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Rural- Friendly Drinking Water Purification Systems

Saly Thomas Panicker
Bhabha Atomic Research Centre (BARC)
Mumbai

Rural- Friendly Drinking Water Purification Systems

- I. Drinking water quality issues
2. Membrane based water treatment technologies
3. A case study
4. Lessons learnt
5. Adaptation of the systems to make them rural-friendly
6. Stand-alone systems, deployable in rural areas

Effects of Water Contaminants & Remedies

I. Suspended & colloidal load -

Filterable particles like dust, dirt etc.

&

Micro-organisms such as, bacteria, viruses etc. causing diarrhea ,
dysentery, typhoid & cholera.

Solution : Membrane based filtration (Ultrafiltration –UF)

2. Dissolved solids – Total : > 500 mg/l - Tastes bitter / metallic, cause stiffness in the joints, blockages of the arteries and kidney & gall stones.

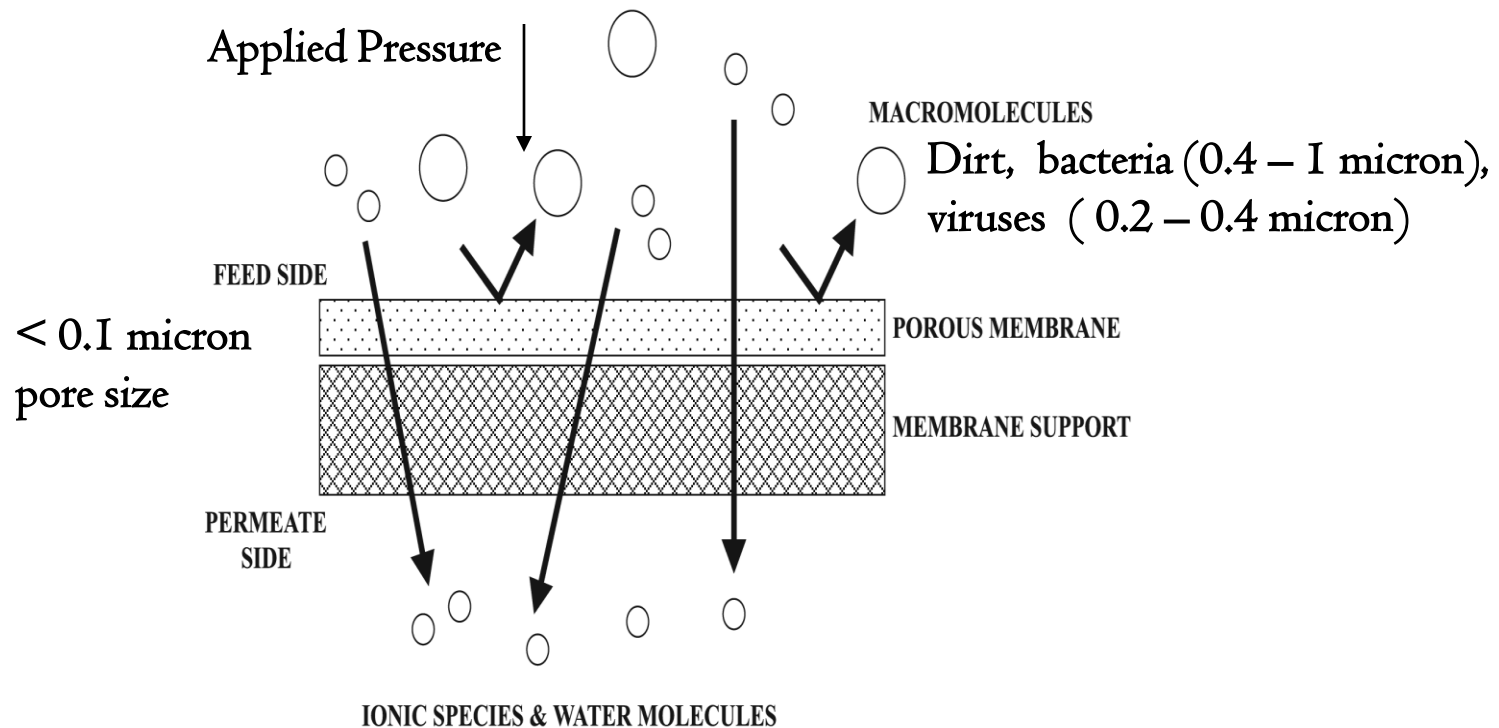
Arsenic > 0.05 mg/l - Cancer, skin diseases, & affects nervous system.

