

WATER

Development & Deployment of Desalination & Water Purification Technologies

Bhabha Atomic Research Centre (BARC) has developed several water purification and desalination technologies, as a part of its research & development efforts towards the betterment of the society. These technologies or products are backed with robust design concepts and pilot plant studies, which can cover the needs of households, communities, industries and metropolis. Know how of products/components/technologies and services available in the field of water treatment can be broadly classified based on their applications as:

1. Water purification systems for the removal of microorganisms, turbidity & toxic contaminants such as, As, Fe, F etc for producing safe drinking water.
2. Desalination Units for the removal of salinity using membrane process or thermal desalination for producing pure water for drinking or industrial uses.
3. Effluent treatment plants based on UF & RO for recovery of water for reuse or for safe disposal.
4. Units which can operate without electricity (domestic UF) or operating on solar power (UF & RO), which are most suited for remote and rural areas.

The know-how of these technologies/ products has been transferred to several parties for wider deployment in a commercially viable manner and is available on non-exclusive basis through technology transfer. Similarly, services in design, engineering, installation, commissioning, operation and troubleshooting of brackish water & seawater desalination and effluent treatment plants are available through consultancy. The important technologies are discussed in brief below.

On-line Domestic Water Purifier Based on Ultrafiltration Polysulfone Membrane

BARC has developed the “point of use” membrane devices with following advantages:

1. The device is very effective as it almost completely filters out bacteria and turbidity thereby producing crystal-clear water.
2. The device is very compact, a small inexpensive portable gadget that can be easily installed and needs no electricity or addition of any chemicals.
3. The device works in a dead-end manner and hence not a single drop of water is wasted.

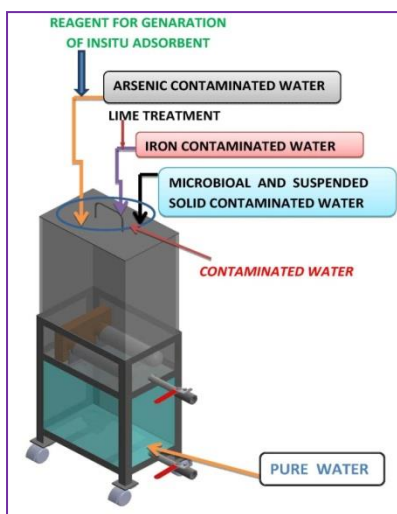
Know-how of this technology has been transferred to 25 private parties for commercialization.



Products manufactured & marketed by BARC licensees

Nanocomposite Ultrafiltration Membrane Device for Domestic Drinking Water Purification with respect to Arsenic, Iron and Microbial Contaminations

Water quality problems exist nearly in all the parts of our country. Micro-biological contamination is a common problem in most of the parts. Specific regions have some predominant geogenic based contaminants like iron in north eastern States and arsenic in the eastern part of the country. BARC has developed a combo domestic water purifier device for removal of microbial contaminations, arsenic and iron without the need of any electricity and overhead water tank. The device is most suitable for rural and slum areas. Know-how of this technology has been transferred to two private parties for commercialization.



Methodology of Operation of Combo Membrane Device



Combo domestic water purification device marketed by BARC licensee

Composite Polyamide Reverse Osmosis (RO) Membrane for Brackish Water Desalination

Reverse osmosis (RO) is an efficient water purification technology for providing safe drinking water from saline and/or contaminated water. BARC provides a process for the preparation of thin film composite polyamide (TFCP) membranes and the procedure to assemble them in commercially usable spiral modules. These membranes are capable of providing safe drinking water by removing 90% salinity from brackish water of TDS up to 5000 ppm. Besides removal of salts, it also removes/reduces virtually all the contaminants from water like turbidity, heavy metals, fluoride, arsenic, halocarbons etc. The technology can be applied for desalination of brackish water, water recovery and reuse (in pharma /biotech, waste water, electrocoating, food and beverage industries) and radioactive waste treatment. Technical know-how of this TFCP-RO membrane preparation process is available on nonexclusive basis.

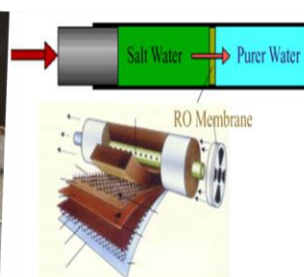
Step-1



Step-2



Step-3



Water Treatment Using Charged Nanofiltration Membranes

Removal of various contaminants like low dissolved ionic solids, heavy metals, hardness, alkalinity, etc. are important aspects of water management for various domestic uses as well as industrial applications. Nanofiltration, which operates at low pressures, offers a viable alternative to reverse osmosis that requires high energy input. Charged nanofiltration membrane technology developed at BARC have the ability to achieve these goals making water suitable for drinking purpose as well as for various industrial purposes.



