem, including suppliers, users, traders, associations, regulators, and makers. Together with these partners, we intend to leverage this event to discuss issues pertinent to the growth of India's stainless steel industry, and solutions needed to raise the bar for the whole country."

GSSE 2022 will also have Outokumpu, Ratnamani, Laxcon Steel and Minox Metal as Gold Partners. Other participants include Aperam, Rimjhim Stainless, Tubacex, Synergy Steel, Chandan Steel, Ambica Steel, Rajputana Stainless, Divine Tubes, Scoda Tubes, Welspun, Balaji Niryaat, Suncity, Shiv Ganga, Vizinox, Avtar Steels, Phoenix Foils, Moonlight, Navbharat Tubes, Salem SS Suppliers, Hisar Metal, Shree Tubes, Panchratan Steels, Quality Foils, Maiden Forgings, Moonlight Tubes, Shree Ramdev, Veritas Stainless, Alok Ingots, ASB Tubes, Vashisht Alloys, Stainless Bazaar and many others.

GSSE 2022 will have participation of leading manufacturers of long & flat products, duplex, bars, pipes, tubes, sheets, coils, finished goods, machinery, technology, tools, welding equipment from India and overseas. The visitors' profile includes segments like architecture, building & construction, automotive, transportation, dairy, white goods, water & waste management, gas & energy, pharmaceutical/medical devices, food processing/wine/alcohol/beverage, hospitality/ lifestyle, oil, HVAC & refrigeration, infrastructure, defense, cookware/utensils, laminate / hardware, 3D printing and much more.

The concurrent conference theme "Moving towards Building a Stainless Future", will have 12 knowledge-packed sessions with extremely topical sessions on 'Boosting Application in Architecture, Building and Construction Sector', 'Enabling Application in Water Re-Cycling, Water Distribution and Waste Management', 'Powering the Automotive, Railway & Surface Transportation Industry in India', 'Masterclass on Welding, Corrosion and Fabrication', 'The role of Digital in enabling transformation of MSME's' and 'Fueling New Applications for End-User Industries and Emerging Markets' among others.

GSSE is supported by Indian Stainless Steel Development Association (ISSDA) as Lead Association, Pegasus Consulting as Knowledge Partner, Stainless Bazaar as Digital Partner, Stainless Steel Pipe & Tube Manufacturer Association (SSPTMA), Metal and Stainless Steel Merchants Association (MASSMA), All India Stainless Steel Industries Association (AISSIA), Stainless Steel Merchants Association (SSMA), Process Plant & Machinery Association of India (PPMAI) and Non-Ferrous Metals Association-Karnataka (N'MAK).

Rajeev Sherry, Managing Director, Outokumpu India and steering committee member said "We are upbeat as business activity has picked up and there is pent-up demand for quality stainless steel. GSSE is an apt platform to showcase impressive, efficient and state-of-the-art solutions to potential customers".

GSSE 2022 will be a crossroad where the entire stainless steel industry will come together to showcase the latest developments in the industry, share knowledge and their expertise. One can participate in discussions on new-age cutting edge technology and familiarize themselves with the best technology from across the world.

This focused exhibition will be open only for trade visitors who are interested in knowing about the latest stainless steel innovations, new launches in the market and sourcing directly from the manufacturers.

With adequate safety precautions in place, the exhibition will be hosted with necessary care and precautions to avoid the spread of COVID-19. Specific requirements for Service Providers, Exhibitors and Visitors are being flawlessly implemented. The Standard Operating Procedure (SOP) to be followed for holding Business-to-Business (B2B) trade shows, issued by the Department of Commerce, Government of India are also taken into consideration.

Jio World Centre in BKC is a state-of-the-art convention facility spread over 8.7 million sq. ft. that offers a world-class experience and ambience for commerce, large events, festivals, and concerts. The synergy between modern architecture and nature is highlighted in the top-level services at the venue. The venue is built with the ambition of bringing the world to India.

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12-14 April 2022

Timings: 10 am to 6 pm

Jio World Convention Centre (Entry from Gate No.20), Mumbai

WHY PURITY OF OXYGEN IS SO IMPORTANT IN OZONE GENEARTION?

I have always been advocating that we should not be wasting time in re-inventing the wheel. We need to leave the specialists to do the work they are good at. The oxygen supply to the ozone generator is very important. It has to have the required purity, the required pressure and the required dew point. All the three will affect the performance and the reliability of the system, It for this reason I am always against an Ozone manufacturer manufacturing oxygen system. Of course, if we are able to make a reliable oxygen system that confirms strict specification of the ozone feed gas, it should be ok. Often the oxygen system in not given the requisite importance and resulting in frequent failures of system and the process

