



CORDIS Results Pack on **water innovation in India**

A thematic collection of innovative EU-funded research results

November 2023

Sustainable solutions for water management

*Research and
Innovation*

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Editorial

Sustainable solutions for water management

India has 18 % of the world's population but only [4 % of the world's water resources](#). This Results Pack highlights the work of seven successful Research and Innovation Actions co-funded by the EU Horizon 2020 programme and the Government of India. The innovative solutions developed by these projects are making it possible for India to achieve a more sustainable use of water and to improve access to clean water, as well as strengthening scientific cooperation between the EU and India.

Globally, 2.1 billion people [live without access to safe water](#). Among them are 160 million people worldwide who collect their drinking water directly from surface water sources, where they are exposed to pollutants such as sewage, industrial waste waters, pollution and contaminants of emerging concern (CECs) such as genetic material, pharmaceutical residue and synthetic hormones.

This issue is particularly prominent in water-stressed areas such as India. Here, [63 million people](#) do not have access to clean drinking water, with shortages also affecting irrigation and industrial use. There is an acute need for effective solutions to increase access to safe water and treat waste water for recycling, to prevent outbreaks of waterborne illness such as diarrhoea, cholera and typhoid. In addition, clean, reliable water supplies are essential to serve the needs of the population and provide growth and prosperity.

This Results Pack casts a spotlight on the groundbreaking work carried out by projects funded under a pioneering collaboration between the EU and India's [Department of Science and Technology](#) and the [Department of Biotechnology](#) within the Indian Ministry of Science and Technology. All projects are dealing with environmental challenges and focus notably on water management and treatment.

The seven projects address a range of important issues, including: drinking water purification, with a focus on emerging pollutants; waste water treatment, including bioremediation technologies, with scope for rainwater harvesting and resource and energy recovery; and real-time monitoring and control systems in water distribution and treatment systems.

The coordinated support of EU and Indian funding programmes is allowing new innovations to be devised, developed and demonstrated in field trials. Not only is this work providing a foundation of innovative methods and technologies within the specific geographical areas targeted by the different projects, but it brings solutions that can be applied and upscaled throughout the whole country. From these projects, several new technologies are emerging: they are ready for scale-up and market uptake. In the framework of the [Trade and Technology Council](#) (TTC), the EU and India are committed to following closely the market uptake of these new technologies and products, so as to ensure a good return on investment for research and innovation cooperation between the EU and India.

Nature-based treatment of brackish groundwater in India

Offering a low-cost, high-recovery solution for extracting potable water from saline groundwater, the INDIA-H2O project's nature-inspired technology is also energy-efficient and scalable, and not only reduces waste, but recycles it.



Over [2 billion people still lack safely managed drinking water](#). The arid Indian state of Gujarat suffers acute water scarcity, with limited surface water and increasingly saline groundwater due to abstraction activities and rising sea levels. Desalination technology could remove salt from these ground sources, but existing processes are energy-intensive, costly and environmentally damaging.

In response, [INDIA-H2O](#) has developed a promising nature-inspired water treatment system, powered by renewable energy. The project is co-funded by the EU and India's [Department of Science and Technology](#).

"Our water purification technology, known as hybrid-batch reverse osmosis, benefits from low energy consumption while converting 95 % of contaminated water into clean water," says Philip Davies, professor of Water Technology at the [University of Birmingham](#) and INDIA-H2O project coordinator.

Technologies that mimic nature

Osmosis is a natural process in which water molecules cross a semipermeable membrane, and can be seen in how water molecules travel into and out of plant and animal cells. Crucially, these membranes act as a barrier to other molecules and particles (solutes) in the water.

INDIA-H2O explored [hybrid forward and reverse osmosis water treatment](#) based on biomimetic membrane technology, which embeds novel biological proteins to transport clean water across the membrane. Forward osmosis mimics how water is drawn into cells; reverse osmosis uses pressure to force the water through.

INDIA-H2O's reverse osmosis approach, uniquely configured to recycle the energy used to pressurise the water, can remove almost all the salt from water without discharging large volumes of liquid waste, which is usually the case with other desalination techniques. "The pressure required usually needs at least 1 kWh of electricity for 1 000 litres of drinking water," notes Davies. "Our design, which [features a pressure exchanging piston](#), halves this."

