

HIX-Nano™ 200

HIX-Nano 200 is a hybrid anion exchange resin doped with hydrated 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-Nano 200 resin is suitable for selective removal of dissolved fluoride, Phosphate and arsenic present in contaminated waters from the background of other ionic species usually present in much higher concentrations. The parent resin has macroporous structure with polystyrene matrix and divinylbenzene crosslinking. HIX-Nano 200 is a robust, durable, high capacity sorbent media that efficiently reduces fluoride, phosphate, arsenic in the 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, whitish with light yellow tint
Structure	Macroporous polystyrene beads
Particle size	0.3 – 1.2 mm
Approx shipping wt.	720 – 780 g/L
Ionic form (as shipped)	Cl ⁻
Adsorption capacity(Fluoride)*	4 – 15 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 in www.drinkwellsystems.com*

Application and Bed features:

Recommended use of HIX-Nano 200 is for removal of dissolved fluoride in water supplies. It needs occasional backwash and does not generate any fluoride contaminated fines during backwash. 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 also reduces volume of waste by several factors.

Recommended contact time [#]	2 min- 5 min
Recommended bed depth [#]	around 1000 mm (or more)
Service flow	Intermittent / Continuous
Preferred operating pH	3 - 7
Operating temperature limit	50°C (Max)
Backwash	Occasional/ Periodic
Operating pressure	20 – 75 psia
Pressure drop	Low due to porous structure of beads

[#]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:

Drinkwell Resin 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 sunlight.

Regeneration & Safety:

Regeneration interval depends on influent water quality, water production and is a part of system design. Alkaline-salt chemical solution applied for regeneration of HIX-Nano 200 media is corrosive in nature and these should be handled with proper care to avoid any contact with eye, skin or other parts of body. Drinkwell as a part of its service program recommends replacement of exhausted media by fresh/ regenerated media for safe, environment friendly handling and/or disposal.



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

HIx-Nano™ 200+

HIx-Nano200+ is a hybrid ion exchange resin doped with hydrated aluminium nanoparticles 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-Nano 200+ resin is suitable for selective removal of dissolved fluoride present in contaminated waters from the background of other ionic species usually present in much higher concentrations. The parent resin has macroporous structure with polystyrene matrix and divinylbenzene crosslinking. HIx-Nano 200+ is a robust, durable, high capacity ion exchange media that efficiently reduces fluoride in the 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, Brownish with grey tint
Structure	Macroporous polystyrene beads
Particle size	0.3 – 1.2 mm
Approx shipping wt.	780 – 800 g/L
Ionic form (as shipped)	Al ³⁺
Adsorption capacity (Fluoride)*	3 – 4 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 in www.drinkwellsystems.com*

Application and Bed features:

Recommended use of HIx-Nano 200+ is for removal of dissolved fluoride in water supplies. It needs occasional backwash and does not generate any fluoride contaminated fines during backwash. The media is stable over a wide range of pH (2.5 – 13). It is amenable to

Recommended contact time #	2 min- 6 min
Recommended bed depth#	around 750 mm (or more)
Service flow	Intermittent / Continuous
Preferred operating pH	3 - 7
Operating temperature limit	50 °C (Max)
Backwash	Occasional/ Periodic
Operating pressure	20 – 75 psia
Pressure drop	Low due to porous structure of beads
Regeneration solution	HIX-Nano Salt solution (2-15%)

#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:

Drinkwell Resin 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 sunlight.

Regeneration & Safety:

Regeneration interval depends on influent water quality, water production and is a part of system design. Alkaline-salt chemical solution applied for regeneration of HIX-Nano 200+ media is corrosive in nature and these should be handled with proper care to avoid any contact with eye, skin or other parts of body. Drinkwell as a part of its service program recommends replacement of exhausted media by fresh/ regenerated media for safe, environment friendly handling and/or disposal.



