

# The Future of Water: Bio-filter Technology for Water Recovery



**Bio-filter technology is one of the most novel, green, economically viable sustainable solution for the treatment of wastewater and can recover water from it. Read on...**

By Ankur Sawhney, Smita Singhal & Sunil Singhal

**W**ater is the essence of life, but the reckless exploitation of this valuable natural resource has inclined the civilization towards a future where the availability of potable water will appear as an unrealistic dream. Although, a renewable resource till date, in the near future it will become the scarcest of the resources, leaving half of the population to dwell on unfit water.

Partially or un-treated sewage is the single major source for deterioration of surface or ground water quality. It contributes to 70% of the population load to streams or water bodies of India.

The untreated waste water is a potential pollutant which contaminates the ground water, rivers and natural drainage system causing pollution in downstream areas. The consumption of polluted water has an adverse effect on human health as well as on aquatic life.

## The Need of the Hour

Treatment of sewage is absolutely necessary for making our river and water bodies clean. In spite of all efforts, only 23,277 MLD of treatment capacity have been developed against the total sewage generation of 62,000 MLD. It is mandate for SPCB's/ PCC's under section (I) (i) of The Water Prevention and Control of Pollution Act, 1974 to make, vary, revoke any order for prevention, control or abatement of discharge of waste into streams and under section 24 to prohibit use of stream or well for disposal of polluting matter. Therefore, it is necessary to make it mandatory for setting up STP's by the municipal authorities for bridging the treatment gap.

## Only 30% Sewage Being Treated: Why?

In a conventional methodology, which India has adopted too, sewage is being transported to a centralized treatment plant for the treatment. It demands a highly stabilized infrastructure for continuous working of system.



The principal disadvantages of centralized conventional process technologies are:

- Laying sewage network is highly expensive
- High power requirement
- Long retention time; hence storage/collection tanks/ Clarifiers etc.
- Sludge formation an its disposal
- Long time for stabilization

- Highly skilled manpower needed for operation
- High operation & maintenance cost

### Way Forward: Reusing The Treated Water – Need Of The Time

In such a scenario, alternatives are needed urgently for treating domestic wastewaters which are eco-friendly and effective in a decentralized arrangement. We can recover WATER from sewage in an effective manner that its quality is safe for human consumption, be it fit for drinking, bathing, flushing, gardening, ground water recharging etc.

Reusing treated municipal sewage is not a new idea. It has been treated and used for indirect possible use in a number of ways. In Adelaide, Australia, the treated sewage is discharged into the Murray- Darling rivers, which are then used as drinking water sources for the cities downstream ([https://en.wikipedia.org/wiki/Water\\_supply\\_and\\_sanitation\\_in\\_Australia](https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_Australia)). The Orange County Water, California treats the raw sewage and uses the same for ground water recharging. ([https://en.wikipedia.org/wiki/Orange\\_County\\_Sanitation\\_District](https://en.wikipedia.org/wiki/Orange_County_Sanitation_District)). NEWater, Singapore is another example – where the treated wastewater (sewage) goes into water supply. (<https://en.wikipedia.org/wiki/NEWater>)

### The Absolute Water Bio-Filter (Vermi-filtration) WRS Technology

The global scientific community today is searching for a technology which should be “economically viable”, “environmentally sustainable” and “socially acceptable”. Vermi-filtration has opened new grounds for treating wastewater in the world and specially so in the developing countries due to its low cost and eco-friendly nature. Absolute Water has come up with such unique green technology that can be used in a decentralized way, which face multi-dimensional issues when it comes to managing wastewater as well as existing water resources i.e. to treat the sewage in a cluster and recover potable quality water which meets the WHO/BIS standards of drinking water.

### Water Recovery System Technology

The process described here is unique as it is the first such proven project in India, directly converting raw sewage into drinking water.

