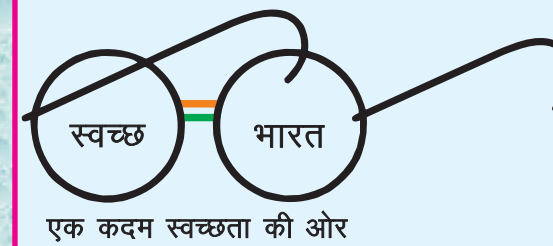


COMPENDIUM OF INNOVATIVE TECHNOLOGIES ON RURAL DRINKING WATER & SANITATION



Government of India

MINISTRY OF DRINKING WATER AND SANITATION
Paryavaran Bhawan, CGO Complex, Lodhi Road, New Delhi-110003
www.mdws.gov.in



GOVERNMENT OF INDIA
MINISTRY OF DRINKING WATER & SANITATION

JANUARY 2015



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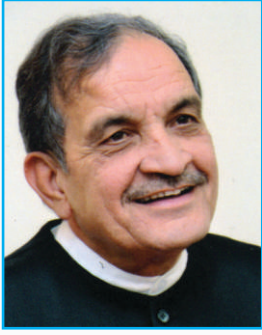
**COMPENDIUM OF INNOVATIVE TECHNOLOGIES
ON
RURAL DRINKING WATER & SANITATION**



**GOVERNMENT OF INDIA
MINISTRY OF DRINKING WATER & SANITATION**



JANUARY 2015



बीरेन्द्र सिंह
Birender Singh



ग्रामीण विकास, पंचायती राज और
पेयजल एवं स्वच्छता मंत्री
भारत सरकार
MINISTER OF RURAL DEVELOPMENT, PANCHAYATI RAJ
AND DRINKING WATER & SANITATION
GOVERNMENT OF INDIA

MESSAGE

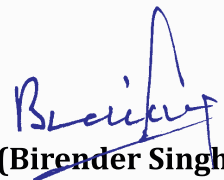
The Ministry of Drinking Water and Sanitation has been providing financial and technical assistance to the State Governments in realizing the objectives of safe potable drinking water and open defecation free rural India. With the Launch of the “**Swachh Bharat Mission**” by the Hon’ble Prime Minister of India on 2nd October 2014, the mandate of the Ministry has become more widespread and the target has been fixed to achieve open defecation free India by 2nd October 2019 as a befitting tribute to Father of the Nation, on his 150th birth anniversary.

In order to achieve the target in most economical way and for use of new technologies, this Ministry organizes Exhibition cum Workshops on Innovative Technologies from time to time. This Ministry has invited innovators/innovative technologies in the field of Water and Sanitation and has provided a platform to these innovators/technology providers to present their innovations before the State Government officials /implementers.

The present booklet is the compilation of different innovative technologies, vetted by a high level Technical Committee constituted by the Ministry, under the Chairmanship of Padma Vibhushan Prof. R. A. Mashelkar, Ex. Director General, CSIR.

I would like to acknowledge the efforts of the officials of this Ministry for bringing out this Compendium.

I hope this Compendium would be of immense use for all the State Government officials.


(Birender Singh)



राम कृपाल यादव
Ram Kripal Yadav



राज्य मंत्री
पेयजल एवं स्वच्छता मंत्रालय
भारत सरकार
MINISTER OF STATE
DRINKING WATER & SANITATION
GOVERNMENT OF INDIA

संदेश

पेयजल और स्वच्छता मंत्रालय एवं ग्रामीण पेयजल आपूर्ति और स्वच्छता का कार्यभार देख रहे राज्य विभागों का अधिदेश स्वच्छ पेयजल उपलब्ध कराना और ग्रामीण भारत में **"स्वच्छ भारत"** के उद्देश्य को प्राप्त करना है।

