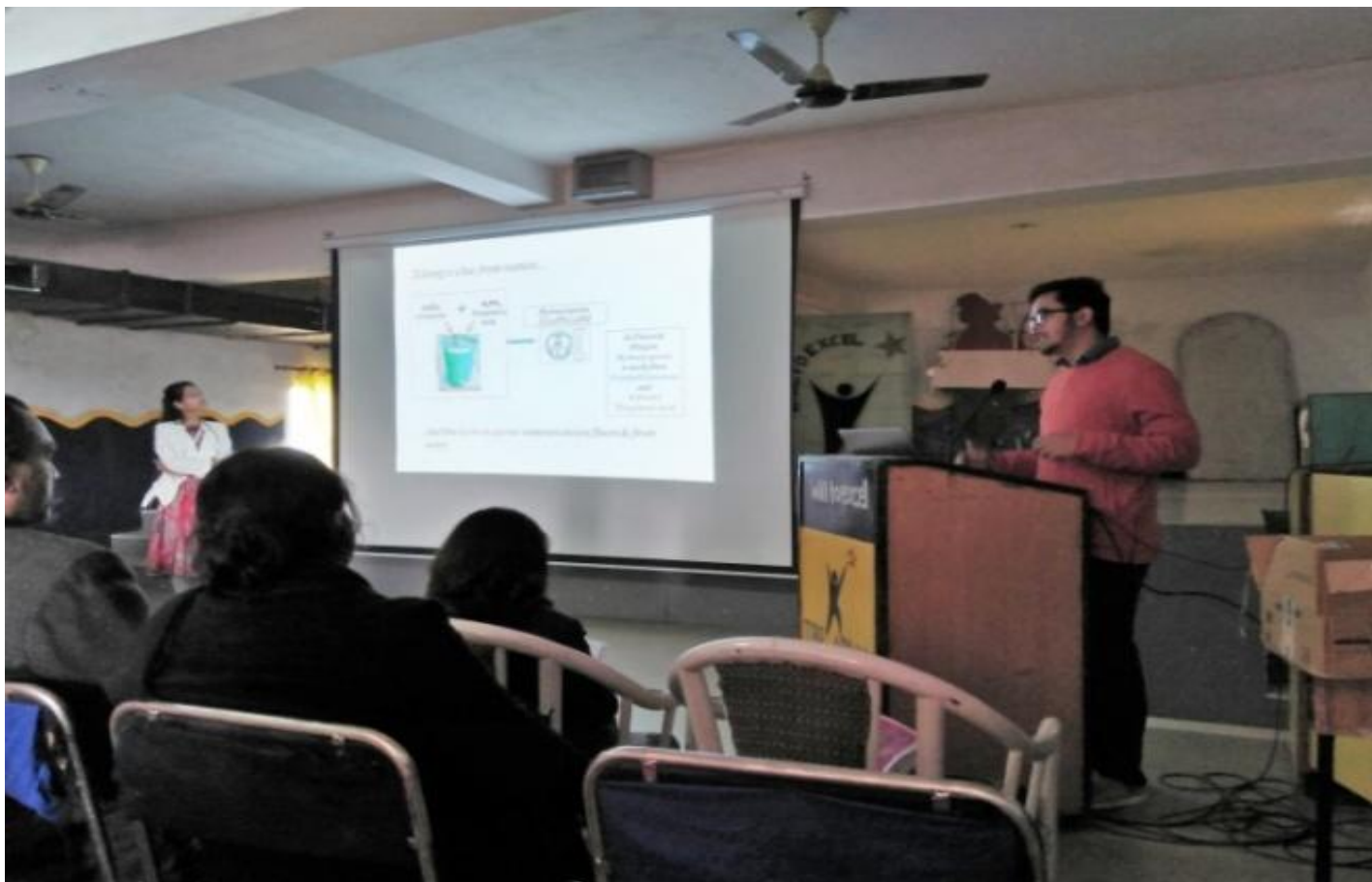


**Extension and Outreach activity
By Dept. of Chemical Sciences,
Tezpur University**

Supporting Document 2018



A Regional Workshop on Arsenic and Fluoride in Drinking Water was organized in Varanasi on 28 January 2018 at Aryan International School with 75 participants from UP and Bihar.