PURITY: This has reference to the percentage of oxygen in the gas. Oxygen plants generally produce oxygen at around 93% purity. Liquid Oxygen has about 99% and above purity. This means that if we feed a 93% oxygen, it means that the oxygen gas contains 93% oxygen, and the rest inert gases like Argon etc. To remove the more than 78% Nitrogen from the Air will require special media that is very expensive. The media should also be selected so that it consistently adsorbs the nitrogen required to produce over 93% oxygen gas. Ozone generators are calibrated to produce ozone at different concentrations depending on the volume and purity of the feed gas will affect ozone production, subsequently the process. Most of the time this factor is ignored. Cost of oxygen plants can be manipulated based on the quantity of molecular sieves used and the pre treatment of air

The molecular sieve media is hygroscopic. That means it can absorb moisture if it is exposed and deteriorate in quality, effecting the purity of the oxygen. Small oxygen concentrations that are used take air from the plant room and hence water /moisture in the room, relative humidity can all interfere in the performance. To prevent accumulation of water vapor in the plant room, it is always suggested to have free recirculating air by way of an exhaust fan The systems are to be installed in a dry place .In larger oxygen plants this issue is resolved since compressed dry air is used



Ozone System using small oxygen Concentrators

PRESSURE: Many ozone generators require high pressure (2-3 Bar) oxygen as feed gas. By stipulation of high pressure they are ruling out high dew point (PDP). This is because the higher the air is compressed the more water is removed and the performance of the molecular sieves are far better at higher pressures. Small Oxygen concentrators provide oxygen at very low concentrations (the medical oxygen generators). Small Oxygen concentrators at high pressure are manufactured by very few companies like Sequel, Airsep. They are classified for industrial use and are expensive, Customers often do not want to use them since they are aversed with the high cost-plus service availability if required. Normally these units are very dependable.

DEW POINT (Pressure Dew point) Dew point suggests the quantity of moisture in the air. It is specifically important if air is used as feed gas. Using feed gas as air will generate up to 5% ozone concentration (since air has only 19-21% oxygen compared to 93% and above in oxygen). However, in the manufacturing of an oxygen system the PDP of the air feed to the oxygen plant is important since excess moisture will affect the performance of the Molecular sieves. Hence air preparation becomes very important and design of the air preparation will have a bearing up to the ozone production

Therefore, it is important that prospective users of ozone realize the importance of the oxygen system that is supplied with the ozone generator. In my 30 years of experience in ozone, 70% of the issues with ozone systems are due to the oxygen system. Oxygen plants meant for an ozone system have unique specifications and are quite different from oxygen system supplied to other industries like steel plants etc.

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NEW DATES

12-14 April 2022

Timings: 10 am to 6 pm

Jio World Convention Centre (Entry from Gate No.20), Mumbai

EXHIBITORS

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TENDERS

Ownership:
Central Government / Public Sector
Tender Value: N.A.
Location: Delhi - India
Closing Date: 20-4-2022
Ref No: 47964258

Supply of pWTP(02 nos) at mehsana asset

Ownership:
State Government
Tender Value: 40,400,000.00
Location: Delhi - India
Closing Date: 31-3-2022
Ref No: 47965847
Comprehensive annual operation and maintenance of including round the clock security service and repair and maintenance of all civil works including building, roads hard standings, paths, security wall, sewer lines, plumbing, drainage works, sanitary pantry fittings fixture, ther related items etc internal nd external electrical works dg sets specialized e &m equipment and camc of lifts, RO and water coller, general pest control,STP Plants,building management system with cctv camera,fire fighting system with wet riser, sprinkler and fire alarm,water supply system, transformers, ht electricity panels, lan system, wi-fi system, epbax system, STP, solar power generation Plant, Rain water Harvesting system, public address system, it works, o&m of ups, mechanized housekeeping, horticulture.

Ownership:
Corporations / Associations / Others
Tender Value: 2,000,000.00
Location: Chhattisgarh - India
Closing Date: 23-3-2022
Ref No: 47940223

Supply of building construction materials. Repair work of different types of submersible pump / panel board. Providing of necessary materials for water research machinery. Providing of JCB on hire basis for tractor tanker/ drain, drain cleaning and leveling work for drinking water supply. Drain and other construction/ repair work in different ward. Building and other construction /repair work in different ward. Zonal work different ward (different construction work). Tap connection shifting/new connection supply work. Rain water Harvesting construction work.

Ownership:
Central Government / Public Sector
Tender Value: 2,358,139.00
Location: Gujarat - India
Closing Date: 21-3-2022
Ref No: 47960058
Operation and maintenance of Reverse Osmosis Plants for 24 months (2) repairs to Reverse Osmosis Plants

Ownership:
State Government
Tender Value: 810,001.00
Location: Uttar Pradesh - India
Closing Date: 21-3-2022
Ref No: 47967237
Annual operation and maintenance of Sewage Treatment Plant situated at 2x500 mw d tps anpara

Ownership:
State Government
Tender Value: 225,687,733.00
Location: Gujarat - India
Closing Date: 19-3-2022
Ref No: 47932160
Providing, supplying lowering, laying and jointing various dia di & pvc pipeline, construction and designing of WTP, storage at various bhuj part-2 villages, pumping machinery for bhuj part-2 rwss augmentation scheme (under nal se jal programme 2020-21 bhuj part-2).

