

HIX-Nano™ 100+

HIX-Nano100+ is a hybrid anion exchange resin doped with a mixture of hydrated iron and zirconium oxide nanoparticles irreversibly inside resin beads. WIST Water Solutions Pvt. Ltd. Kolkata, India (brand-name “drinkwell”), currently is engaged in commercial-scale production of different HIX-Nano media suitable for removal of a variety of trace contaminants (e.g. Arsenic, Fluoride, iron, phosphate etc) from water. HIX-Nano100+ resin is suitable for selective removal of dissolved arsenic (both arsenate and arsenite) present in contaminated waters from the background other ionic species usually present in much higher concentrations. The parent resin has macroporous structure with polystyrene matrix and divinylbenzene crosslinking. HIX-Nano100+ is a robust, durable, high capacity sorbent media that efficiently reduces arsenic in treated water to levels recommended by World Health Organization (WHO). The media is regenerable, can be used for multiple cycles without losing its performance and thereby greatly reducing the cost of treated water.

Physical & Chemical characteristics:

Appearance	Spherical beads, dark brown/ reddish
Structure	Macroporous polystyrene beads
Particle size	0.3 – 1.2 mm
Shipping weight (approx.)	700 – 760 g/L
Ionic form as shipped	Cl ⁻
Operating capacity (Arsenic)*	3-12 gm/kg

** Operating equilibrium capacity depends on influent contaminant concentration; type of contaminant, operation pH, presence of interfering species & other background species, process chemistry & kinetics, etc. References of peer-reviewed publications are available at <http://drinkwellsystems.com/resources?category=Journal+Articles>*

Application (site installation) and Bed features:

Recommended application of HIX-Nano100+ is for removal of dissolved arsenic species from contaminated water supplies. It needs occasional/ periodic backwash and does not generate any arsenic contaminated fines or wastes. The media is stable over a wide range of pH (2.5 –

13). It is Amenable to regeneration reduces operating and maintenance cost significantly and reduces volume of waste by an order of magnitude.

Recommended contact time [#]	2 - 4 min
Recommended bed depth [#]	around 900 mm or more
Service flow	Intermittent / Continuous
Backwash	Periodic/ occasional
Operating pH (recommended)	4 – 8
Operating temperature limit	50°C
Operating pressure	20 – 75 psia
Pressure drop	Low due to porous structure of beads

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To be selected carefully for design purpose based on detail water quality, provision of pre-treatment, process flow etc in consideration with physical structure & properties of media, media kinetics & related intrinsic process features.

Storage:

HIX media is packed in HDPE lined bag. It should be kept under proper cover or storage shade. This resin is never recommended for keeping in open condition or under sun-light.

Regeneration & Safety:

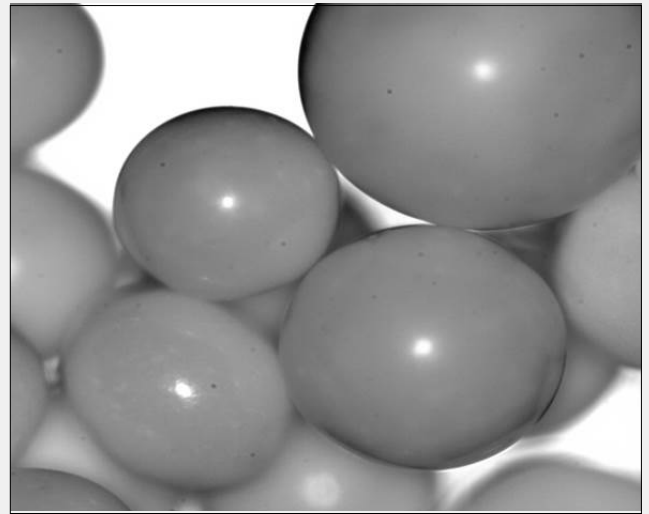
HIX-Nano100+ offers a very high capacity for arsenic sorption. The regeneration interval for the media is recommended to be a year or more based on influent quality, water production & good O&M practices with proper design. Drinkwell as a part of its service program strongly recommends replacement of exhausted media by fresh/ regenerated media (provided by Drinkwell) for safe, environment friendly handling and disposal of arsenic laden waste.