Workshop on Arsirion Nilogon and Fluoride Nilogon (24-25 Feb 2018).
Left: VC of Tezpur University speaking at the workshop and Right: A section of the participants.



Awareness program at Kakodonga HS School on 30 April 2018



Workshop on Fluoride Nilogon at Rajesh Pilot Polytechnic College, Jeerota in Dausa in Rajasthan (Top: Principal Dr. Ashok Sarma with grey shirt, Bottom: Mr Rajesh Ghusinga, Asstt. Engg., PHED, Rajasthan our collaborator, demonstrating, at center with a white shirt): 3 Nov 2018.

ARSENIC-FREE DRINKING WATER

Assam researchers make low-cost filter

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GUWAHATI: Residents of Mazgaon village in Assam's Lakhimpur district could do little about the arsenic contaminated water they were forced to drink until a few years back. They found most water purifying machines expensive until they began using a low cost and easy-to-use filter—Arsiron Nilogon.

Researchers at Assam's Tezpur University have developed and patented the filter that removes arsenic and iron from drinking water. It has been making a difference to the lives of thousands of people across the state by providing them access to clean drinking water they did not have until a few years back.

"Six big and small arsenic filters have been set up in our village and nearly 400 people are benefitting from them. Now we are not worried about consuming arsenic with our drinking water," said Deeprupa Bhaktiari, a Mazgaon-resident.

The Union science and technology department has acknowledged the method the filter uses.

It has been published in national and international journals and was granted patent number 280737 last year.

High amounts of arsenic, a poisonous contaminant that can cause diseases like cancer, have been detected in Assam's 29 of the 33 districts. The World Health Organisation (WHO) recommends a maximum of 10 ppb (part per billion) of arsenic in drinking water. A Tezpur University research found 990 ppb of the carcinogenic agent in a tubewell in Mazgaon.

"Concerned about the situation, we began our research in 2005 to find an easy and cheap solution that would benefit poor people in rural areas," said Tezpur University professor Robin Kumar Dutta.

Dutta and his team tried finding a new method as several existing methods of removing arsenic like reverse osmosis were found to be ineffective for use in rural areas of developing countries due to high cost, use of electricity etc.

Dutta said a Japanese firm has approached them for exclusive rights to produce the filter commercially. "But as that would



• The low-cost filter is able to remove arsenic content. BY ARRANGEMENT

make the method costly and out of reach of poor people, who we want to benefit, we rejected the offer."

Dutta's team developed the filter in 2010, which involves treatment of contaminated water using small quantities of cooking soda, potassium permanganate and ferric chloride.

The results were impressive. The process was able to remove arsenic content from as high as 1,000 ppb to less than 2 ppb or to the undetectable levels.

"... (The filter) is very effective

as, unlike other available methods, it does not use electricity and removes arsenic and other heavy metals at very low cost," said Manoranjan Nath of Tezpur-based North Eastern Regional Institute of Water and Land Management (NERIWLM).

NERIWLM did the third party technical evaluation of Arsiron Nilogon using various samples of groundwater with high arsenic content (between 500 ppb and 250 ppb). It found the filter was able to bring it down to single digits—below the WHO's recommended

levels.

Two 20 litre buckets—one for chemical treatment water and other to be used as a sand gravel filter—are needed to set up a filter unit at home along. A 500-litre unit costs ₹3,700.

For a household unit of 20 litres, one needs to add just 2 gm of cooking soda, nearly 6 drops of potassium permanganate and around 2 ml of ferric chloride. It would cost a user around ₹500 to filter 100,000 litres of water.

"We started taking field trials in 2010. The filter soon became popular and people asked us to set it up for them. Till date, we have set up over 100 filters across Assam, but many more are being set up by users themselves after getting training from us," said Dutta.

A filter unit was set up in Uttar Pradesh's Mirzapur two months ago.

"We have been using the filter to remove arsenic from our drinking water for our family of 24 members. Now many more people in the area want to get such units installed," said Akhilesh Kumar, a school teacher in Mirzapur.