Ownership:
State Government
Tender Value: 17,243,000.00
Location: Uttar Pradesh - India
Closing Date: 19-3-2022
Ref No: 47959299
services-annual miscellaneous maintenance work for Sewage Treatment Plant and water supply system

Ownership:
State Government
Tender Value : 4,653,000,000.00
Location: Delhi - India
Closing Date: 18-3-2022
Ref No: 47781950
Press nit no. 19 (2021-2022) ee(sdw)viii augmentation/up-gradation of various existing STPs in delhi (package-1)

Ownership:
Central Government / Public Sector
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 17-3-2022
Ref No: 44864887
Augmentation of sewage system including Sewage Treatment Plant at cme.

Ownership:
Central Government / Public Sector
Tender Value: 101,120,000.00
Location: Bihar - India
Closing Date: 17-3-2022
Ref No: 47228541
Provision of central sewage system including STP at mil station.

Ownership:
Central Government / Public Sector
Tender Value: 8,930,000.00
Location: Kerala - India
Closing Date: 17-3-2022
Ref No: 47932332
Provision of Rain water Harvesting at af stn sulur (phase-i)

Ownership:
Corporations / Associations / Others
Tender Value: 3,132,000.00
Location: Haryana - India
Closing Date: 25-2-2022

TENDERS

Ref No: 47959768
Grey water management under sbm (g) phase 2 at village banwala block dabwali district

Ownership:
Central Government / Public Sector
Tender Value: 5,155,911.00
Location: West Bengal - India
Closing Date: 16-3-2022
Ref No: 47932223
Electrical work for Water Treatment Plant for supplying water to settlement.

Ownership:
State Government
Tender Value: 6,608,557.00
Location: Maharashtra - India
Closing Date: 16-3-2022
Ref No: 47936450
Construction of wbm road from shiloda main chowk to Annual maintenance contract swerage Treatment Plant (STP), in p.no.01

Ownership:
Central Government / Public Sector
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 16-3-2022
Ref No: 47973277
Supply of filtration unit as per specification no hemrl / nm /spec / 117 (q3)

Ownership:
State Government
Tender Value: 2,125,000.00
Location: Karnataka - India
Closing Date: 15-3-2022

Ref No: 47960098
Providing installation and commissioning of water Purification system with dispensers at kspcb corporate.

Ownership:
Corporations / Associations / Others
Tender Value: N.A.
Location: Gujarat - India
Closing Date: 15-3-2022
Ref No: 47969271
Operation and maintenance with comprehensive repairing, maintenance of all electrical and mechanical equipment and cleaning works of water pumping station with labor and material upto 31.07.2025 of 06 nos water pumping stations of south zone of amc.Comprehensive repairing, servicing, and maintenance of Chlorination system with connection, disconnection and transportation of chlorine cylinder up to 31.07.2022 of 06. nos water pumping stations of south zone of amc.Rate contract for servicing, repairing, breakdown, routine and preventive maintenance of 11 KV H.T switch gears, transformers with H.T. and L.T. electrical panel and equipments of different wds of amc. All in all comprehensive repairing work of 33 nos. KSB make submersible pump - motor sets with lifting, lowering and its electrical mechanical equipments of different borewells of central zone of amc for two years.

Ownership:
State Government
Tender Value: 490,728.00
Location: Gujarat - India
Closing Date: 15-3-2022
Ref No: 47972143
Work of in-situ Repairing / overhauling / Reconditioning of High Pressure Valves & Safety Valves at KLTPS during AOH/COH and on as when required basis of Unit 3. Repairing Work of R.O. Plant and various Sign Boards at GSECL colony KLTPS. Consultancy Services for strengthening of CW pump house & Fire pump house at KLTPS.

Ownership:
Corporations / Associations / Others
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 14-3-2022
Ref No: 47930389
Design build and operation and maintenance of ghatkopar wwtf

Ownership:
Corporations / Associations / Others
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 14-3-2022
Ref No: 47930391
Design, build, operate and maintenance of malad wwtf

Ownership:
Corporations / Associations / Others
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 14-3-2022
Ref No: 47930576
Design, build and operation and maintenance of bandra wwtf

Ownership:
Corporations / Associations / Others
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 14-3-2022
Ref No: 47932578
Design build and operation and maintenance of bhandup wwtf

Ownership:
Corporations / Associations / Others
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 14-3-2022
Ref No: 47932579
Design, build, operation and maintenance of versova wwtf

Ownership:
State Government
Tender Value: N.A.
Location: Maharashtra - India
Closing Date: 14-3-2022
Ref No: 47933150
Design, Build, Operate and Maintenance of Worli Wwtf, Malad Wwtf, Dharavi Wwtf, 360 MLD Bandra Wwtf, Ghatkopar Wwtf, Bhandup Wwtf, Versova Wwtf Under Msdp Statge -ii.

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