पेयजल की गुणवत्ता हमारे बहुत से गाँव में चिन्ता का मुख्य कारण है। ग्रामीण क्षेत्रों से इस संबंध में, जागरूकता बढ़ रही है और मांग बढ़ रही है कि भारतीय मानक ब्यूरो (बीआईएस) के विनिर्देशों के अनुसार, पीने और खाना पकाने के उद्देश्य हेतु साफ पानी उपलब्ध कराया जाना चाहिए। हमारे देश में ग्रामीण क्षेत्रों के अधिकांश भागों में पेयजल स्रोतों में अत्यधिक आर्सेनिक, फ्लोराइड, लवणता, विषैले धातुओं, यूरेनियम और कीटनाशकों आदि की समस्या सामने आ रही है, जिसका कि तत्काल समाधान किए जाने की आवश्यकता है। इसके अतिरिक्त, ग्रामीण क्षेत्रों का उच्चतर प्रतिशत स्वच्छता की पर्याप्त सुविधाओं के बिना है जो कि राष्ट्र के सामने एक दूसरी बड़ी चुनौती है। अतः माननीय प्रधानमंत्री द्वारा दिनांक 02 अक्टूबर, 2014 को प्रारम्भ किए गए **स्वच्छ भारत मिशन** का उद्देश्य अक्टूबर, 2019 तक स्वच्छ भारत की स्थिति प्राप्त करना है। पेयजल और स्वच्छता के क्षेत्र में इन चुनौतियों से निपटने के लिए सार्वजनिक और निजी क्षेत्रों में बहुत से भिन्न-भिन्न अनुसंधान संस्थान अभिनव प्रौद्योगिकियों का विकास करने में लगे हुए हैं।

मैं, इस सार-संग्रह को फलीभूत करने के लिए, इस मंत्रालय के अधिकारियों द्वारा किए गए प्रयासों और पदम विभूषण प्रोफेसर आर.ए. माशेलकर की अध्यक्षता में गठित उच्च स्तरीय तकनीकी समिति द्वारा किए गए पहलों की सराहना करता हूँ।

यह सार-संग्रह मंत्रालय द्वारा तैयार किए गए कुछ अभिनव प्रौद्योगिकियों का एक संकलन है, जो कि मैं आशा करता हूँ कि राज्य सरकारों के लिए काफी सूचनाप्रद और लाभप्रद होगी।

राम कृपाल यादव

नई दिल्ली
22 जनवरी, 2015

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DRINKING WATER

1.0 PurAll online water purification device

PurAll Solutions

PurAll solutions are online NON-ELECTRIC water purification solutions which work on a simple chemical based technology. It has an online Chlorine CPU with replaceable water purification cartridges, for continuous operation. PurAll solutions use NSF approved and certified chemical (NSF- National Science Foundation, USA) for drinking water, which delivers an appropriate dose of chlorine and controls disease-causing organisms in water systems.

Chemical Technology

All PurAll devices use NSF certified Trichloroisocyanurate tablets. This chemical has a low solubility of 0.2 %. This low solubility enables online chlorination, in flowing water, at a defined contact time and contact area. The **EPA approvals and NSF certifications** have made these materials available for routine use in drinking water. The chemical is sourced from Shikoku Corporation, Japan. These products have several advantages over traditional products and may be considered for use water systems where **safety and security** point of view.

Features

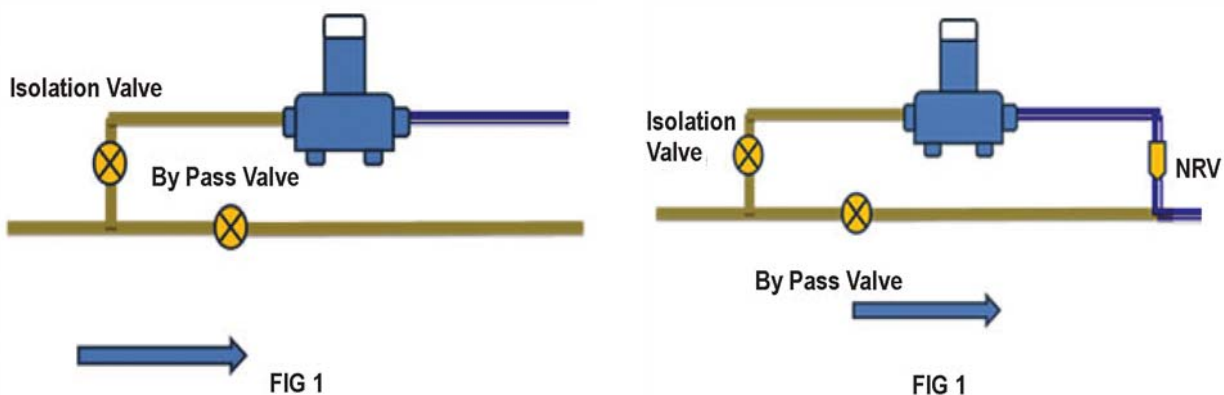
PurAll is a Stand Alone device for disinfecting **drinking water**. It requires minimal maintenance. PurAll is capable of delivering a constant and appropriate dose of chlorine to control disease-causing organisms in small community water systems. PurAll is an inexpensive, non-electrical, appropriate technology instrument.