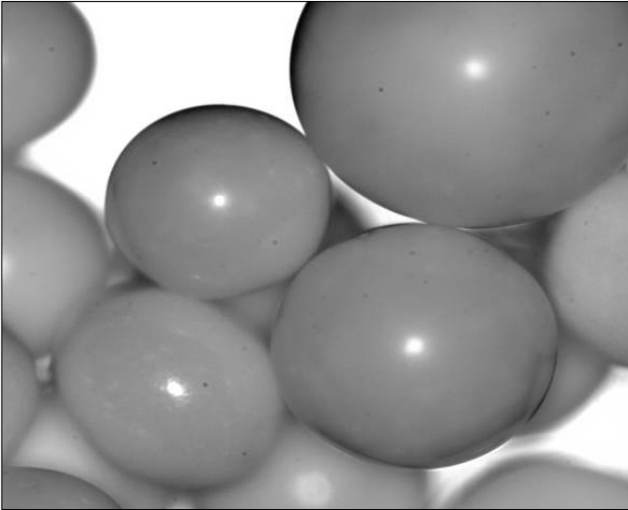
WIST Water Solutions Pvt. Ltd.
Kolkata, India

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



drinkwell

HIX-Nano™ 200: Fluoride Removal



HIX for great water

For over 15 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 or HAP

Can only treat 300-400BVs

Weak material- single-use material that degrades during regeneration

Very low capacity at pH>7.5

Fouled by silica

HIX-Nano

Can treat up to **3500 BVs!**

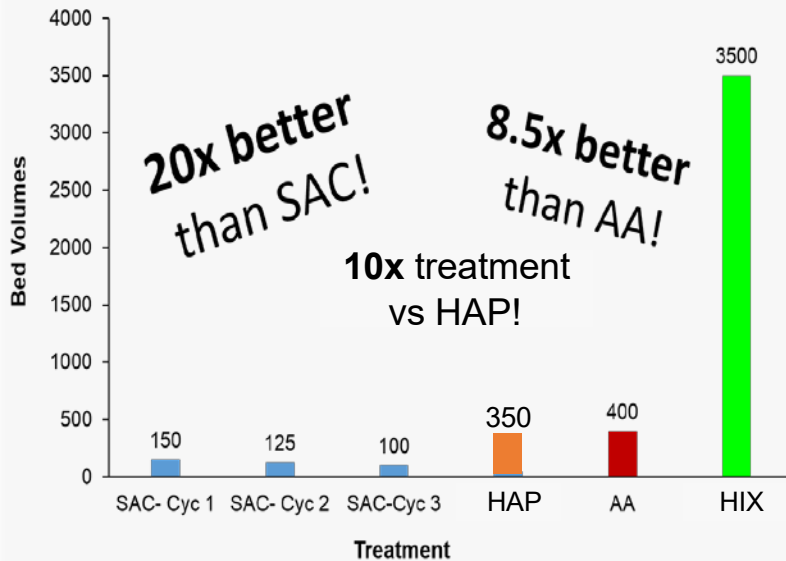
Can be used for **multiple cycles** of regeneration