Regd. Office: 78 Biren Roy Road West, Kolkata 700061
Web address: www.drinkwellsystems.com



HIX-Nano™ 100: Arsenic Removal



HIX for great water

For over 20 years, a lot of research has been done to make a material that can give people living in rural Indian communities safe drinking water. A product that is not just **durable** and **easy to use** but also **cost effective**.

HIX is the result of research that has successfully proven to keep people safe from arsenic, fluoride, nitrate, phosphate and uranium.

HIX is easy-to-use

- No electricity required
- Sustainably operated by employees from the local community
- Profit-generating for the community

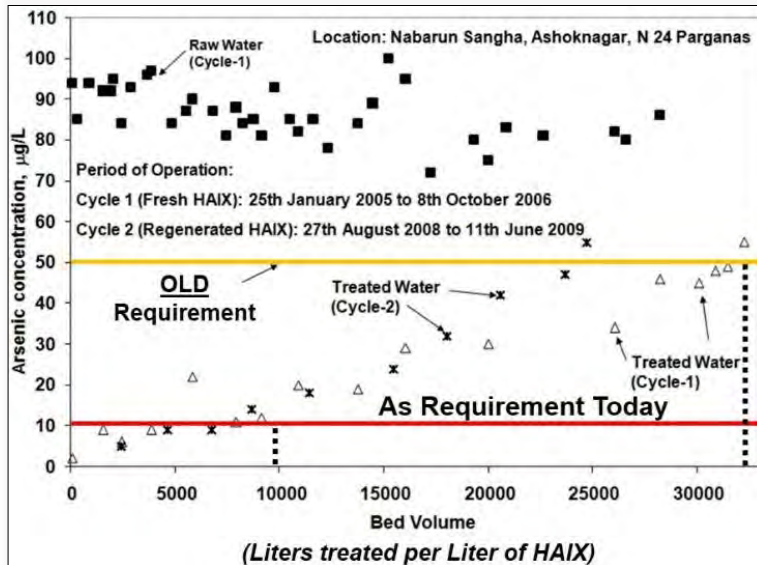
... and durable!

- No clogging from fines during use
- No backwash of HIX
- No material breakdown
- No replacement only recycle & reuse

AA	GFH	HIX-Nano
CANNOT meet 10 ppb As standard	Imported from Europe: high price, long supply chain	Used <u>internationally</u> to achieve 10 ppb As
Weak material- degrades during regeneration	Physically weak, single-use material	Can be used for >5 cycles of regeneration
Very low capacity for As(III)	Generates large volumes of hazardous waste	Similar capacity for As(V) and As(III)