Models and Areas of Applications

There are various models of PurAll – PurAll 50, PurAll 50+, PurAll 50H and PurAll 100, suitable for piped water supply schemes and hand pumps. All the models come with an end of life indicator, which indicates the time to replace the cartridge.

How PurAll Works

Schematic diagram of installation of PurAll model for piped water supply schemes



It is advised that PurAll device be connected to the main raw water supply line as per Fig 1 above. Only in rare case, if installation as per Fig 1 above is not possible, then PurAll be installed as per Fig 2 above. The valves used should be of the type that will not restrict the flow very much, such as ball valves or gate valves. During operation it will be necessary to take samples downstream of PurAll to check the chlorine residual. The sample must be drawn after the chlorinated flow has merged with the bypassed flow. A sample tap might be installed for this purpose.

In operation, the water flows by gravity through the bypass line (Fig 1) or in a pressurized bypass line (Fig2) through PurAll. In this arrangement adequately chlorinated water is mixed in raw water to have desired free chlorine. The dose should remain relatively constant regardless of the rate of flow.

The chlorine dose so adjusted should be sufficient to satisfy the chlorine demand and provide a residual level in the distribution system. If PurAll adds more chlorine to the water than is needed for these purposes, the chlorine dose can be controlled by the amount of water bypassing PurAll. To increase or decrease the dose the bypass valve may be adjusted to divert more or less water through PurAll. During operation the bypass valve will normally be partially or completely closed for flow control and the isolation valve will be partially or wide open. The valves once adjusted are seldom required to be changed for a site, unless there is a marked change in raw water parameters- viz flow rate.

The technology have been supplied in more than 1500 units of different models in different States in India and in abroad.

Contact details :

EASOL PRIVATE LIMITED

C-3, 304, Saudemini Complex, Kothura, Pune-411028

Mob: 9881256003

2.0 Capacitive Deionization Technology (CDI) using carbon aerogel

Principle

Untreated water flows through an unrestricted capacitor type module consisting of numerous pairs of high-surface area carbon aerogel electrodes. Carbon aerogel contains a very high specific surface area (400-1100 m²/g BET) and a very low electrical resistivity (< 40 m-ohm-cm). The positive and negative electrodes respectively adsorb anions and cations in the water solution upon polarization of each electrode pair by a direct current (DC) power source. The water is re-circulated in the module until ions are removed up to the desired level after which the purified stream is collected and the next stream of untreated water is introduced. The module holds the ions until the material is saturated, and at this stage the power is disconnected and the electrodes are washed with a small quantity of water/acid. The washed out water/acid is collected as waste stream and the entire cycle is repeated.

O & M

The module and the electrodes have a guaranteed life of 5 years and annual maintenance is negligible as there is no need for replacement of any parts. Electricity consumption is estimated to be around 1 KWH per 1000 litres of treated water.

Innovation in the technology and difference from the conventional/prevaling technology

The breakthrough and innovation in CDI is in the use of carbon aerogel materials as electrodes. Almost all the elements in the periodic table can be removed using CDI with carbon aerogel electrodes. CDI with carbon aerogel material has shown massive improvement over RO technologies for brackish water (less than 10,000 ppm dissolved solids) desalination. For low impurity levels in feed water, CDI can be the power technology of the future. Other advantages of CDI over other technologies such as electro-dialysis, sedimentation, chemical separation etc. are as follows:

- ❖ No daily dosage of chemicals or annual replacement of filters.
- ❖ Size of system can be for households level, small community based system or large ones can be designed.
- ❖ Cost forecast to decline with scale and operational improvements.
- ❖ Low electricity consumption, can be integrated with solar for off grid regions.
- ❖ No risk of deterioration of original water quality.

Limitation

- ❖ CDI will be more expensive than other technologies for desalination of water with high salinity content (>10,000 ppm) i.e. seawater desalination.