Fluoride > 1.5 mg/l - Dental and skeletal fluorosis.

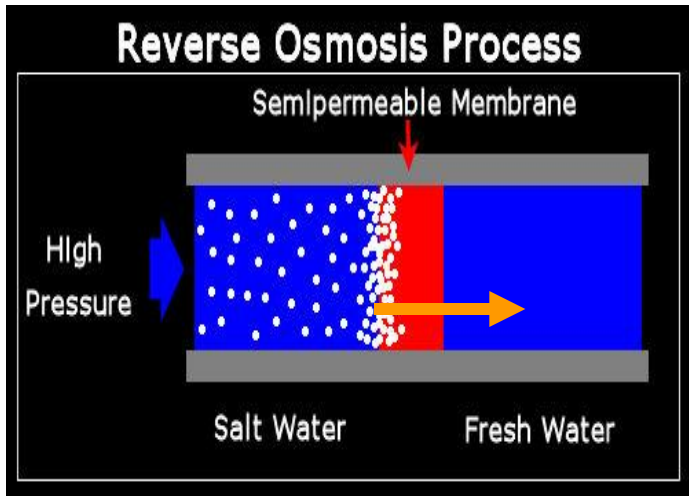
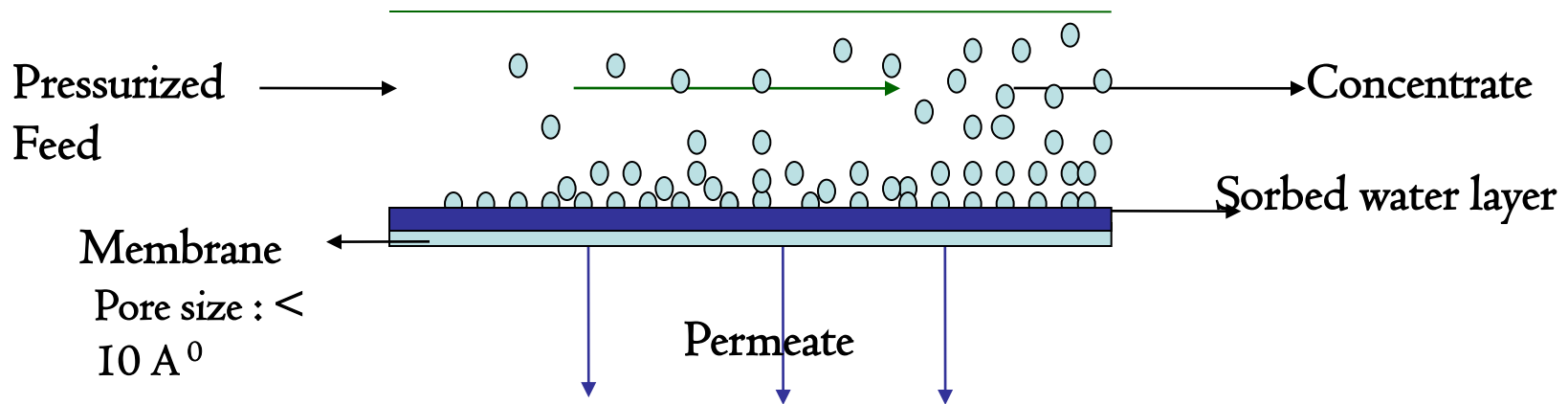
Solution : Membrane based Desalination

Ultra Filtration (UF)

Water and low molecular weight substances permeate through the membrane and particles, colloids, and macromolecules are retained. The removal mechanism is size exclusion.



Reverse Osmosis (RO)



Saline water is passed under pressure through micro-porous semi-permeable membranes. Mineral ions are retained back and water molecules are allowed to pass.

Pressure is required to,

- (1) Detach the salt ions from the water molecules and
- (2) Push the water through the micro-pores of the membranes.

Energy : Electricity

- The rural sector is home for 70% of the population in India.
- Water-borne diseases along with lack of medical care.
- Out of total 17.19 crore rural households living in 29 states of the country, 35.73 % are without any access to electricity (Sept. 2016)



Lifeline of majority of India.