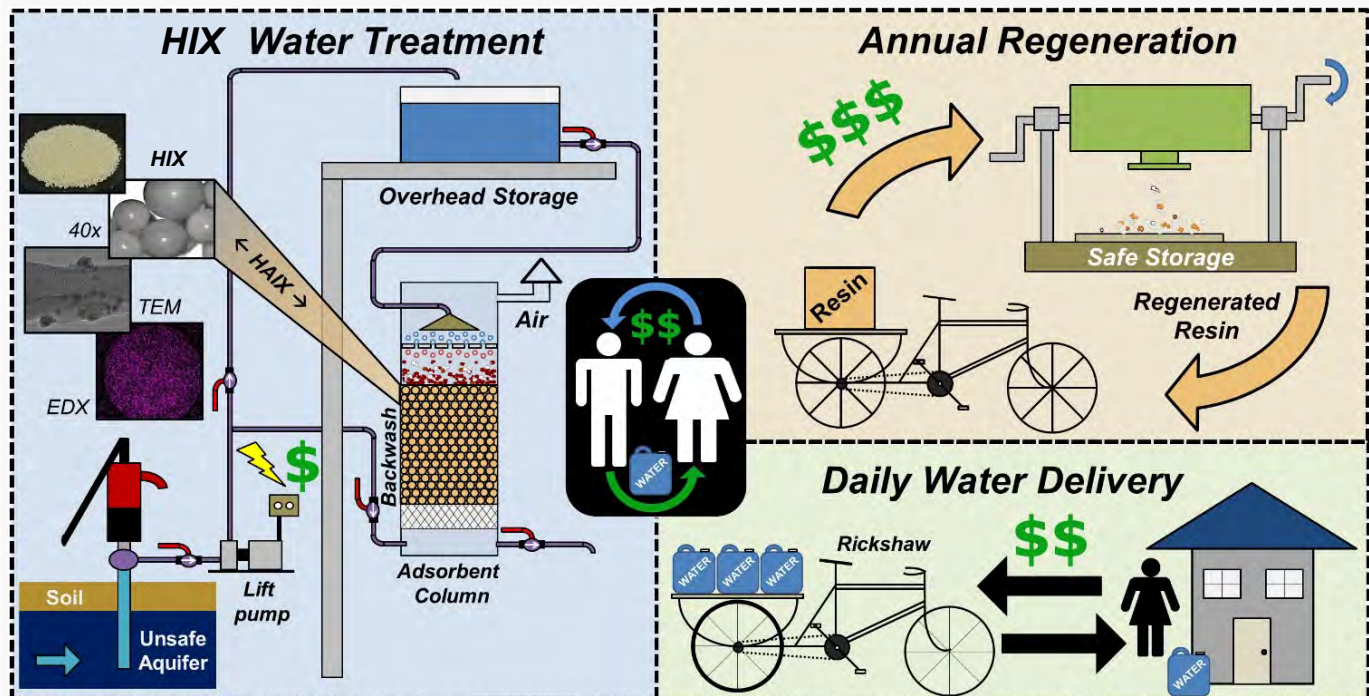
HIX creates jobs

The high quality water from HIX turns the water crisis into economic development through investment in infrastructure. HIX systems have generated **many jobs** over their decade of use across West Bengal. The regeneration procedure has been performed in rural West Bengal by trained **local employees**.



HIX meets 10 ppb As standard >10,000BVs

- Patented in the USA
- Approved & Certified by CSIR
- Empanelled with R.A Mashelkar committee
- Recommended by IIT-Roorkee
- Certified by Arsenic Task Force
- Awarded by USISTEF, Dept. of Science & Technology
- Awarded by FICCI



Find more information on-line: <http://drinkwellsystems.com/>

DRINKWELL® *HIX-Nano™ 100+ or HIX-NanoFe (Arsenic Removal Media)*

Introduction:



In India, development and synthesis of HAIX-NanoFe was initiated with funding from the government of India's Department of Science and Technology (DST) and the US State Department through active collaboration between the Society for Technology with a Human Face or STHF, an NGO in India and WIST Inc., a technology-driven social enterprise.

The primary intent was to deliver a robust adsorbent to mitigate the severe arsenic crisis in the Indian subcontinent directly threatening lives of nearly 200 million resource-poor people. HAIX-NanoFe is essentially a porous polymeric anion exchanger inside which hydrated ferric oxide nanoparticles have been irreversibly dispersed. Its high arsenic removal capacity and regenerability through the use of the Donnan Membrane Principle stand in agreement with the original study by Prof Arup SenGupta in Lehigh University, USA. HAIX-NanoFe is a hybrid polymeric-inorganic material where both polymer and inorganic phases complement each other resulting in enhanced capacity, durability, chemical stability and reusability through regeneration for multiple cycles.

Aside from robustness and durability compared to other inorganic commercial adsorbents, namely, activated alumina, granulated ferric oxide etc., HAIX-NanoFe is capable of recovering nearly 99% of the groundwater treated i.e., only 1% of the water drawn from underground is wasted. In contrast, for competing reverse osmosis (RO) processes, nearly 40% of the water is routinely wasted. HAIX-NanoFe is also capable of removing uranium, phosphate and chromate concurrently. Since HAIX-NanoFe can be regenerated and reused safely for at least five cycles, the overall cost of the treated water per 1000 liters is less than other competing processes. It has been demonstrated through multiple field-scale studies that disposal of spent regenerant and HAIX-NanoFe poses no environmental threat and satisfy TCLP (Toxicity Characteristic Leaching Procedure) requirements.