INDIA-H2O's solution can also remove emerging pollutants (such as agricultural chemicals), as well as recover high-value waste water reagents generated by industrial processes, such as textile dyes.

Additionally, the potential to operate these water treatment processes intermittently makes renewable energy ideal as a power source.

"As well as being arid, Gujarat is sunny, making solar energy an obvious choice," says Anurag Mudgal, from [Pandit Deendayal Energy University](#) (PDEU) in Gandhinagar, Gujarat. "The system's compact design makes it suitable for rural communities whose livelihoods are threatened by climate change."

It takes a village

INDIA-H2O's approach is now being piloted in the Gujarati village of Lodhva, where it is currently producing around 800 litres of clean water per hour.

The technology has been installed in a local school to provide all its drinking water, and at PDEU to pilot the small-scale extraction of safe drinking water from brackish groundwater.

"We are especially excited about developing these rurally relevant systems. They can produce seven to 10 cubic metres of safe drinking water a day using only solar power, or up to 20 using the grid. Costing less than 30 rupees per cubic metre, about EUR 0.35, they offer a real lifeline to communities," adds Mudgal.

The plan is to extend the capability of these village systems to include the recovery of clean water from rural domestic waste water.

To showcase the circular economy potential of the approach, INDIA-H2O is also trialling the cultivation of *Salicornia*, a salt-tolerant edible crop, using the brine by-product of the desalination process. Routes to market are currently being explored, alongside community funding for more installations, to provide the village with a new income stream.

Ensuring the sustainability and scalability of these demonstration systems locally, their design has been shared with Indian fabricators, along with a supply of the specialised membranes.

Building an enabling environment

In 2022, a [Centre of Excellence in Water Treatment and Management](#) was opened at PDEU, offering state-of-the-art facilities to test water treatment solutions. Additionally, after two successful international water management conferences held at PDEU, a third is planned for 2024.



Our water purification technology benefits from low energy consumption while converting 95 % of contaminated water into clean water.

The University of Birmingham has granted a licence for the hybrid batch reverse osmosis technology to spin-out company [Salinity Solutions](#), raising over EUR 1.4 million, and has already reached agreement with British firm [Te-Tech Process Solutions](#) to start production of bespoke water treatment solutions.

Meanwhile project partners are also busy exploiting the technology. The Indian [Central Electronics Engineering Research Institute](#) is currently commercialising sensor and monitoring technologies developed during the project. [Aquaporin](#) in Denmark, developer of the forward osmosis biomimetic membrane technology, has been listed on the Nasdaq Copenhagen, raising EUR 38 million.

PROJECT

**IndiaH2O – bio-mimetic and phyto-techNologies
Designed for low-cost purificAtion and recycling
of water**

COORDINATED BY

University of Birmingham in the United Kingdom

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/820906

PROJECT WEBSITE

india-h2o.eu



A high-tech, low-cost way to monitor water contaminants

The LOTUS project uses carbon nanotube technology to offer real-time monitoring of water supplies, helping to prevent deadly outbreaks of waterborne disease.



There are 746 million people living in India [without adequate sanitation facilities](#). As a result, 37.7 million people are affected by [waterborne diseases](#) annually, and 500 children under five die from [diarrheal diseases](#) daily.

“While clearly a health crisis, problems of water scarcity and quality also jeopardise the livelihoods of millions of people,” says Svetlana Klessova, [G.A.C. Group](#), France, coordinator of the [LOTUS](#) research and innovation project, co-funded by the EU and [India's Department of Science and Technology](#).

Rapid and accurate water quality monitoring has been identified as key to ensuring safe, high-quality drinking water for all in India. LOTUS has developed advanced sensor technology that allows potential contamination problems such as the presence of faecal

bacteria to be detected quickly, cutting resolution time and any negative impacts that could affect people.



We are confident that our device will not only benefit public health and safety but set a benchmark in water quality monitoring.

“Our solution detects harmful substances in the water, giving authorities and communities the information needed to improve water quality and optimise its use,” explains Bérengère Lebental, lead researcher at [Gustave Eiffel University](#) in France.

LOTUS's device is currently being tested in drinking water pipes in India, and its installation in tankers is also planned.