Contact details : Aquas Technology, Corp 301, Runwal Commercial Centre, BS Devshi Marg, Govandi East, Chembur Mumbai 400 088

3.0 Water on the Wheels – Jal Doot

This is integration of following three technologies.

- i) UF-Membrane based surface water filtration technique.
- ii) PTO shaft drive to meet the power required where no power is available.
- iii) Multistage filtration – sand filtration > water softener > silver impregnated coconut shell carbon > micro filtration > ultra filtration.

A coin vending machine is also provided.

Capacity: 5000 lit, Discharge: 1200 LPH



Contact details :

Membrane Filters Pvt. Ltd, Pune

1st Floor Parvati, 73/6, Bhakti Marg,

Off Law College Road, Pune-411004

Tel: 020-25453342, Fax: 020-25450531

Email: info@membranefilters.in

4.0 Solar Operated/Stand Alone Ground Water Treatment Plant

- This system also works using solar Energy.
- Suitable for treatment of Arsenic, Fluoride and TDS .
- Arsenic is removed using disposable granulated media.
- Fluoride is removed by using regenerative / disposable type Granular Media.
- Surface water is treated with micro and ultra filtration.
- Saline water is treated with RO system.
- Capacity: 5.7 KLD for compact system and 40-50 KLD for Mini WS System.

Contact details :

Membrane Filters Pvt. Ltd, Pune

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Off Law College Road, Pune-411004

Tel: 020-25453342, Fax: 020-25450531

Email: info@membranefilters.in

5.0 Jal-TARA Water Filter

Background

Sand filters commonly used for water treatment are of two types a slow sand (2 to $6\text{m}^3/\text{m}^2/\text{day}$) and rapid sand (100 to $150\text{m}^3/\text{m}^2/\text{day}$) filters. Though there are many other ways of treating water, no single process is as effective in simultaneously improving microbiological and physio-chemical qualities of water as slow sand filtration. It is for this reason that slow sand filters are very much favoured in developing countries where land and labour constraints are not pressing, and the ease of operation, maintenance and cost are most important.

Jal-TARA filter has been developed by Development Alternatives, New Delhi. These filters are now marketed by TARA Technology and Action for Rural Advancement), a social enterprise of the Development Alternatives Group. The Filter is designed to treat drinking water contamination with pathogenic bacteria, turbidity (dust, dirt and suspended material) and iron using slow sand filtration technique. Jal-TARA filter is a community level system, which can provide 2000-3000 litres of safe drinking water per day. It doesn't require electricity and is also suitable for hilly region.

Principle

The main principle of Jal-TARA water filter is based on the traditional process of slow sand Filtration system. Filter is a biological filter merged with advanced technique of Fabric protection to improve and simplify the traditional process of slow sand filtration. Generally two types of filtration processes take place in the filter, viz. Physical filtration and Biological Filtration, the fabric filter prevents most organic matter, silt and mud particles from passing through. Biological community builds up on fabric filter and sand bed, scavenging and breaking down pathogens and organic matter in the raw water.

Jal-TARA filter is standardized in 1000 litres water tank with the output water supply of 2500-3000 litres per day. The filter contains pebbles and sand of different sizes. System is provided with a synthetic fabric filter designed with advanced technique of fabric protection. The system can be fed under gravity flow or through conventional pumps or operated by solar photo-voltaic.

Flow Rate: $2-3\text{m}^3/\text{m}^2/\text{day}$

In Jal -TARA Filter two types of filtration processes act together to improve the quality of water. The two filtration processes are as below:

Physical filtration : The fabric filter prevents most organic matter, silt and mud particles from passing through.

Biological filtration : A biological community builds up on fabric filter and sand bed, scavenging and breaking down unwanted pathogens and organic matter in the raw water.

Ja-TARA is NABL accredited laboratory certified community based slow sand filter available commercially in the country.

Contact Details:

Development Alternatives

B-32, TARA Crescent, Qutub Institutional Area New Delhi -110016.

Email: mail@deval.org

Website: www.deval.org

Ph: 011-2654-4100, 011-2654-4200

6.0 Aqua+ and Antenna WATA Technology

The current standard of sodium hypochlorite as per IS: 11673: 1993 reaffirmed 2003 prescribe strength to be at 4 % concentration. The beauty of Aqua+ is that it treats the water and makes it safe for drinking even at a lower concentration of 0.6 %. Therefore a new grade need to be added to the existing BIS standard to encourage electro-chlorinator based sodium hypochlorite production. This was discussed by the developer of Aqua+ with BIS and the initiative has been appreciated by BIS.