In India, HAIX-NanoFe is in use in plants funded by WB PHED, Tata Trusts, Clinton Foundation, Bihar PHED and multiple NGOs. Several community based plants have been in operation well over ten years.

HAIX media or alternatives to *HIX-Nano100+* sold under a variety of brand names like ArsenX^{np}, LayneRT, FerrixTMA33E.

Features:

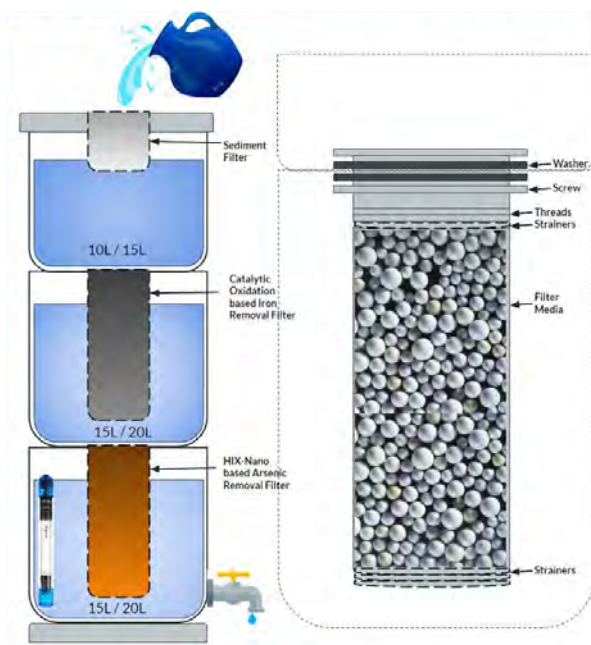
1. Efficiently remove Arsenic (III & V)
2. Regenerable & Reusable media
3. Low energy consumption
4. Pump and gravity-fed system
5. Operating pressure range 15-75 psia
6. Low wastage of water
7. No leaching of Arsenic observed from media bed during filtration, backwash & rinse.
8. Easy for Sludge Handling
9. Gives good results till 10-12 cycles, even more, depending on the operation
10. Rapid adsorption kinetics
11. Low-pressure drop
12. Cost-Effective Treatment

Awards & Certifications

- Patented in the USA by Lehigh University
- CSIR Certified for testing up to 1200 ppb (1.2 ppm)
- Recommended by IIT-Roorkee
- Certified by Arsenic Task Force of West Bengal
- Awarded by USISTEF (Dept. of Science & Technology)
- Awarded by FICCI

System Designs:

