

Title : HAIX: Hybrid Anion Exchange Media based on Fe/Zr nano particles for removal of Arsenic & fluoride from ground water

Current Stage of the Technology : Technology Ready

Estimated Capital Cost,If Quoted (In Rs): 0

Cost of Water Per Litre (Paise per liter): 5.00

Patent filed : No

Patent Application Number : --

Patent granted : Yes

Patent Number : US 2013/0274357 A1

Provide Video Link : --

Key Word : HAIX-Nanomaterial

Summary of the Product : Hybrid anion exchange (HAIX) technologies have been under development by Dr. Arup K. SenGupta (Lehigh University) since 2003. Polymer ion exchange resins impregnated with metal oxides or HAIX are a robust synergy of organic and inorganic phases. Advanced HAIX formulations have been synthesized and tested in the lab, commercialized, and implemented in field-scale systems for arsenic, fluoride, iron, partial desalination, and uranium removal. Variations of HAIX are in use across four continents by over one million people to drink safe water because of the higher performance and lower cost of water. Besides having superior aesthetic performance for water quality, HAIX has much superior trace contaminant removal. HAIX capacity and packed-bed performance are significantly better than other adsorbents on the market. When HAIX is combined in a process that optimizes fluoride/arsenic removal through the smart use of ion exchange resins, removal performance is increased over 10x at unoptimized conditions and the optimized HAIX process is 20x better than typical activated alumina systems. HAIX is a robust, reusable high capacity adsorbent for arsenic, fluoride, and uranium. The hybrid nature of HAIX means it synergizes the high durability and chemical properties of polymeric ion exchange materials with the high capacity of metal oxide nanoparticles for trace contaminants. This synergy creates a long-term water solution with low produced water costs and operational requirements. Due to the Donnan Membrane Principle, impregnating metal oxides inside ion exchange polymers is not a trivial task and is the a key underlying piece of intellectual property for HAIX. HAIX doesn't require electricity. In rural Bihar, arsenic treatment without electricity is on-going over the last three years. Other technologies like RO wastes 50% of groundwater that is pumped out of the ground. HAIX has water recovery of over 99% to protect the precious groundwater resources and reduce the per volume costs of water. Also as the system is online it can be fitted directly on the line between a submersible pump (electric / solar) and ESR/OHT.

Contaminants that can be removed through this Technology : Arsenic & Fluoride

Design Capacity : From 500 LPH to 200 m³/Hr

Pre-Treatment Protocol : Not Required. However in case of water with suspended solids a Dual media Filter is recommended

Post-Treatment Protocol : NA

Operations and Maintenance Cost and Protocol : Operations and Maintenance Protocol: O&M

is very crucial for success of these community based plants. RITE WATER is very particular about Operation & maintenance of these units. The O&M protocol shall be as below: 1. The unit shall be operated & maintained by RITE WATER for period of 5-7 years as deemed fit by DW&SD after which the unit shall be handed over to Gram Panchayat. 2. RITE WATER shall appoint local villager (Son of Soil) and train him to operate the plant. As the plant is very easy to operate, the local villager can easily run the plant. We have successfully proven this in Maharashtra where the local villagers are operating the plant successfully for last 3 years 3. RITE WATER shall ensure that through automation, the operator intervention shall be minimal 4. RITE WATER shall appoint One Service technician per 5 community centers. The service technician would be regularly visit the plants for maintenance and also for periodic check on the operator and plant efficiency 5. RITE WATER technician shall replace electrodes and any other spares as & when required 6. The water will be provided in 20 Ltr jars at a nominal cost of Rs. 2/- per 20 L jar. If required in case of village where the houses are spread far, the operator shall fill the treated water in 20 Ltr "Amrut Jal" cans and distribute it to each household through cycle rickshaw 7. RITE WATER through IEC activities shall encourage villagers to slowly pay some minimal amount if possible for the water so that the collection is sufficient enough to sustain the O&M of the plant at time of handing over to Gram Panchayat at end of 5-7 years Typically Annual maintenance cost if around 5% of the capital cost and Operator (Manpower) cost is as per norms set by Local body / user department

Reject Management Cost and Protocol : Document Attached

Certification of Product : "Certificate- Indian Institute of Science by K Keshav Rao, Bangalore (Chemical Dept)" – letter for certification that HAIx possesses necessary attribution to alleviate the fluoride crises in India. "Certificate- WB Arsenic Task Force by Prof. KJ Nath"- certified HAIx as an effective technology for arsenic removal. "Certificate- Maner Filter by Dr. Ashok Ghosh, Professor-in-Charge at A.N. College (Patna, Bihar)."- certified for the effective arsenic removal by HAIx to
Ease of Operations and Management : This is extremely operator friendly and can be operated by local villager after proper training.

Interference by other Contaminants : NA

Test Trailed : Whether Test Trailed/Implemented : Small Capacity plants implemented across West Bengal, Bihar and MP based on nano material for arsenic removal Large capacity plant (50 m³/hr and 91 m³/hr installation is in progress in North 24 Parganas in West Bengal) Hand Pump based plant has been installed and tested by Govt. of Orissa and NEERI based on HAIx nano material.

Competitors : We have not come across any competitors who offer Nano material for arsenic & fluoride removal for large capacity plants (50 m³/hr & above) However IIT Chennai has developed nano material for arsenic removal for small capacity plants

About Innovator and Contributors : About Innovator Dr. Arup K. SenGupta has been a Chemical and Environmental Engineering Professor at Lehigh University USA for over 25 years. He has advanced and expanded the field of ion exchange and separation science technology and under his non-profit, the Tagore- SenGupta Foundation, he has led the installation of 200+ community-operated arsenic treatment systems across Southeast Asia that today provides safe water to over 200,000 people. He has received many U.S. and international awards and honors, delivered several invited and/or keynote and plenary lectures in both the U. S. and overseas, and is a highly cited scholar with over 75 publications and 9 patents." About Contributor Rite Water

Solutions (India) Pvt. Ltd, has made a significant impact on the availability of drinkable water to villagers in Maharashtra, Chhattisgarh and Madhya Pradesh. Through use of simple and sustainable technologies for treating chemically contaminated water, Rite Water sets up water treatment plants based on sustainable products developed in house in affected villages and provides safe water to the people. In just few years, Rite Water has set up more than 200+ community water centres in water quality affected villages of Maharashtra, Chattisgarh & Madhya Pradesh providing safe drinking water to more than 150,000 people on daily basis. Rite Water has received following prestigious awards for its contribution in this field: 1.Indo-US Science & Technology Forum award for innovation in filed of nano material for removal of fluoride & arsenic from ground water – A joint award by Govt. of India and Govt of USA 2.Innovative Enterprise Award at hands of Shri Nitin Gadkari, Hon Minister, Transport & Shipping, Govt. of India 3.Entrepreneur Execlence Award at hands of Shri Devendra Fadanavis, Hon Chief Minister Maharashtra 4.Bihar Innovation Forum award for Best Social Innovation for Electrolytic Fluoride Removal Technology 5.Abhijeet has been recognized as one of top 5 young entrepreneurs delivering social impact in Masterprener Season I by CNBC TV 18 6.Rite Water has been recognized by Govt. of UK, Department for International which has invested in the company for scaling the work of providing safe drinking water across low income states of India

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