Co-designed with communities

The project team first worked with citizens, suppliers and authorities to map the needs and challenges of local communities. The groups then worked together to co-design and implement bespoke solutions.

“This collaboration helped us identify development of a low-cost portable water quality monitoring device as a priority. After community feedback, we iterated its design, ensuring its suitability for the local context and likelihood of adoption,” adds Senthilmurugan Subbiah, from the [Indian Institute of Technology Guwahati](#) (IITG).

The resulting compact, portable and low-cost LOTUS sensor uses technology based on carbon nanotubes. It is able to sense a wide range of chemicals relevant to water quality, including common pollutants and treatment chemicals such as chlorine.

When exposed to water, chemical compounds adsorb on the nanotubes, which can be tuned to react to specific chemical compounds. This changes their electrical resistance, allowing the concentration of the compound to be measured.

The LOTUS system converts the sensors' analogue signals into digital ones, which are processed and transmitted to the cloud-based data management. A user interface translates the measurements into actionable intelligence with user-friendly visualisation tools.

Real-time monitoring allows immediate action to be taken when contamination is detected, whilst the storage of historical data facilitates trends analyses.

“To facilitate its deployment throughout India, our solution provides wireless communication and, thanks to solar panels, autonomously powered sensors,” notes Lebental.

Sensor testing and pilot installations

The sensor was tested in a 40-metre-long water distribution network demonstrator in France, containing mains water with varying pH levels and chlorine concentrations.

“The results have been encouraging, with the sensor demonstrating high accuracy in detecting active chlorine and pH level in a drinking water pipeline,” says Lebental.

In partnership with communities, authorities and NGOs, the LOTUS sensors will undergo further trials in a test bench at the IITG. Afterwards, devices will be installed in the Guwahati city water distribution network to further demonstrate and validate the technology.

The project also developed several software solutions around the LOTUS sensor for monitoring drinking water systems, managing fleets of tankers and water-saving in irrigation. In the tankers, LOTUS sensors will be at the heart of a chlorine-based water quality management system developed by project partner [AUTARCON](#) in Germany.

Ripples of global collaboration

Building global partnerships is an effective means to achieve some of the UN Sustainable Development Goals. This is reflected in the LOTUS project's focus on technology transfer between Indian and European partners. The project has already shared the system's technology with [Hydroscope Technology](#), an Indian start-up that will commercialise the technology, supported by project partners.

“Thanks to its user-friendly interface and versatility across various water conditions, we are confident that our device, based on the LOTUS results, will not only benefit public health and safety but

set a benchmark in water quality monitoring, of interest to other regions facing similar challenges,” remarks Sudhanshu Mishra, CEO at Hydroscope Technology, India.

With regulatory approval, the technology will not only reach the market, but also contribute to Indian Government objectives, such as the [Jal Jeevan Mission](#) and the [AMRUT programmes](#) designed to improve rural and urban water and waste water infrastructures.

Towards its end, the project team will engage with policymakers, alongside conducting educational and outreach activities. “Earning community trust by improving public water quality will help reduce the use of individual home purifiers, cutting overall costs, saving energy and reducing waste,” concludes Subbiah.

PROJECT

LOTUS – Low-cost innovative Technology for water quality monitoring and water resources management for Urban and rural water Systems in India

COORDINATED BY

G.A.C. in France

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/820881

PROJECT WEBSITE

lotus-india.eu/



Making contaminated waste water safe for irrigation purposes

Co-funded by the EU and India's Department of Science and Technology, the PANI WATER project developed and deployed new technologies capable of making waste water safe for use in agriculture.



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In water-stressed countries, decision makers are looking at ways to recycle and reuse waste water. In urban India, it is becoming increasingly common practice to treat municipal waste water and reuse it to irrigate food crops.

"The problem is that this practice is largely unregulated," says Kevin McGuigan, a professor of Medical Physics at the [Royal College of Surgeons in Ireland](#) and coordinator of the European partners in the [PANI WATER](#) project. "The presence of some

emerging contaminants (ECs) in treated waste waters, including antibiotic-resistant bacteria and genes, poses an unnecessary risk of bioaccumulation in food crops, which eventually are ingested by humans.”