National Defence Force



The privileged group

Water Scenario

One success story of BARC in Rural Maharashtra

Pharare fisher hamlet in Ratnagiri district which is a dwelling for 20 households (population : 250) was selected by BARC for trial runs of an RO Plant. A well is the normal drinking water source for this community. During the period of April to June, the salinity of this well goes up, making it unfit for drinking. During this period, the people fetch water from Parchuri village which is on the opposite bank of the creek, on rented boats, at a cost of, Rs. 250 /family/month.

An RO plant was successfully commissioned in 2011, producing 300 liters per hour of 20 ppm water from 1300 ppm feed. The only consumable was power, amounting to around Rs. 200/month.



Though, the RO plant installation was an initiative towards field trials of BARC technology, for the Pharare fisher hamlet it was like a boon, a relief from their misery of obtaining drinking water. The community inaugurated the plant with sheer ecstasy. Community members especially women were overwhelmed and couldn't stop tears of joy with the hope that their migrant children would no more hesitate to come home for want of good water!

<u>Benefits of Solar Energy Systems</u>	<u>Limitations of Solar Energy</u>
<ul style="list-style-type: none"> ❖ Solar energy is inexhaustible and freely available ❖ Power production using PV panels is environment friendly, no burning of materials & no waste ❖ PV panels are one-time investment, no fuel cost or maintenance ❖ Financial incentives such as, tax exemption, lower customs and excise duties, subsidies etc. available 	<ul style="list-style-type: none"> ▪ Solar energy radiation is intermittent, varies with time & season. ▪ As energy conversion efficiency is less, large number of solar PV panels and thereby large amount of space and initial investment are required.

Solar Energy Potential in India

The daily average solar energy intensity varies from 4 to 7 kWh/m², with about 1500–2000 sunshine hours per year. i.e. 1000 times > demand.

To circumvent the short time (8-10 hrs/day) availability of sun light during the day for power production/water purification,

Produce more energy and store it in batteries –

OR

Produce more water and store -

WHEN THE SUN IS SHINING!

During rainy days,

Have a stand-by power unit such as, wind turbine or DG set

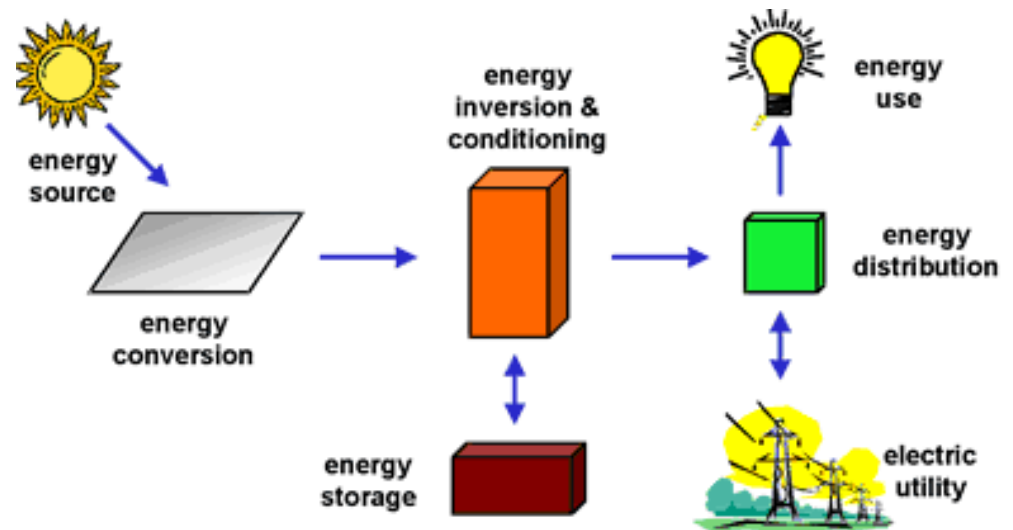
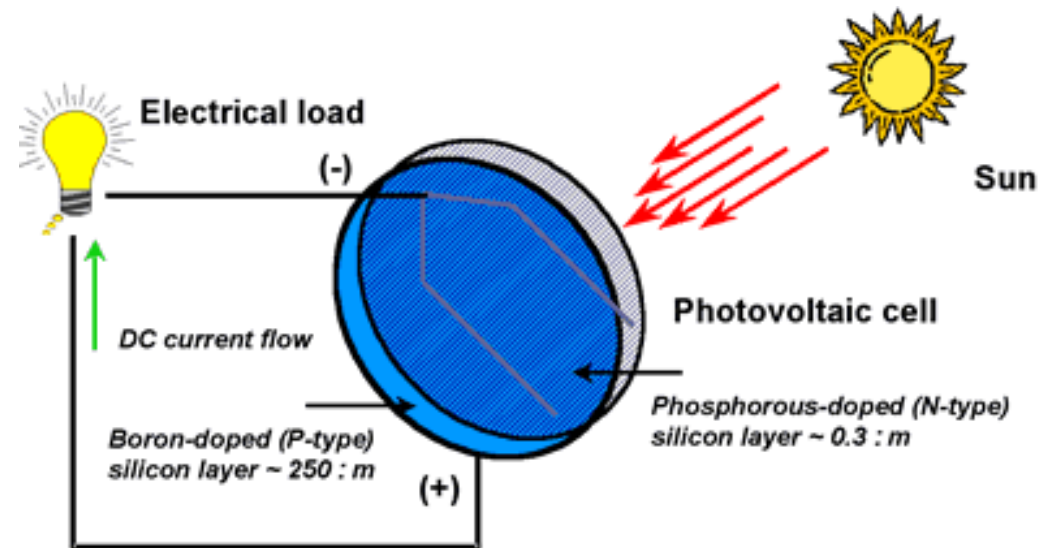
OR