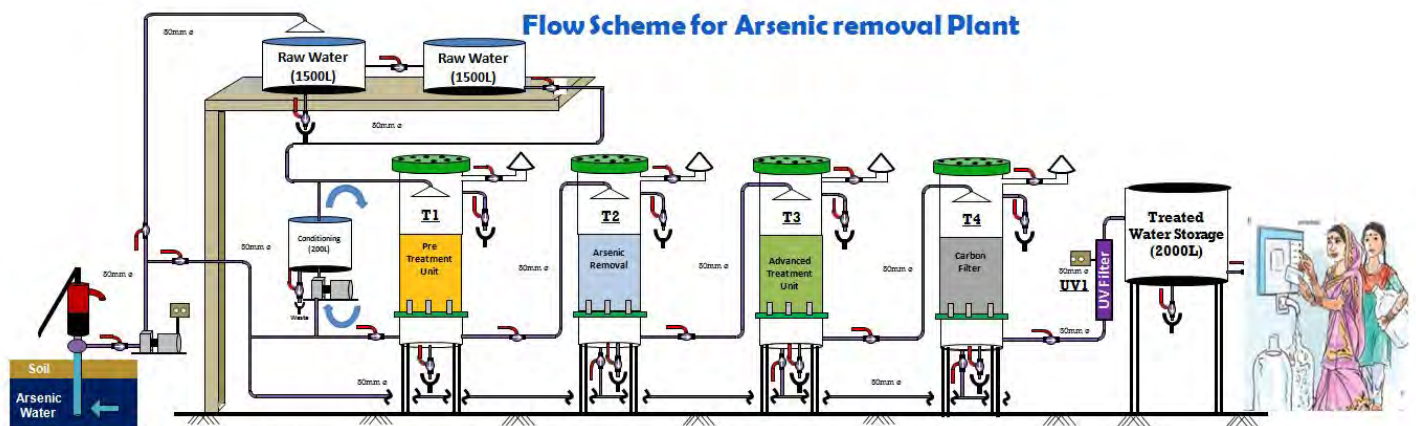
- Point of Use Filter (POU)
- Point of Entry Filter (POE)
- Community Water Purification Plant (CWPP)
- Piped Water Supply System (PWSS)



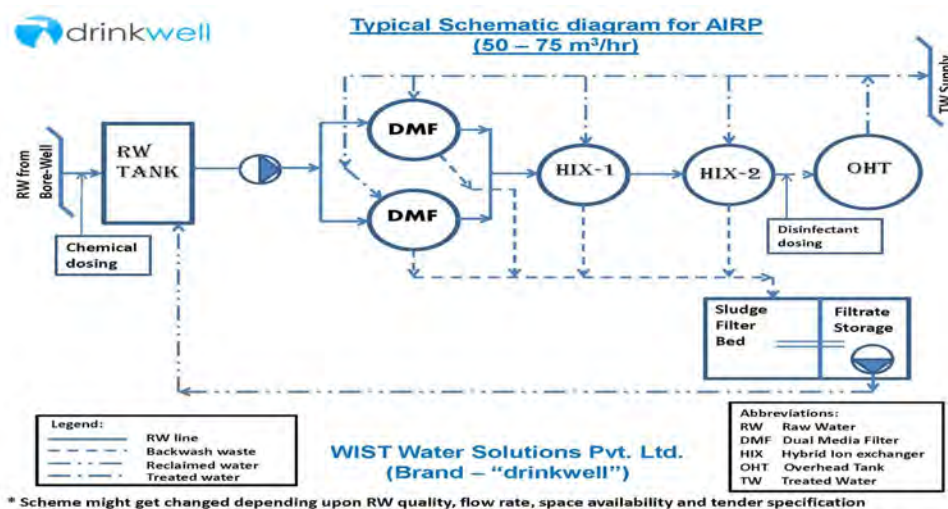
Point of Use (POU)



Point of Entry (POE)



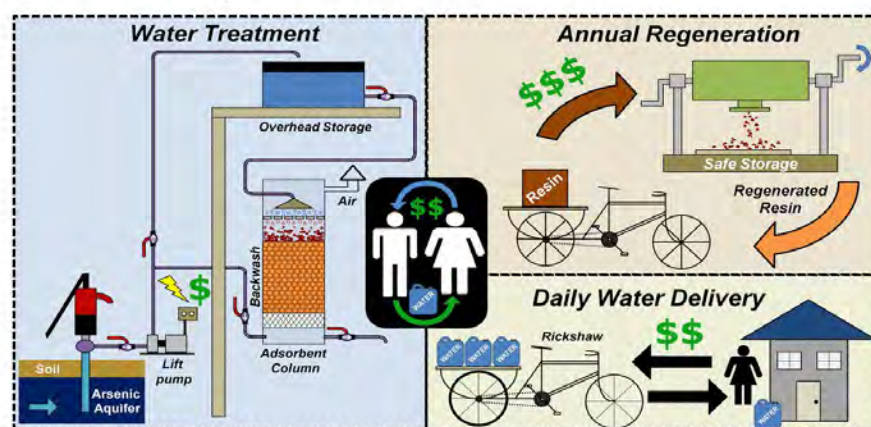
Community Water Purification Plant (CWPP)