With the support of PANI WATER, McGuigan, together with Rita Dhodapkar, are leading an [international effort](#) to develop and deploy new technologies capable of producing safe irrigation water out of contaminated water sources. Dhodapkar, a senior researcher with India’s [CSIR-National Environmental Engineering Research Institute](#), served as the project coordinator for the partners based in India.

New waste water treatment technologies

Researchers began by examining the current state of play of waste water treatment in India. They created a database on ECs, such as pharmaceuticals and hormone disruptors, that had been observed in treated municipal waste waters within the project. “Our goal was to identify the gaps in the available technologies for treating these ECs in waste water,” explains Dhodapkar.

With this database in hand, the project then developed three technologies aimed at filling the identified waste water treatment gaps. Among them was a pilot-scale multifunctional reactor capable of treating 50 000 litres per day.

Researchers also developed a lab-scale solar-driven device for removing organic matter, microorganisms and contaminants of emerging concern (CECs), such as antibiotic-resistant bacteria, from waste water at the point it enters the main sewer. The prototype can treat up to 100 litres per day.

Last but not least, the project created an ultraviolet C (UVC)-driven advanced oxidation treatment process. The pilot-scale plant uses peroxidants as a means of treating as much as 10 000 litres of waste water a day.

While the project’s focus was on waste water treatment, it also developed and deployed new technologies for treating drinking water. These include combined activated carbon filtration and UVC-LED technologies for microbial remediation, along with electrocoagulation technologies for removing arsenic, fluoride, iron and faecal bacteria.

Demonstrating how the technology works

Working hand-in-hand, EU researchers and their Indian partners successfully validated these waste water treatment technologies during [a number of pilots](#) that were implemented across India. The pilots aimed to demonstrate how the technologies could be used to remove CECs, including antibiotic-resistant bacteria, along with other chemicals, toxins and pollutants.

Both Dhodapkar and McGuigan agree that these pilots represent an important step towards making waste water safe for agricultural use. “This was the first field study of this scale to target the safe reuse of waste water for agriculture – a direct result of the dedication of our international network of interdisciplinary researchers,” they say.

With these results in hand, the project’s EU and Indian partners are now working on a policy brief on reusing treated waste water for irrigation purposes.



Our goal was to identify the gaps in the available technologies for treating waste water.

PROJECT

PANI WATER – Photo-irradiation and Adsorption based Novel Innovations for Water-treatment

COORDINATED BY

Royal College of Surgeons in Ireland

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/820718

PROJECT WEBSITE

paniwater.eu/



Sustainable technologies help tackle water challenges in India – and Europe

The PAVITR project has resulted in a number of cost-efficient waste water and water treatment systems that are already benefiting over 50 000 people.



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While [India comprises 18 % of the world's population, it holds only 4 % of the world's water resources](#). This makes India one of the most water-stressed countries in the world, with [6 % of the population](#) facing extreme water stress.

The Government of India has [committed](#) to provide tap water connections to every household by 2024. To meet this goal, there

is an urgent need for effective solutions to increase access to safe water.

The [PAVITR](#) project is helping to answer this call. "The project aims to develop the cost-effective and sustainable solutions needed to ensure the provision of safe water across India," says Mirko Hänel, a researcher at [ttz Bremerhaven](#), the project's European coordinating partner.

Collaborative research

The project, which was co-funded by the EU and India's [Department of Science and Technology](#), brought together researchers and experts from across the world.

"The cooperation is a win-win situation, as India not only is a huge market for Europe, but also offers know-how, skilled staff and suitable climate conditions for nature-based solutions," adds Hänel. "By bringing together experts from both continents and working together towards a common goal, we've been able to address real social challenges."

Together, the project's [22 partners](#) developed and deployed 14 advanced innovative technologies.

"These market-ready technologies provide cost-efficient waste water and water treatment systems for rapidly expanding rural and urban water treatment, reuse and valorisation, and are adapted to Indian conditions," explains Hänel.

Among those technologies is an electro-chlorination unit. The station doses chlorine in very small quantities into the water for residual disinfection. Using an internal sensor, the amount of chlorine needed to achieve the treatment target is continuously adapted to reflect demand.

"Compared to common chlorination systems, our solution substantially reduces the amount of disinfectant used, overall costs and the risk of potentially formed by-products," notes Hänel. The station can supply 30 000 litres of water, which meets Indian and international guidelines, every day.