Collect naturally desalinated water from the clouds –

i.e. harvest the rain water

Working of a Solar Cell

Photovoltaic cells are made of semi-conductors. When light energy strikes the solar cell, electrons are knocked loose from the atoms and starts moving. The semiconductor wafer is treated to form a P-N electric field. The electrons can be captured in the form of an electric direct current (DC). Inverters then convert this DC into alternating current (AC). Modules are connected in series – parallel mode as per the required current & voltage.





Solar PV/ Wind Turbine Based Brackish water RO Plant (500 lph)



Hand-driven UF module
(1 lpm)



Foot operated RO
(150 ml/min) /UF unit
(2 lpm)



Bicycle-mounted, RO / UF unit
operated with hybrid power system



During the recent visit of the Hon'ble Prime Minister of India, Shri. Narendra Modi to BARC, the bicycle mounted unit was included among the exhibits. The Prime Minister showed interest on the unit and operated it by himself.

Vision

To provide safe drinking water to improve the life conditions and to make the people healthier and happier.



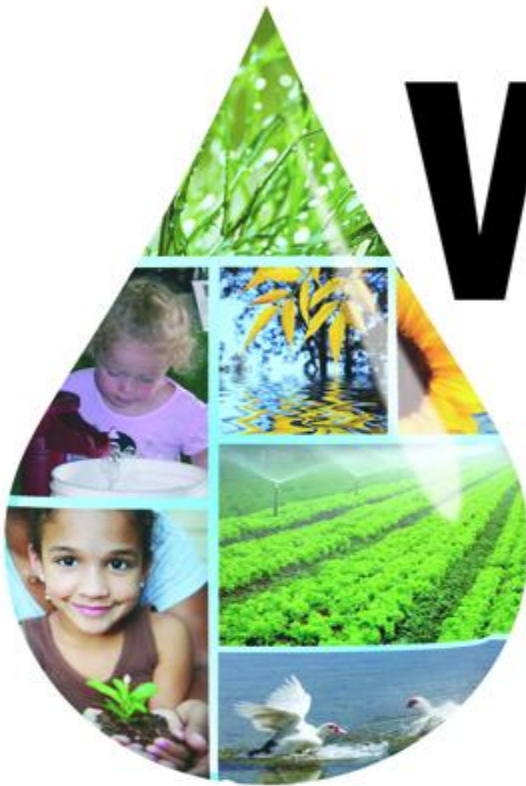
LET IT BE THE PAST



AND THIS BE
THE PRESENT
&
THE FUTURE



Conserve



Water
is life
And Life
is Precious