Same capacity across **all pH** values

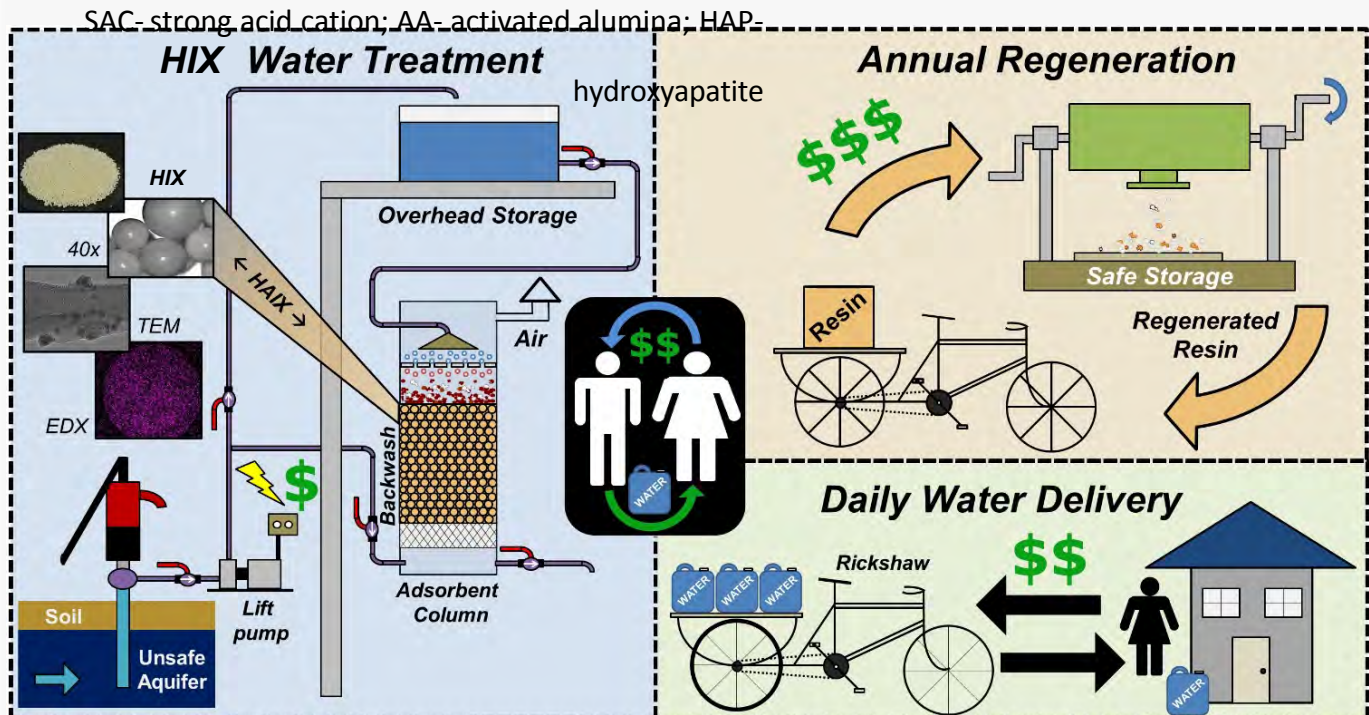
Process designed to **avoid silica fouling**

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**.



- Patented in the USA
- Approved & Certified by CSIR
- Empanelled by R.A Mashelkar Committee
- Certified by Fluoride Task Force
- Recommended by IISc Bangalore
- Awarded by USISTEF, Dept. of Science & Technology
- Awarded by FICCI



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

DRINKWELL® HIX-Nano™ 200 or HIX-NanoZr (Fluoride Removal Media)

Introduction:



In India, development and synthesis of HAIX-NanoZr 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 severe fluoride crisis in the Indian subcontinent directly threatening lives of nearly 200 million resource-poor people. HAIX-NanoZr 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-NanoZr 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-NanoZr is also capable of removing uranium, phosphate and chromate concurrently. Since HAIX-NanoZr can be regenerated and reused safely for at least five cycles, the overall cost of the treated water per 1000 litres is less than other competing processes. It has been demonstrated through multiple field-scale studies that disposal of spent regenerant and HAIX-NanoZr poses no environmental threat and satisfy TCLP (Toxicity Characteristic Leaching Procedure) requirements.

In India, HAIX-NanoZr 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.

Features:

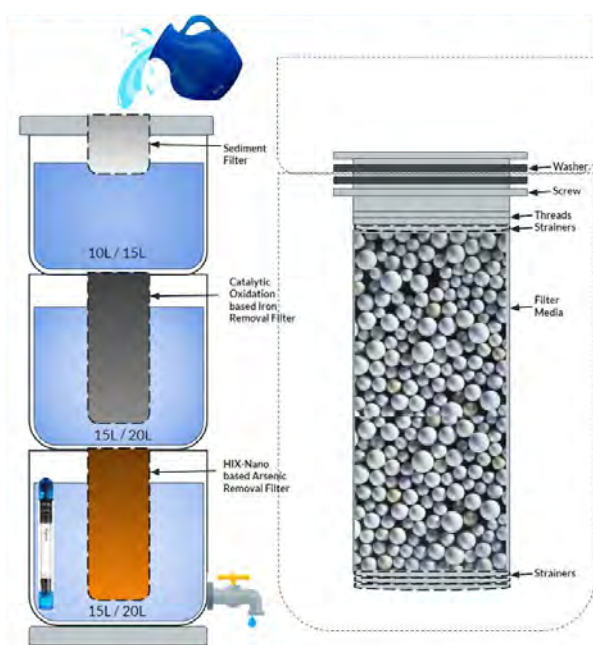
1. Efficiently removes Fluoride till 18 ppm
2. Regenerable media
3. Low energy consumption
4. Pump and gravity-fed system
5. Operating pressure range 15-75 psia
6. Low wastage of water
7. No leaching of Fluoride observed from media bed during filtration, backwash & rinse.
8. Easy for Sludge Handling
9. Gives good results till 18-20 cycles, even more, depending on the operation
10. Rapid adsorption kinetics
11. Low-pressure drop
12. Cost-Effective Treatment