Research that benefits Europe too

Guided by India's coordinator Nadeem Khalil, professor of Environmental Engineering at [Aligarh Muslim University](#), PAVITR technologies have already been implemented across India, constituting a total treatment capacity of 824 000 litres per day, benefiting more than 50 000 people.

But why stop there?

To ensure an even bigger impact, the project's partners collaborated to develop new management and planning strategies to better

monitor pollution levels. They also provided evidence-based input to help India enact effective water-related policies.

Crucially, the project's work was not a one-way street. "PAVITR contributed to the development of sustainable technologies to cope with water shortages not only in India, but also in Europe, where climate change is expected to have a major impact on water resources," concludes Hänel.

Khalil adds: "The project has offered an excellent opportunity for research organisations, from both India and Europe, to collaborate and to enhance and enrich one another's knowledge and technical capacities in new and innovative technologies for water, waste water and sludge treatment; and demonstrated their efficacy for possible replication."



The project aims to develop the cost-effective and sustainable solutions needed to ensure the provision of safe water across India.

PROJECT

PAVITR – Potential and Validation of Sustainable Natural & Advance Technologies for Water & Wastewater Treatment, Monitoring and Safe Water Reuse in India

COORDINATED BY

Association for the Promotion of Technology Transfer at Bremerhaven University of Applied Sciences in Germany

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/821410

PROJECT WEBSITE

pavitr.net/



Delivering clean water to vulnerable communities on the Ganga

The PAVITRA GANGA team is piloting advanced technologies to treat and recycle water, benefiting communities in the Ganga River Basin. The systems are helping to protect local water sources from pollutants from tanneries, hospitals and industry.



The [Ganga River](#) is a sacred water source that flows east from the Himalayas through India and into Bangladesh. It is a critical component of India's economy and important for public health. Yet it suffers from high pollution and contamination by heavy metals.

The [PAVITRA GANGA](#) project is co-funded by the EU and [India's Department of Science and Technology](#). A collaborative team of Indian and European researchers are testing a range of advanced technologies to offer waste water treatment to communities who lack adequate access.

"The PAVITRA GANGA project aims to explore the opportunities for low-cost and energy-efficient solutions for waste water treatment, reuse and resources recovery in peri-urban India," says Jaiswal Anshuman, director of the Water Resources Division at [The Energy and Resources Institute](#) (TERI).

[Paul Campling](#), international business development manager at the Flemish Institute for Technological Research (VITO) and PAVITRA GANGA project coordinator, explains that the project focuses on two distinct urban and peri-urban waste water treatment cases typical for India.

The first is at an urban waste water treatment plant in Kanpur, on the banks of the Ganga River, which has been impacted by illegal discharges of tannery waste water into the sewage system. The second is an open drain in New Delhi, which is meant to remove excess rainfall during the monsoons but is likewise impacted by illegal discharges of industrial and hospital waste water.

"In both cases, socially vulnerable groups are using the partially treated waste water for irrigation and non-potable uses, which is detrimental to their health and well-being," adds Campling.

Exploring new treatment technologies

PAVITRA GANGA focuses on two types of treatment technologies. The first remove bulk organic material and nutrients, and the second, known as polishing technologies, remove contaminants of emerging concern such as pharmaceuticals and heavy metals.

One of the technologies trialled, a [self-forming dynamic membrane bioreactor](#) (SFD-MBR), separates solids and liquids through a self-forming cake layer on the surface. The team has shown this method offers improvements over conventional filtration systems.

Another is the [ANDICOS](#) modular system that can be added to existing treatment plants, filtering waste water through membranes to produce a sewage concentrate. This concentrate can be mixed with other organic waste streams to produce biogas and, eventually, electricity.

The team are testing additional treatment technologies, including constructed wetlands and structured adsorbents to remove pharmaceutical residues, and low-cost approaches for open drains, such as a [photoactivated sludge](#) (PAS) system that uses algae to remove pollutants.

"We are also working with the local population to improve awareness of the fact that it is more prudent to prevent waste water reaching open drains in the first place," notes Campling.

Proving technology in real-world pilots

All technologies studied by PAVITRA GANGA are first tested in the laboratory before being upscaled to demonstrate pilots under real-world conditions, with the collaboration of local scientists.