Aqua+ was developed by Developed Alternatives, New Delhi in partnership with Antenna technologies, Switzerland. After developing and testing the business model , it was then halved off into a profit company called TARAlife Sustainability Solutions Pvt Ltd. Aqua+ contains Sodium Hypochlorite in liquid form (0.6 % concentration) and it is packaged in 50 ml bottle with dropper. Each bottle can treat 500 litres of water and the Shelf life is 6 months from the date of manufacturing.

WATA technology was developed by Antenna technologies, Switzerland. It uses a simple, manageable process of electrolysis to convert a measure of salt and water into sodium hypochlorite. It is available in 3 models. The difference in the 3 models is the scale of operation. Although the standard WATA device produces 1 litre Sodium Hyp. Solution per hour, the maxi-WATA produces 12.5 litres of sodium hypochlorite.



1 liter of water + 25 g of salt + 1 hour of electrolysis=1 liter of sodium hypochlorite = treatment of 4 000 liters of water = daily consumption of drinking water by 1 000 people

Contact Details:

Development Alternatives

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New Delhi -110016.

Email: mail@devalt.org

Website: www.devalt.org

Ph: 011-2654-4100, 011-2654-4200

7.0 P&G sachets for purification of water for drinking purpose

Technology

“P&G Purification of water” sachet is a powdered water purification technology packaged in a 4 gram sachet. It treats 10 liters of water at a time. P&G Purification of water sachets are a simple, point of use, household level water treatment technology developed by Procter and Gamble in collaboration with US Centers for Disease Control and Prevention (CDC). Treatment with P&G purification of water results in water quality that meets WHO guidelines. The product has a self-life of 3 years.

P&G Purification of Water contain a chlorine disinfectant (Calcium Hypochlorite) for killing of bacteria and an iron salt coagulant (Ferric Sulphate) for removing suspended matter, protozoa and viruses . The packets do not require any electricity or maintenance. Only simple readily available household implements- bucket, stirrer, cotton cloth, scissor/knife are needed to use the packets. P&G Purifier of water is safe for long term use by the entire family, including infant, and is considered a protective technology by WHO effectively reducing pathogens, muddy sediments leaving residual protection and demonstrating health benefits.

P&G Purifier of water is designed to treat water source that people are already using for drinking water. Typically, these are surface water like lakes, rivers, and ponds, or water from wells or reservoirs. Many time, these water resource become contaminated and require treatment. **P&G Purifier of water will not desalinate sea water and should not be used on sewage sludge or water contaminated with industrial wastes.**

Guideline for use:

Add the contents of 1 packet to 10 liters of contaminated water and stir to begin the process of flocculation and coagulation. Stir for 5 minutes until flocs form and the water is clear. Let water rest for 5 minutes. Filter clear water through a cotton cloths and dispose of separated floc in latrine. Wait 20 minutes before drinking to allow for complete disinfection. Store in suitable container to prevent re-contamination. The amount of labor required for using P&G Purifier of water is roughly 5 minutes, even though the full treatment process require approximately 30 minutes.

The product is primarily used for treating water used for drinking purposes in rural areas, and natural disasters effected areas. It has been used in Utrakhand floods 2013 and J&K floods 2014, Pune and in HIV/AIDS Care Center. The product has been approved from Haffkine laboratory and from a BIS approved laboratory.



Contact details :

Apro Green Tech, Mumbai

702, Sea Shell, Green fields, ABAAIR Road, Mumbai, Juhu, Pin-400044

Mobile : 9930717875

8.0 Supremus Aqua standalone water purification system

Supremus Aqua is stand alone water treatment systems having capacity of 1000 LPH/ 600 LPH and based on low pressure Ultra –Filtration technology conforming to WHO requirements for safe drinking water. It operates without electricity and only requires daily back wash as part of its maintenance. There is no replacement of parts and no wastage of water. Low pressure ultra - filtration membrane technology is highly effective in removing all non dissolved elements in feed waters. The system removes Pathogens (disease causing organism), Total Suspended Solids and Turbidity from water. Raw water flows into housing under low pressure. As it passes through the porous walls of the hollow fibre membranes inside the unit, solids are retained on the membrane surface. Units are suitable for using either pumped feed or gravity feed applications.