Awards & Certifications

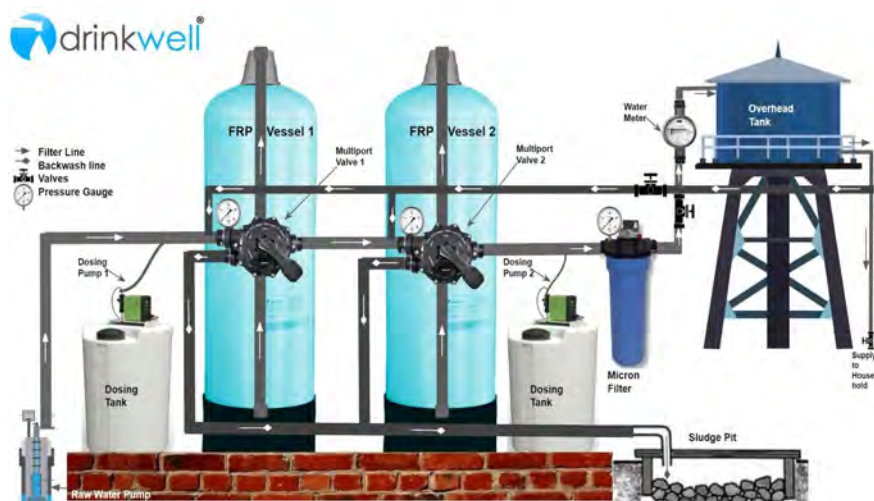
- Patented in the USA by Lehigh University
- CSIR Certified for testing up to 10 ppm
- Recommended by IISc, Bangalore
- Certified by Fluoride Task Force of West Bengal
- Awarded by USISTEF (Dept. of Science & Technology)
- Awarded by FICCI

System Designs:

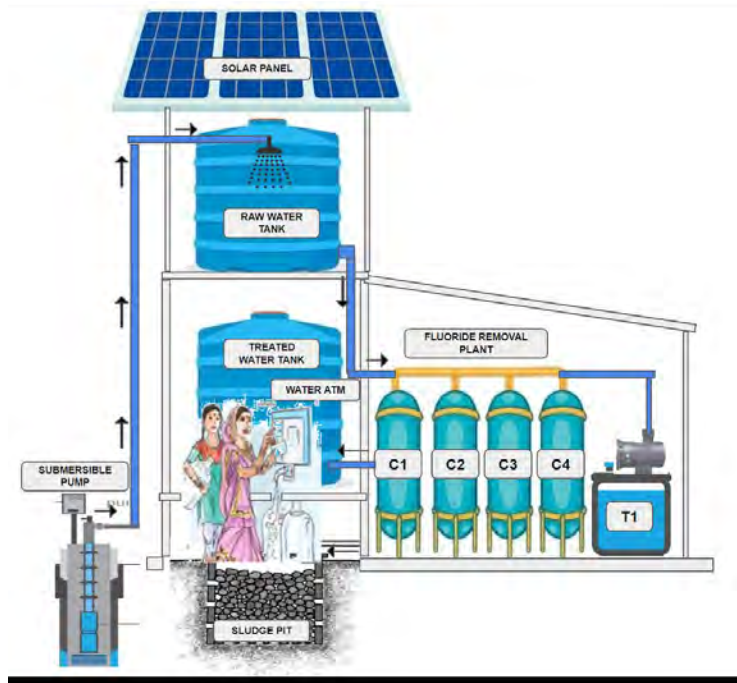
- Point of Use Filter (POU)
- Point of Entry Filter (POE)
- Community Water Purification Plant (CWPP)
- Piped Water Supply System (PWSS)