In total, the project is running eight pilots, some of which have been more successful than others. One issue has been the dramatic changes in the waste water quality before and after COVID-19, pushing beyond the design parameters of pilots based on previous water quality characteristics.

Nonetheless, Campling remarks: "The filtration-based pilots have worked extremely well considering the changing water characteristics."

There are ongoing discussions to implement successful technologies at other locations after the project funding ends. The team is also providing capacity-building workshops and online course material for Indian water professionals, through the establishment of a technology and learning network.

"The experience of working in collaboration with Indian researchers has been very rewarding," says Campling, "with a lot of interactions on how to design laboratory experiments to support real-world piloting."

Anshuman concludes: "The project partners' joint interventions bring significant learnings and insights for co-creating options for better water governance and policy interventions."



Socially vulnerable groups are using the partially treated waste water for irrigation and non-potable uses, which is detrimental to their health and well-being.

PROJECT

PAVITRA GANGA – Unlocking wastewater treatment, water re-use and resource recovery opportunities for urban and peri-urban areas in India

COORDINATED BY

Flemish Institute for Technological Research in Belgium

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/821051

PROJECT WEBSITE

pavitra-ganga.eu/en

Delivering decentralised waste water treatment systems to India

Many people across India lack access to safe drinking water. Researchers for the Saraswati 2.0 project tested a range of decentralised waste water treatment technologies to give local communities cleaner, more plentiful water.



India suffers from a low level of waste water treatment, with over [90 million people](#) lacking adequate access to safe water. The nation is also increasingly urbanised, with roughly a third of the population living in cities, making the treatment of urban waste water fundamental to public health.

However, large, centralised water treatment plants can prove unwieldy and inefficient in urban settings. The [Saraswati 2.0](#) project, co-funded by the EU and [India's Department of Science and Technology](#), investigated the potential of decentralised systems to offer a more flexible alternative that can address water scarcity issues by offering treated water for reuse.

"In countries such as India, the fragmented urban planning and large scale of cities makes centralised solutions generally unfeasible," explains Markus Starkl, Saraswati 2.0 project coordinator and senior scientist at the [University of Natural Resources and Life Sciences](#) in Austria.

"Decentralised systems provide the opportunity for treated waste water reuse, which is not possible in centralised systems due to the high cost involved in laying a pipe network," adds Makarand Ghangrekar, professor of Civil Engineering at the [Indian Institute of Technology Kharagpur](#) (IITKGP), and coordinator of the Indian Saraswati 2.0 team.



In countries such as India, the fragmented urban planning and large scale of cities makes centralised solutions generally unfeasible.

The project takes its name from the Hindu goddess of knowledge, music, arts and nature, as well as a [lost holy river](#) that once flowed through India. It is a continuation of a [previous project](#) that completed in 2017.

In the project, the European and Indian researchers are testing a series of waste water treatment and reuse technologies to identify candidates for best available technologies (BAT) status – technologies approved by regulators for meeting standards required for a given purpose.

Testing pilot technologies

Saraswati 2.0 is running 10 pilots in locations selected based on recommendations from Indian partners.

At the [Indian Institute of Technology Bhubaneswar](#), one pilot is testing an integrated waste water treatment system centred on an upflow anaerobic sludge blanket (UASB) reactor. This technology forms a granular sludge within a reactor, where the waste water is treated by anaerobic microorganisms.

"This has been proven to be a feasible and cost-effective technology for the regions with warmer climate conditions," says Ghangrekar.

Another technology known as C-TECH is being tested in Haridwar along the Ganga River. This is a [sequencing batch reactor system](#), in which all treatment steps are integrated into one basin before the treated water is discharged. This technology is currently used in India at large system sizes, and the Saraswati 2.0 project is testing a smaller-scale version for its potential use in decentralised treatment.

In a third pilot, a photoheterotrophic bioreactor is being employed for post-treatment of anaerobic digester effluent. This technology is proposed by [TU Delft](#) and is being piloted at the IITKGP.

Other pilots include technologies for household waste water treatment, effluent treatment using an electrically conductive biofilter, sludge treatment to enhance methane content, and an ion-exchange membrane bioreactor technology for nitrogen removal.