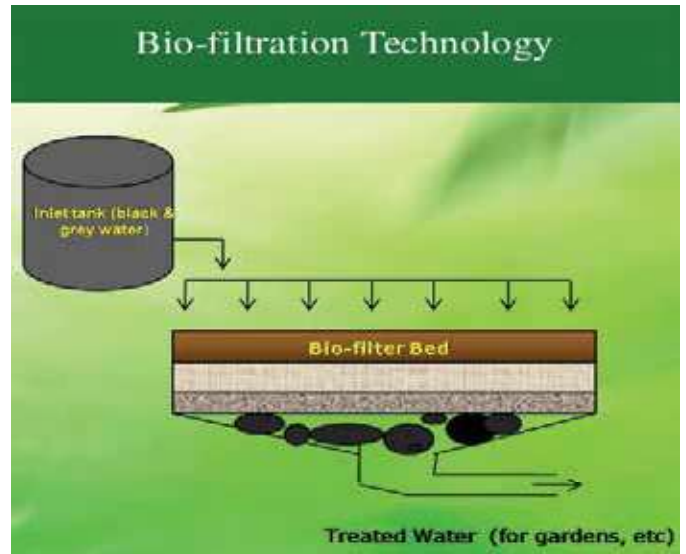


Figure 1(a): showing Bio-filter Principle



Figure 1(b): Inside view of Bio-filter Basin

The System comprises of two steps:

### Step 1: Sewage Treatment Through Bio-Filter (Vermi-Filtration)

- Bio-Filter System is High efficiency and multi filter medium which include worms, specially developed microbes, organic & in-organic media.
- Sewage pumped from the Effluent collection tank is allowed to pass through screen to remove/ separate the macro particles present in the effluent.
- Sewage is distributed evenly over the surface of filter medium, by sprinklers. As the waste water slowly percolates down, naturally occurring microbes degrade the solids and

organic matter, reduce coli from bacteria, nitrify ammonium, producing clear and odourless water.

- Filtration through In-organic media followed by sand filtration to remove the traces of suspended solids present in the treated water.

## Step 2: Recovering Clean Safe Water From Bio-Filter Treated Sewage Through Membrane System

- This is non-R.O. System with a very high recovery (> 80%).
- The specially designed Membrane not only filters out various contaminants but also the harmful Bacteria, Viruses, and other Pathogens.
- The feed is taken from the treated sewage tank and is passed through a pressure sand filter to remove the suspended solids, if any. There is another filter to ensure that the feed to the membranes does not have any particles in it. This ensures long life for the membranes.
- The filtered treated sewage is feed into the membrane system and permeate from the membrane is of Potable/Contact water/Bathing water quality.

## Bio-filter offers a number of distinct advantages over other conventional treatment methods which are as follows:

- Totally natural, green process, based on beneficial microbes and earthworms to break down the organic waste present in the sewage
- It harnesses the energy, carbon, and other elements present in the waste and converts them to Energy rich humus, Bio fertilizer & Nutrient enhanced treated water
- Reduces costs of collection, transfer and treatment of raw sewage
- Toxicity of Ammonia gets reduced through Nitrification, converting to useful Nitrates that will act as nutrient when the treated water is used in gardening (similar to urea)
- No odour and no sludge formation

- Very low power requirement, only one small pump of 1.0 KW/ 100KLD System
- Does not require skilled person for operation & monitoring
- Accessing the Pollution Board norms for use of treated water in gardening
- System can be tailor made to suit site conditions and geometrically sized accordingly.
- Automatic operations
- Noise free system
- Plug & Play assembly for easy installation. Frequent Start/ Stop will not disturb biological balance or plant output water characteristics
- Very cost effective

The reclaimed water from this plant is already being catered to the nearby communities, which is used for:

- Potable/Non-potable
- Bathing/Washing/Flushing
- Irrigation

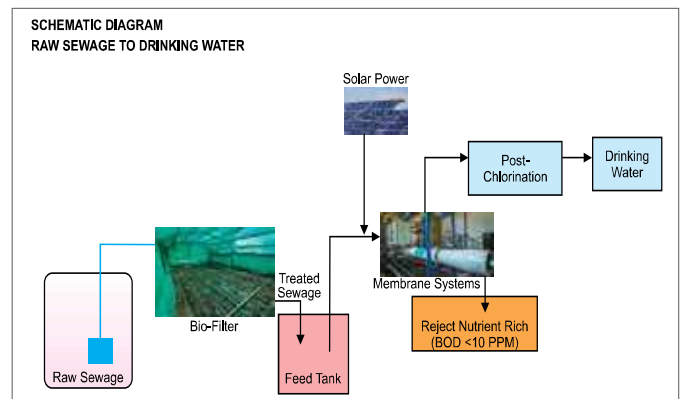


Figure 2: Schematic lay out of the Bio-filter based WRS system

- Horticulture/Construction
- Ground Water Recharging
- River Rejuvenation

## Layout of Bio-filter based Water Recovery System

### Modular Arrangement For Lower Capacities With Utmost Result

Another aspect of Bio-filter which makes it superior from other technologies is its arrangement, as it can be easily installed in a modular system for those industries/institutions/hotels/housing colonies where the wastewater generation is in low quantity and facing space constraint as well. It need very less work space for its installation as compared to conventional techniques acquiring a smart foot print for its installation with the shortest stabilization time over all the conventional technologies, as shown below in figure 3(a) & (b).