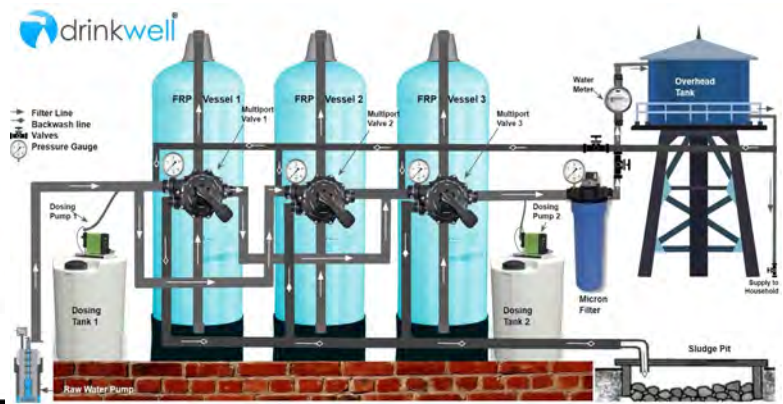
Point of Use (POU)



Point of Entry (POE)



Community Water Purification Plant (CWPP)



Piped Water Supply System (PWSS)

Performance Tested by CSIR with influent Fluoride up to 10 mg/l

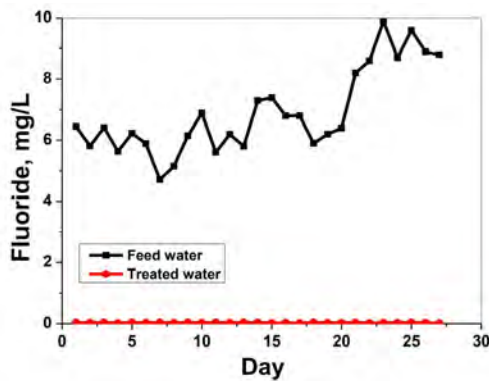


Figure 2.1: Removal of Fluoride in synthetic water by HIX-Nano 200 resin of WIST Water Solutions Pvt Ltd in a packed bed column (Conditions: Flow rate, 100 L/h; run time per day, 4 hour)

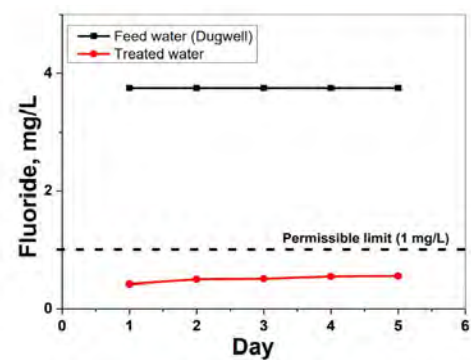


Figure-2.2: Removal of Fluoride from contaminated water collected from a Dug-well, Balinghpur, Nayagarh Dist, Odisha by HIX-Nano 200 resin of WIST Water Solutions Pvt Ltd (Conditions: Flow rate, 100 L/h; run time per day, 4 hour).

HIX-Nano200 Calculator:

Flowrate in LPH	500
Total Alkalinity in mg/l as CaCO ₃	200
Total Dissolved Solids in mg/l	500
Total Fluoride (F) in mg/l	10

SUBMIT

• Drinkwell Recommendations

Pre-Filtration media type	HIX-Nano200+
Pre-Filtration media required	120L
Pre-Filtration Freeboard	25-30%
Pre-Filtration Required vessel volume	16*65
HIX-Nano™200 media required	150L
HIX-Nano™200 Freeboard	25-30%
HIX-Nano™200 Required Vessel Volume	18*65
HIX-Nano™200 Filtration Rate	8
HIX-Nano™200 EBCT	6
Post-Filtration media type	HIX-DeCal
Post-Filtration media required	75L
Post-Filtration Freeboard	25-30%
Post-Filtration Required vessel volume	14*65