Monitoring and evaluation

All pilots have been implemented across India and are now in operation. "Currently the 'monitoring and evaluation' phase of the project is taking place," notes Starkl, adding that this will continue until the end of 2023.

While all pilots have been set up in institutional settings, the project ran three stakeholder workshops with local communities in Kolkata, Mumbai and Chennai. "The performance evaluation of most of the pilots is in advanced stages, and we have reliable performance results for some of the pilot technologies," remarks Ghangrekar.

The collaboration between EU and Indian researchers has run smoothly. "Our project is still running for a year and will finish in July 2024," says Starkl. "Most of the pilots are expected to continue after project end, in particular as most pilots have been implemented in institutional settings."

PROJECT

Saraswati 2.0 - Identifying best available technologies for decentralized wastewater treatment and resource recovery for India

COORDINATED BY

University of Natural Resources and Life Sciences in Austria

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/821427

PROJECT WEBSITE

projectsaraswati2.com/

Using biotechnology to clean waste water at the source

The SPRING project is developing a cost-effective waste water treatment technology to remove pollution from stagnant and flowing water sources in India.



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Polluted water is a major environmental and health issue in India. This includes a range of [organic and inorganic pollutants](#) that persist in the environment for long periods of time and pose a risk to human health. [Fluoride contamination](#) affects 19 states in India, and 10 states have reported carcinogenic compounds and arsenic in water.

Typically, [physicochemical methods](#) are used to treat contaminated surface water and groundwater, but these are expensive to operate, requiring infrastructure and chemical additives and conditioners.

The [SPRING](#) project, co-funded by the EU and [India's Department of Science and Technology](#), set out to address this unmet need.

"SPRING is developing bio-oxidation technology for treating waste water from different sources," explains India coordinator Sanjukta Patra, professor at the [Indian Institute of Technology Guwahati](#) (IITG) in India. "We are developing a low-cost, scalable, stable bio-oxidation based enzyme system for pollutant removal."

The integrated system, which combines bioremediation technology with real-time monitoring tools, can be installed at the source, ensuring effluent stays within safe limits. It can be deployed as an alternative to physicochemical treatments or used in combination.

Treating waste water at the source

The SPRING system is based on bio-oxidation technology, which uses an advanced enzyme-based process to break down pollutants. Patra is leading a team to investigate various eco-friendly enzymes that can treat organic pollutants such as sewage as well as inorganic pollutants originating from industries such as dyeing, tanning and electroplating.

Following this exploratory work, researchers at the [Indian Institute of Technology Kharagpur](#) (IITKGP) will develop methods for mass production of these enzymes for their use at commercial scale.



SPRING is developing bio-oxidation technology for treating waste water from different sources.

The project's EU coordinator is [Rajnish Kaur Calay](#), a professor of Energy Systems at The Arctic University of Norway. She explains that the bio-oxidation of contaminated sites will be performed by an efficient smart bioreactor system designed and manufactured by research teams working at the [University of Pécs](#) in Hungary, [INESC TEC](#) in Portugal and [Elixir](#) in India.

The SPRING team will produce at least two prototypes for demonstration in April 2024 with the support of other stakeholders, including the Bhimavaram municipality, and industry partners. The project will run several field trials in urban and rural areas. SPRING is also developing microbial fuel cell (MFC)-based novel

biosensing systems to enable remote sensing of waterborne pollutants in the study area.

Progressing technology levels

Some of the systems being developed under the project are expected to reach [technology readiness level](#) (TRL) 7, and can be used in applications beyond waste water.

"After demonstration, the next phase is developing the system as a commercial product, which will be done by Elixir, the industry partner participating in the project," Calay says. "Elixir is already in discussion with local food processing and pharmaceutical industries, to make and install waste water treatment systems for their needs," she adds.

Due to travel restrictions during most of the project duration, researchers in Europe and India couldn't visit sites mutually or visit other laboratories. However, collaborative scientific work through jointly advised PhD students was carried out at the IITG in India and [Enviroinvest](#) (website in Hungarian) in Hungary.

PROJECT

SPRING – Strategic Planning for Water Resources and Implementation of Novel Biotechnical Treatment Solutions and Good Practices

COORDINATED BY

UiT – The Arctic University of Norway

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

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