Merits/edge over other similar technology/product (USP): Supremus Aqua Water Treatment Systems do not require replacement of parts and run without electricity. Units can be clubbed together to increase output for more than 1000 LPH. It only requires 30 minutes training for layman to understand the operation and maintenance.

Suitability of the product in rural areas: Based on Lean & Green technology, it is suitable in rural and remote areas where electricity and servicing of water treatment system is a problem. There is no annual maintenance contract required with these systems as daily backwash for 2 minutes maintains the system for 10 years.

Eco/Energy friendliness: Supremus Aqua neither consumes electricity nor requires mixing of any chemicals. It does not waste precious water also during the treatment process.

Capacity of the product: 1000 LPH and 600 LPH. However, units can be clubbed together to produce higher output.

Reject management protocol: No water is rejected by Supremus Aqua Water Treatment Systems during purification.

Ease of O & M: Only two minute Back Wash everyday is required to clean the system. Handle for Backwash is given on the top of the system. No replacement of part, no addition of any chemical is required. However, System should be washed with chlorine once in a month through Chlorine tank attached with the system. Chlorine is not mixed with drinking water but only used for cleaning membrane. The secret to the successful operation and maintenance of the systems is effectiveness of its patent backwash system which uses mechanical agitation process to clean the membrane surfaces.



Contact details :

Supremus Developers Pvt. Ltd.

No 42-F, Pocket-1, phase-1

Mayur Vihar, Delhi-11009

9.0 Disinfection by Electro chlorination

The process is based on the partial electrolysis of sodium chloride (brine solution). The direct current is applied on and brine is dissociated into Na^+ and Cl^- ions, causing chemical reactions. The chlorine and hydroxide ions react to form hypochlorite. By adding sodium - hypochlorite to water, hypochlorous acid (HOCL) is formed. This hypochlorous acid dissociates into hydrogen ions and Hypochlorite ions (OCl^-). The free available chlorine is Hypochlorous acid and Hypochlorite ions. This free available chlorine is highly reactive and reacts with bacteria, virus and fungi. This method is applicable for treating ground water sources for the removal of Arsenic, Fluoride and Pathogens also.

Contact Details :

Fontus Water Pvt. Ltd., New Delhi

A1/152, Neb Sarai, IGNOU Road, New Delhi-110068

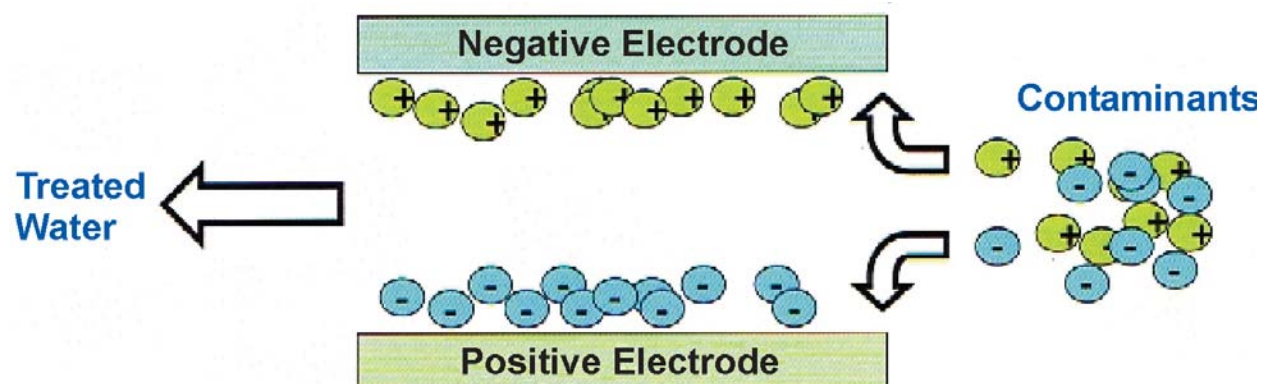
Ph.: 011-43100500, Fax: 011-43100599

Web site: www.fontuswater.com

10.0 Water Treatment by Electro Static Deionization(ESD)Technology

ESD desalination technology is for removal of dissolved ions from water. This system consists of two carbon electrodes that are oppositely charged when a potential difference is applied across. The units are operated in two process steps 1- Purification 2-Regeneration. In the purification step the ions are adsorbed on to the oppositely charged electrodes in the presence of an applied potential difference thereby resulting in the purified water. In the regeneration step the polarity of electrodes is reversed, thereby forcing the adsorbed ions to detach from electrodes, which are then collected in a purge stream which forms approximately 5-10% of the feed water volume that is rejected as a waste.