Piped Water Supply System (PWSS)

Reject Management System:

Water Ecosystem Overview



HIX-Nano100+ Calculator:

Flowrate in LPH	500
Iron (Fe) in mg/l	5
Total Arsenic (As) in ppb or µg/l	100

SUBMIT

- **Drinkwell Recommendations**

Pre-Filtration media type	HIX™ 100
Pre-Filtration media required	100-150L
Pre-Filtration Freeboard	25-30%
Pre-Filtration Required vessel volume	16*65
HIX-Nano™ 100 media required	100-200L
HIX-Nano™ 100 Freeboard	25-30%
HIX-Nano™ 100 Required Vessel Volume	18*65
HIX-Nano™ 100 Filtration Rate	8
HIX-Nano™ 100 EBCT	6

*This calculator has been designed based on real-time data obtained from system installation worldwide.

*The contamination concentration and the filtration rate is a best-fit approximation and is subject to be updated.

*This calculation is only a recommendation for system design. Please do not forget to read and follow the instructions given in our HIX-Nano100 product literature.

Comparisons:

Basis	HIX-Nano™ 100+	GFH	Titansorb
Company	Drinkwell	Watch Water	Watch Water
Material	Hybrid Resin Bead	Granular	Granular
Chemistry	Hydrated Iron Oxide	Hydrated Iron Oxide	Titanium Oxide
Min. Contact time	2 min	3 min	3 min
Arsenic Residuals	No Residuals or Fines	Yes- Backwashed Fines	Yes- Backwashed Fines
Disposal	Regenerable or Reusable	Landfill	Landfill
Regenerable	Yes	No	No
Waste Handling	2kg of toxic sludge(solid) soak pit arrangement.	100kg of solid waste for each replacement	100kg of solid waste for each replacement

Technical Data:

- Physical Properties

Appearance	Dark Brown spherical beads
Mesh Size	0.3 - 1 mm
Uniformity Coefficient	1.34 - 1.78
Bulk Density	0.72 - 0.75 kg/m ³
Removal Capacity	3-12 gm/L
Moisture Content	45 - 50%
Specific Gravity	1.2 g/ml
Shipping Weight	720 - 750 g/L
Porosity	Macroporous Beads

- Recommended Operating Conditions

pH Range	4.5 - 8.5
Max. operating Temperature	40 - 45°C
Max Differential pressure across the bed	0.4 - 0.6 bar/m
EBCT	2 - 4 min
Freeboard	25 - 30%
Min. bed depth	750 mm
Optimal Bed depth	1.250 mm
Service Flow	8-12 m ³ /hr m ²
Backwash Velocity	1000 LPH
Backwash Time	15 min
Rinse Time	10 min