Figure 3(a) Civil based Bio-filter (for larger capacity) and



Figure 3(b) Modulated Bio-filter plants (for smaller capacity)

## First Sustainable STP Cum WRS of India

Absolute Water joined hands with Delhi Jal Board, water governing body of National Capital, to build the first sewage treatment cum Water Recovery System of 100KLD capacity at Keshopur STP, based on Bio-filter technology with a commitment of giving a potable quality treated water. This plant is the first green technology based STP cum WRS plant of India where the domestic wastewater coming from neighbouring areas is being treated and recovering >85% potable water for Delhi people, catering the water needs of nearby community. Treated water is also being taken by DTC for washing of buses etc., managing the ground water resources as well.

The main challenge was to meet the drinking water supply to those areas where the water supply is inadequate and managing the wastewater treatment as well in a most economical and highly efficient way. Absolute water is running the plant since more than a year with the consistent efficiency. It has acceded to its expectations very well and very soon we are going to install another such plant for the other location as well. Our technology has been approved to be viable by the DJB as inaugurating the system at national level by the Delhi Chief Minister Mr. Arvind Kejriwal himself, while further installations are already up and would be running at many locations very soon in the whole country.

### Salient Features of the Project

- The first ever STP cum WRS of India recovering >85% potable water from city's wastewater, catering the freshwater needs of nearby areas where water supply is inadequate.
- Zero discharge of wastewater as the reject stream of NF is very much efficient in
- Nutrients (NPK) using it for irrigational purpose.
- Small footprint and designed on "Toilet to Tap" concept.
- The first STP of Delhi running on solar power, saving energy as system is having very low power requirement (1.0KW for 100KLD) serving energy for those areas where power supply is inadequate.
- No sludge generation (cuts sludge disposal cost) and no chemicals needed.
- Noise free system and odour free system surroundings.

## Inlet & Outlet Water Characteristics

The reject stream having its BOD < 10 ppm, can be sold as a liquid fertilizer (highly nutritive rich in NPK), very much beneficial for horticulture purpose in parks & golf courses or in converting a wasteland (contaminated land) into a wonderful land (fertile land). The evaluation of the project has already been carried out with the present system. The Bio-filter media is generally re-filled within 6-8 months depends upon the system operation; the rejected media is a highly enriched humus, used as a rich bio-fertilizer manure for irrigational land/horticulture or can be even marketed to nurseries as well.

Parameters	Raw Sewage	After Bio-Filter	After Membrane System	Reject
pH	6.0-7.0	6.5-8.5	6.5-8.	8.0-8.5
COD(mg/l)	Upto 500	<100	<10	<30
BOD(mg/l)	Upto 250	<30	<2	<10
TSS(mg/l)	Upto 700	<20	<1	<50
TDS(mg/l)	Upto 700	<600	<250	<2100
Turbidity(NTU)	Upto 70	<1	<1	<40
Colour	Dark Grey	Pale yellow	Colourless	<Dark Yellow
Odour	Strong	No Odour	No Odour	Slight
Faecal Coliform (MPN/100ml)	10 <sup>6</sup> /100 ml	10 <sup>4</sup> /100ml	BDL(Below Detectable Limit)	#

Table 1: Water parameters before and after treatment with Bio-Filter of the running installation at Keshopur, New Delhi

#: To be let out after ozonation for ascertaining no bacterial activity is in the reject water.

Note: The drinking water produced, meet the stringent parameters laid down by the WHO and the BIS 10500-2012 specifications.

## Water Quality of Various Samples



Figure 4: Raw Sewage, After Bio-Filter and After Membrane quality water

## Conclusion

Bio-filter technology is one of the most novel, green, economically viable sustainable solution for the treatment of wastewater and can recover mankind's most precious resource i.e. WATER from it. Our technology has so far proved its efficiency when compared to the existing technologies. AW Bio-filter technology has the potential to address wastewater management and water crisis simultaneously. We believe that we will set India as an ideal example especially among the developing countries which face multi-dimensional issues when it comes on managing wastewater and water resources as well. It is self-sustaining with no wastage/being a ZLD system. We can achieve the desired effect of "AVIRAL" by converting our poisoned river into an incessant stream of pure water.

### ABOUT THE AUTHORS



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