In this technology the salt rejection is more than 90% and water recovery rate is above 90%. This technology is not tested for streams with high TDS(higher than 4000 ppm) and those with high organic content.



Contact Details :

Fontus Water Pvt. Ltd., New Delhi

A1/152, Neb Sarai, IGNOU Road, New Delhi-110068

Ph.: 011-43100500, Fax: 011-43100599

Web site: www.fontuswater.com

11.0 Water Treatment using nanofiltration (NF) membrane

This technology simplifies RO treatment by mitigating the effects of membrane fouling. It uses nano filtration (NF) membrane which is selective form of an RO membrane. NF rejects bacteria and viruses completely similar to RO, but it selectively removes hardness salts to a greater extent than NaCl salt and therefore requires far less pressure than RO. This system lowers the effect of fouling and eliminates the need of process chemicals and reduces membrane cleaning significantly.

The operation and maintenance is very minimal in this technology as there is no requirement of addition of any chemicals. The membrane life cycle is very long and under normal circumstances last for more than 5 years.

Contact details :

Chemical System Technology Pvt. Ltd, New Delhi

M-58, 2nd Floor, Market Greater Kailash-II,

New Delhi-110048.

Ph.: 011-29216344, Mob.: 09871638624

Email: chemsystems@sugarchem.com

Website: www.sugarchem.co

12.0 UV based water treatment system

The raw water is fed through sand filter, activated carbon filter, micron cartridge filter and activated carbon cartridge filter. This filters are designed for a flow rate of 21000 lit/day. Subsequently, the biologically contaminated water flows through the UV treatment system.

Contact details :

Water Health Pvt. Ltd, Hyderabad

9-7, Survey No.308/1, Nagaram, Keesara Mandal

Hyderabad, Urban-500083

Phone: 91-4067011709, Fax: 91-4067011710

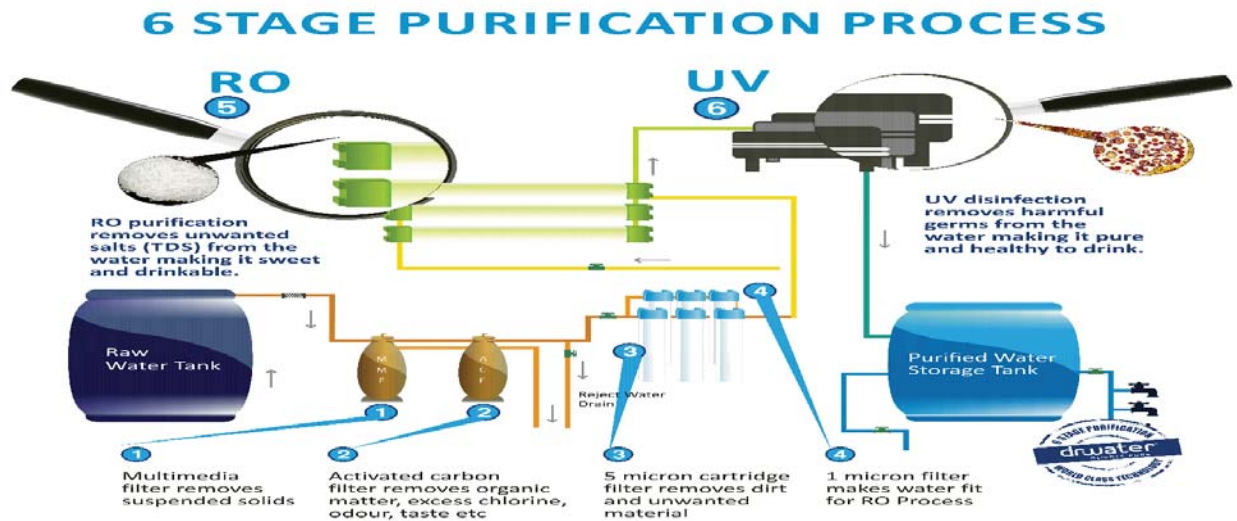
Mob. 09295029123

Email: manivash@waterhealth.com

Website: www.waterhealth.com

13.0 Water Treatment with R.O and UV radiation

First all the salts in the water is removed by RO system. However in this process some of the desirable minerals for humans are also removed. To arrest the loss of such salts, UV treated water is blended to provide safe drinking water that is low on TDS and contain some amount of minerals essential for human body.