Performance Tested by CSIR with influent Arsenic up to 1800 mg/l

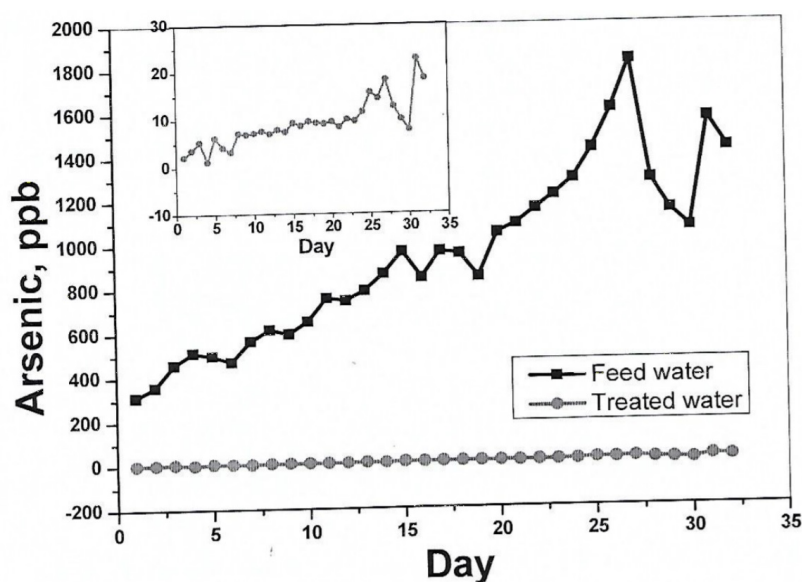


Figure-1.1: Removal of Arsenic by HIX-Nano 100 resin packed bed column from synthetic water (Conditions: Flow rate, 100 L/h; run time per day, 4 h)

DRINKWELL®HIX-Nano™ 100+ Case Studies:

India Rural Arsenic Case Study: Kothora Village, Assam



Drinkwell Arsenic Iron Removal System (Est. May 2017)

<i>Location</i>	Kothora Village, Nalbari District, Assam
<i>Google map coordinates</i>	26.41368, 91.49664
<i>Capex Sponsor</i>	Tata Trusts
<i>Operating Partner</i>	Gram Vikash Mancha
<i>Households Served</i>	200- 300
<i>Capacity</i>	5000 - 6000 Liters Per Day
<i>Impurities</i>	Arsenic (Raw: 240 ppb Treated: 1 ppb) Iron (Raw: 2.10mg/L Treated: 0.24 mg/L)
<i>Daily Avg of Ls Sold</i>	4,650
<i>Operation & Maintenance Capabilities</i>	- ATM dispensing system - Water Dispense Monitoring via Sensors