Tackling pollution to provide clean drinking water for all

SOLUTION Experts are trying to develop new, innovative techniques to treat water contaminated with arsenic and fluoride

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Not just air, water pollution is also a major concern with most water bodies being used as dumping sites for industrial waste, untreated sewage and even solid waste matter, making water largely unfit for drinking and a health hazard.

Several studies have shown how water pollution remains a global challenge, especially chemical contamination.

A World Bank report, *Quality Unknown: The Invisible Water Crisis*, released in August this year, using a vast database on water quality, showed it would be nearly impossible to meet the global targets set to save the deteriorating environment by 2030. Failure to meet the targets will eventually have an impact on the overall health, economy, education, and soon, of all countries.

The 193 United Nations (UN) member-states agreed on September 23, 2015 to a 15-year target of 17 sustainable development Goals (SDGs), with 169 targets aimed at helping everyone live healthier, more prosperous lives on a cleaner planet.

SDG 6 refers to clean water and sanitation for all, but the UN World Water Development Report found about three out of 10 people - 2.1 billion - did not have access to safely managed drinking water at home in 2015. India was no different, with many parts of the country reporting water contamination due to arsenic, mercury, cadmium and fluoride, among others.

Arsenic contamination, espe-

cially is huge, and was first reported in 1983 from West Bengal. Since then, it has affected at least six other Indian states -- Jharkhand, Bihar and Uttar Pradesh, in the floodplains of the Ganga river; Assam and Manipur in the floodplains of the Brahmaputra and Imphal rivers and Rajnandgaon village in Chhattisgarh, according to the abstract, *Groundwater Arsenic Contamination in India: Vulnerability and Scope for Remediation*, prepared by experts from the National Institute of Hydrology, Roorkee.

Some experts say it is a problem in the floodplains of all rivers originating from the Himalayas and the Barail range in the northeast.

Arsenic poisoning leads to symptoms such as skin diseases, liver toxicity, heart ailments, destruction of red blood cells, and even cancer.



TACKLING WATER CONTAMINATION

Efforts have been made by various agencies and individual experts in devising ways to ensure safe water supply to the affected population.

Robin Dutta, a professor in the chemical sciences department at Tezpur University in Assam, has been working on a technique to remove arsenic and fluoride from water since 2005, and after five years of work, finally the technique became functional in 2010 and first tested in Assam's Jorhat city, one of the severely affected areas in the state.

The technique was patented in 2017.

"While most other contaminants such as lead, mercury etc. are a man-made problem, arsenic and fluoride contamination



People stand in queues to fill vessels with drinking water in Chennai, which suffered from an acute water shortage caused by drying lakes and depleted groundwater, on June 19, 2019.

AP FILE

low as 1 paise for filtering one litre of water.

The Fluoride Nilogon technique involved treating water with crushed limestone that absorbs fluoride and phosphoric acid. The contaminant in this case can also be filtered out. The cost is even lower than the arsenic removal technique at 0.4 paise to filter a litre of water.

With support from the department of science and technology for his project, Dutta is already working on expanding the technique to other states such as Bihar and Uttar Pradesh that are also grappling with water contamination.

Dr Kuttanellore Muralaeddharan, director of the Council of Scientific and Industrial Research (CSIR)-Central Glass & Ceramic Research Institute (CGCRI), has also worked on filtration techniques that help remove hazardous contaminants from water.

"Be it arsenic, iron or other elements dissolved in water, our ceramic membrane technology is capable of purifying it with good results," he says.

CGCRI experts developed the technology over a decade ago but it picked up only about 5-6 years ago. A filtration plant can be installed at the community level to filter water for as low as 20 paise per litre.

"It can purify everything else apart from the saline contamination for which reverse osmosis (RO) technique is good enough. There have to be slight modifications done before installation based on the type of contaminant in water. The device can stay active for 6-7 years," said Dr Swachchha Majumdar, a researcher at the CGCRI lab who is also part of the team that developed the technology.

The institute has tied up with a manufacturer and takes orders for installation of the plant at its laboratory. "It is our indigenous product and our laboratory takes the orders," he added.

Dr Muralaeddharan says, "There is a huge need to come up with innovative techniques for water purification that are affordable for masses at the ground level as water contamination is a major issue in India."

News in regional newspapers about Fluoride Nilogon