Spiral modules of charged nanofiltration membranes

High Salt Rejecting Composite Polyamide Reverse Osmosis (RO) Membrane for Desalination

Reverse osmosis (RO) is an efficient and increasingly common solution for providing safe drinking water from saline water sources. The thin film based composite polyamide membranes developed by BARC with high salt rejection for higher feed salinity like sea water are capable of removing more than 99% salinity from saline water with concentration up to 35000 ppm i.e. typical sea water salinity. The commercial size flat sheet membranes can also be made by using this technology. The membrane modules from the licensee are tested and the performance is found at par with commercially available imported seawater RO (SWRO) membranes.



SWRO membrane fabrication



SWRO membrane modules

Multi-Effect Distillation – Mechanical Vapour Compression (MED-MVC)

Multi-Effect Distillation (MED) is a thermal desalination technology that produces distilled quality water directly from seawater/brackish water by using heat and electricity. With the use of a Mechanical Vapour Compressor along with MED, the technology is called MED-MVC. This technology uses electricity alone for

the production of distilled water. Single unit capacity installed in BARC is 5000 liters per day. It is a skid mounted unit and capacities are limited by the availability of lower pressure mechanical vapour compressors.



50000 l/d MED-MVC Plant at BARC, Trombay

Multi Stage Flash (MSF)

BARC has developed MSF technology based on long tube design requiring less energy consumption as compared to conventional cross tube MSF. Based on the experience gained from the 15 KLD desalination experimental facility and 425 KLD MSF pilot plant at Trombay, a 4.5 MLD MSF unit was designed and built as a part of the 6.3 MLD Hybrid MSF-RO plant.



4.5 MLD Multi Stage Flash Plant at Nuclear Desalination Demonstration Plant (NDDP), Kalpakkam coupled to Madras Atomic Power Station

Multi-Effect Distillation-Thermo Vapour Compression

BARC has successfully installed & commissioned 240 m³/d capacity MED-TVC, based on horizontal falling film evaporation along with thermal vapour compression. MED-TVC has successfully demonstrated production of low conductivity (~2 μ S/cm) distilled water directly from seawater. The know-how has been transferred to two private entrepreneurs for commercialisation and deployment.



240 m³/d capacity MED-TVC plant at BARC

Development of Environment-friendly Integrated Zero Liquid Discharge (ZLD) Based Desalination System

Efforts are taken up to concentrate brine from desalination plant in order to achieve ZLD in desalination plants. In this regard, following developments have been made.

- Installed & commissioned Brine Purification Unit for online purification of brine @ 400 kg/h rejected from desalination plant.
- 5 m³/d thermal Brine Concentrator Unit was operated to concentrate brine from salinity 5 -7% to close to its saturation limit (~22%) and recover low conductivity (<5 μS/cm) distilled water @ 200 kg/hr.



Brine Purification Unit



Brine Concentrator Unit

5.0 MLD Seawater Desalination Plant at OSCOM (4.5 MLD SWRO + 0.5 MLD MED)

BARC has taken up a project on setting up of 5 MLD seawater desalination plant at IREL, OSCOM, Odisha. All statutory clearances are obtained (OSPCB, MoEF&CC-CRZ, AERB), and design, engineering & tendering are completed.



Civil Buildings



Sea Water intake pump house

Deployment of Water Purification Technologies in 50 Villages in India

BARC has taken up a pilot project on deployment of water technologies in 50 villages in India. The following milestones have been accomplished in this project.

- A 1000 LPH RO plant along with Water ATM was installed and commissioned, and inaugurated on 27th Nov, 2019 at Somthana Village of Nanded District, Maharashtra, which is affected with nitrate (140-150 ppm) and salinity (1200-1400 ppm). Presently the plant is catering to the drinking water requirements (as per Indian Standard 10500) of about 2500 population in the village.
- Another 1000 LPH arsenic removal plant along with water ATM was installed and commissioned at Ichapur village, North 24 Parganas, West Bengal that caters to requirement of 2000 population, providing them arsenic and iron-free safe drinking water. The Plant, through 8 hours of daily operation, is providing Arsenic purified water to about 400 families in 2 villages, at a daily consumption of 20 litres per family @5/- rupees, through in-built smart card dispensing system.
- 400 numbers of arsenic & iron removal PoU devices (24 LPD capacity) were deployed at Harail village, Samastipur, Bihar.



1000 LPH As removal plant set up at Ichapur

INSIDE VIEW OF PLANT



Inside view of 1000 LPH RO plant installed at Somthana, Nanded, Maharashtra.



Point-of-Use arsenic removal device (24 LPD) installed at a household of Harail village, Bihar.

WATER ATM



Water ATM facility of 1000 LPH RO plant at Somthana, Maharashtra.