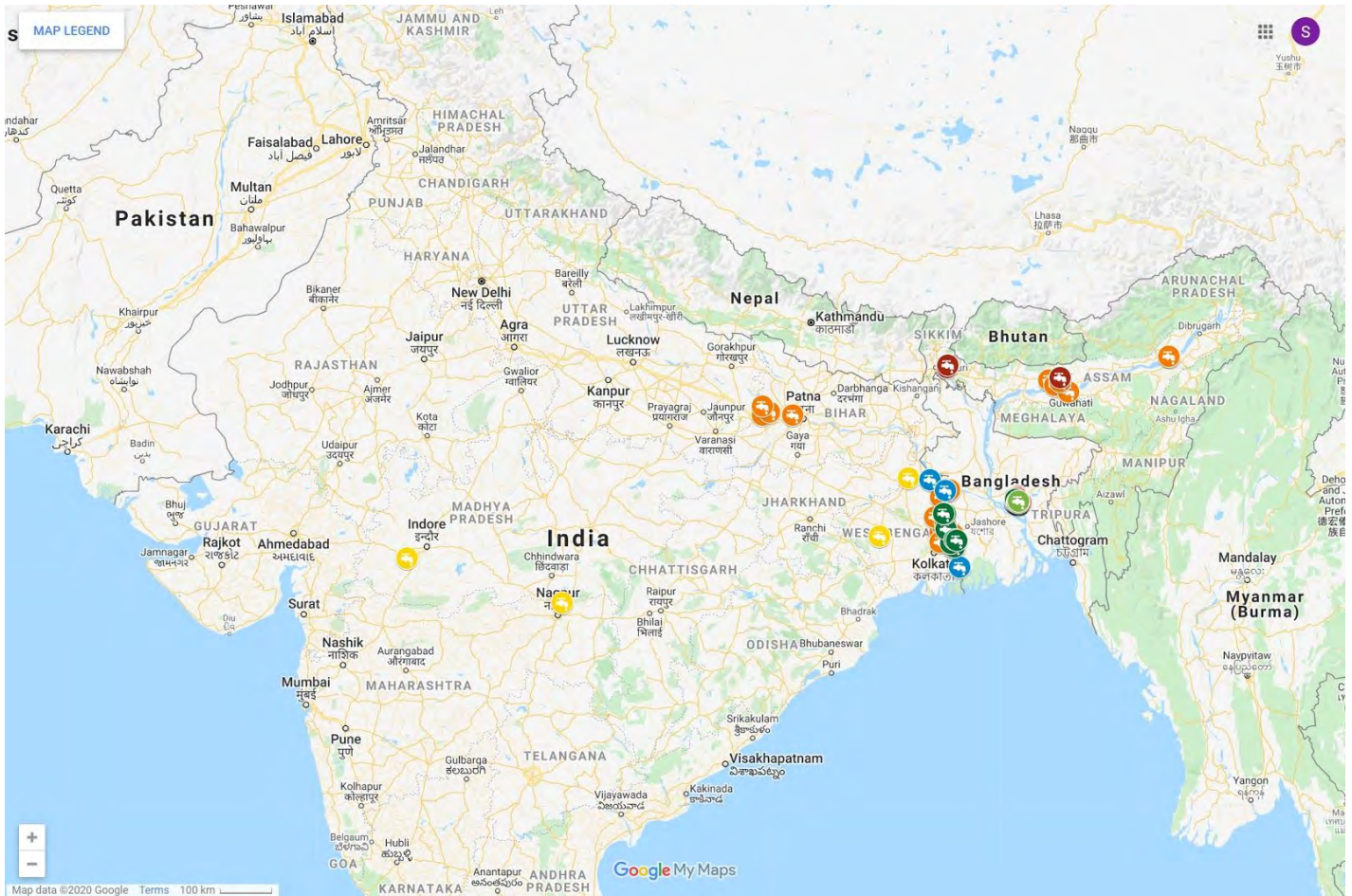
Bazitpur Arsenic Mega Project



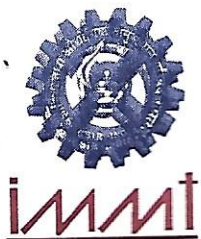
Drinkwell-RiteWater Arsenic & Iron Removal PWS (Est. July 2016)

<i>Location</i>	Bazitpur Village, Basirhat Block, North 24 Parganas, West Bengal
<i>G-Map coordinates</i>	22.71649, 88.85703
<i>Capex Sponsor</i>	West Bengal PHED
<i>Operating Partner</i>	RiteWater
<i>System Type</i>	Piped Water Supply scheme
<i>Capacity</i>	92000 Litres Per Hour
<i>Impurities</i>	Arsenic (Raw: 0.2 mg/l Treated: <0.002 mg/l) Iron (Raw: 0.62 mg/L Treated: <0.1 mg/L)
<i>Daily Avg of Ls Dispensed</i>	370000 litres

DRINKWELL® HIX-Nano™ 100+ installations in India



URL: <https://bit.ly/2yhKgUm>



सीएसआइआर - खनिज एवं पदार्थ प्रौद्योगिकी संस्थान

(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)

भुवनेश्वर-751013, ओडिशा, भारत

CSIR - INSTITUTE OF MINERALS & MATERIALS TECHNOLOGY

(Council of Scientific & Industrial Research)

Bhubaneswar - 751013, Odisha, INDIA

Ref.No-AM/02/2020/TSP-29

To Whom It May Concern

This is to certify that CSIR-IMMT Bhubaneswar tested hybrid ion exchange nanotechnology media **HIX-Nano™ 100** of WISTWATER SOLUTIONS PVT. LTD. (brand name "drinkwell"), 78 Biren Roy Road West, Kolkata 70061, for arsenic removal at CSIR-IMMT, Bhubaneswar.

Arsenic removal column set-up filled with resin **HIX-Nano™ 100** of WISTWATER SOLUTIONS PVT LTD, was tested using feed water contaminated with different level of arsenic up to 1.2 mg/l (1200 ppb). The media HIX-Nano™ 100 was found to remove 1200 ppb of arsenic efficiently within the permissible limit as per BIS 10500-2012.

Arsenic removal efficiency was tested in the laboratory scale with arsenic contaminated water synthetically prepared using CSIR-IMMT groundwater.

N:B-This is only applicable to WIST WATER SOLUTIONS PVT. LTD.

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