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

*The contamination concentration and the filtration rate is 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™200	Activated Alumina	Fluorolith
Company	Drinkwell	Acuro	Dr. Ecker GmbH
Material	Hybrid Resin Bead	Spherical Beads	Granulate
Chemistry	Hydrated Zirconium Oxide	Hydrated Aluminium Oxide	Hydroxylapatite
Min. Contact time	3 min	4 min	10 min
Fluoride Residuals	No Residuals or Fines	Yes- Backwashed Fines	Yes- Backwashed Fines
Leaching	NO	Yes- Aluminium	Yes- Phosphate
Disposal	Regenerable or Reusable	Partially Regenerable or Landfill	Regenerable or Reusable
Regeneration	Yes	Yes - trace amt. of sodium aluminate	Yes - trace amt. of trisodium phosphate
Waste Handling	5kg of solid sludge produced after each conditioning and kept inside soak pit under oxidizing environment.	75-85kg of solid waste for each replacement	High fluoride concentrated spent solution

Technical Data:

- Physical Properties

Appearance	Off-white 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	3-5 gm/L
Moisture Content	45 - 50%
Specific Gravity	1.25
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	3 - 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

DRINKWELL® HIX-Nano™ 200 Case Studies:

India Rural Fluoride Case Study: Nalhati, West Bengal



Drinkwell Fluoride Removal System (Est. Feb 2016)

Location	Nalhati, Birbhum District, West Bengal
Google map coordinates	24.26717, 87.73762
Capex Sponsor	US-India Science & Tech Endowment Fund
Implementation Partner	Ritewater
Served	300 - 400 students
Capacity	2000 Liters Per Day
Impurities	Fluoride (Raw: 18 mg/L Treated: 0.5 mg/L)
Daily Avg of Ls Sold	650
Annual Maint. Contract	Quarterly Site Visits with full treated water quality report

India Rural Fluoride Case Study: Dhar, Madhya Pradesh

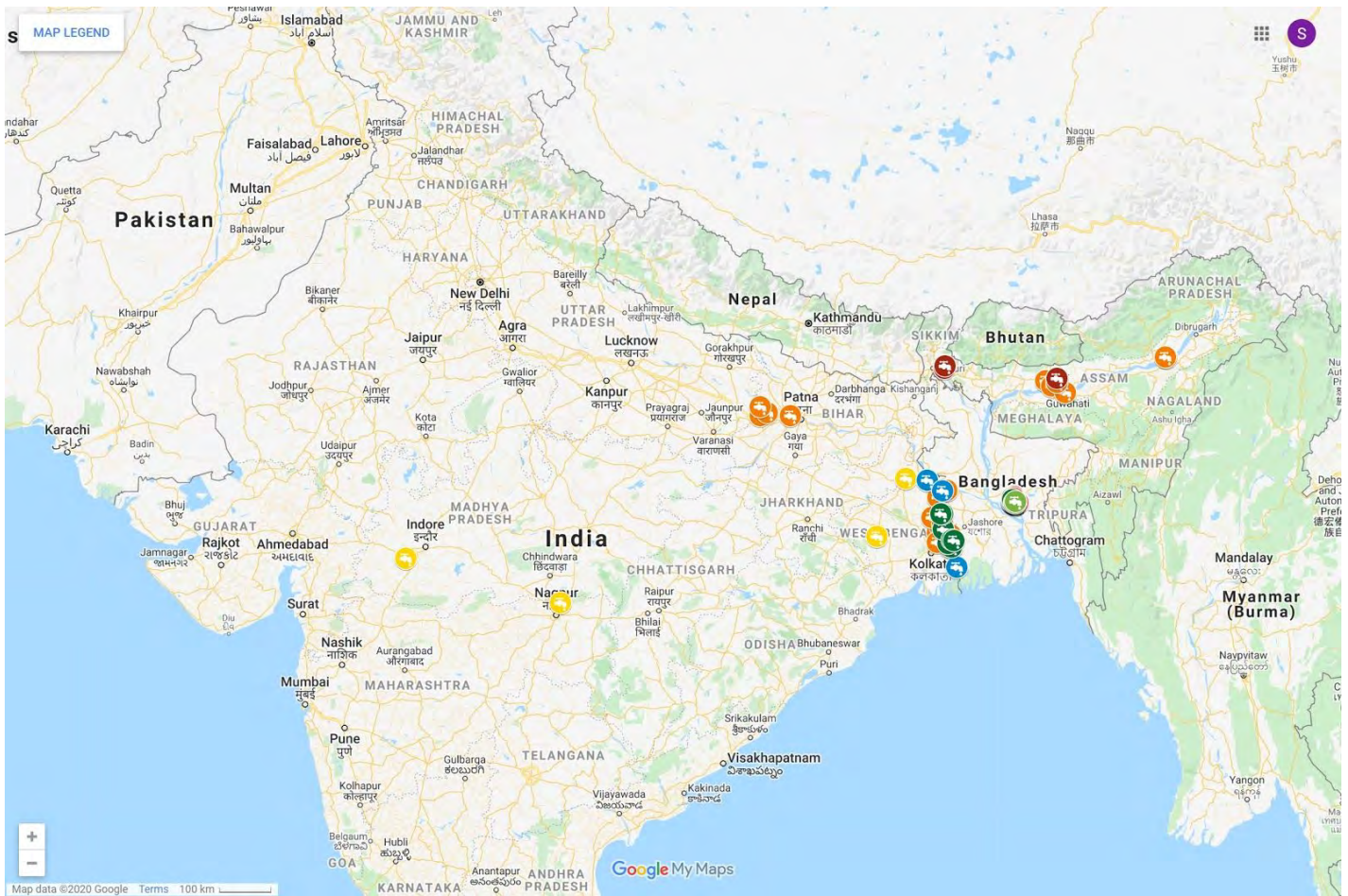


Drinkwell Fluoride Removal System (Est. Sept 2018)

Location	Patadi Village, Dhar District, Madhya Pradesh
Google map coordinates	22.44791, 75.3574
Capex Sponsor	Tata Trusts & Clinton Foundation
Operating Partner	Entrepreneur, Mr. Dinesh Maliwad
Households Served	100-150
Capacity	6000 Liters Per Day
Impurities	Fluoride (Raw: 3.95 ppm Treated: 0.01 ppm) TDS (Raw: 312 mg/L Treated: 210 mg/L)
Daily Avg of Ls Sold	2500
Operation & Maintenance Capabilities	- ATM dispensing system - Water Quality Monitoring via Sensors



DRINKWELL® HIX-Nano™ 200 installations in India



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



सी.एस.आइ.आर - खनिज एवं पदार्थ प्रौद्योगिकी संस्थान
CSIR - INSTITUTE OF MINERALS & MATERIALS TECHNOLOGY

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
Council of Scientific & Industrial Research
भुवनेश्वर-751013, ओडिशा, भारत, Bhubaneswar-751013, Odisha, INDIA

No. : 1129/E & S/SSP- 347 /June/2019

To Whom It May Concern

This is to certify that CSIR-IMMT Bhubaneswar tested hybrid ion exchange nanotechnology media **HIX-Nano 200** of **WIST WATER SOLUTIONS PVT. LTD.**(brand name "drinkwell"), 78 Biren Roy Road West, Kolkata 700061, for Fluoride removal at CSIR-IMMT, Bhubaneswar.

Fluoride removal column set-up filled with media **HIX-Nano 200** of **WIST WATER SOLUTIONS PVT LTD**, was tested using feed water contaminated with different level of fluoride up to about 10 mg/l. The media HIX-Nano 200 was found to remove fluoride efficiently within the permissible limit as per BIS 10500-2012

Fluoride removal efficiency was tested in lab scale in both synthetically prepared fluoride contaminated water and naturally occurring fluoride contaminated water.

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


Dr. Arakshita Majhi
Sr.Scientist &Project Leader
CSIR-IMMT, Bhubaneswar
पर्यावरण एवं सततता विभाग
Environmental & Sustainability Dept.
सी.एस.आइ.आर.-खनिज एवं पदार्थ प्रौद्योगिकी संस्थान
CSIR - Institute of Minerals & Materials Technology
भुवनेश्वर/Bhubaneswar 751013