Contact details :

Water Health Pvt. Ltd, Hyderabad

9-7, Survey No.308/1, Nagaram, Keesara Mandal

Hyderabad, Urban-500083

Phone: 91-4067011709, Fax: 91-4067011710

Mob. 09295029123

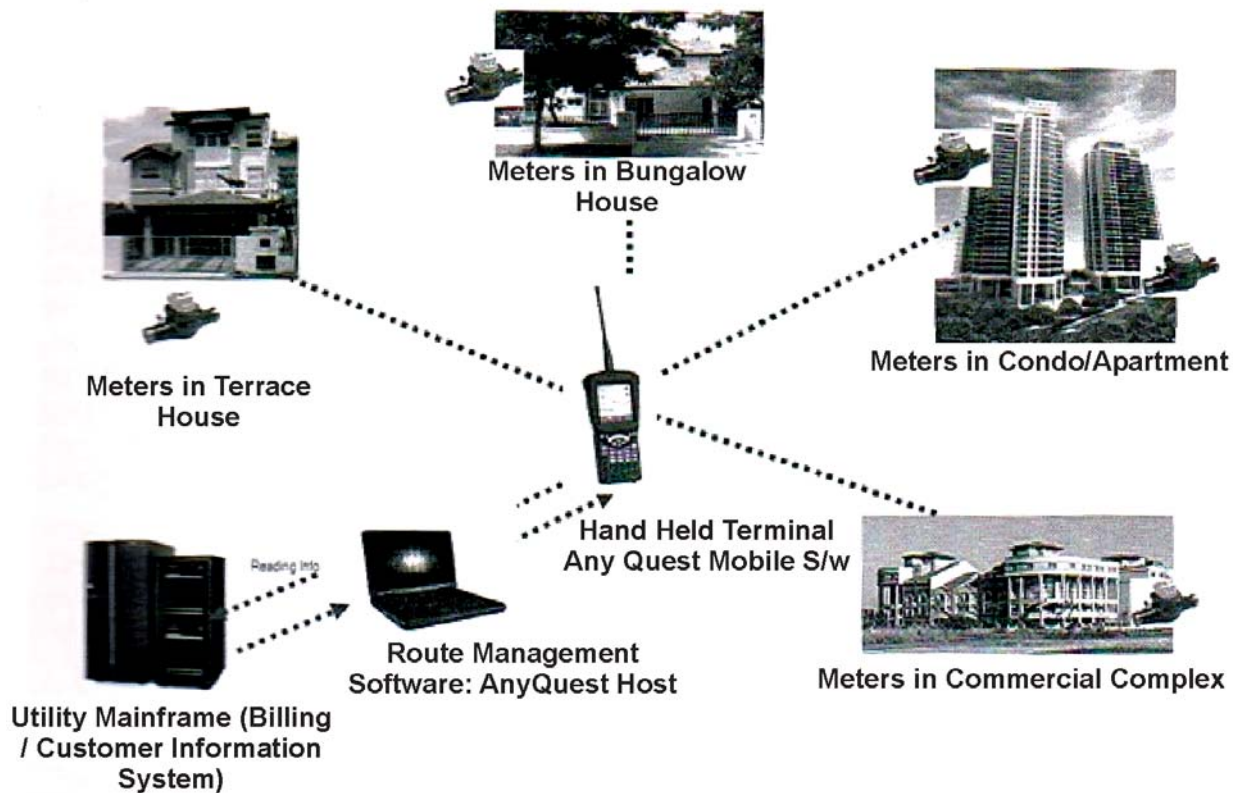
Email: manivash@waterhealth.com

Website: www.waterhealth.com

14.0 Meter Reading (AMR) solution for water metering

The above system consists of following components.

- A pre-equipped Automatic Water Meter.
- An Any Quest Cyble Modules (an inductive sensor)
- Hand held unit for data collection with RF receiver
- Any Quest Software.
- PC/Laptop operating system.



Contact details :

Itrom India Pvt. Ltd, Noida

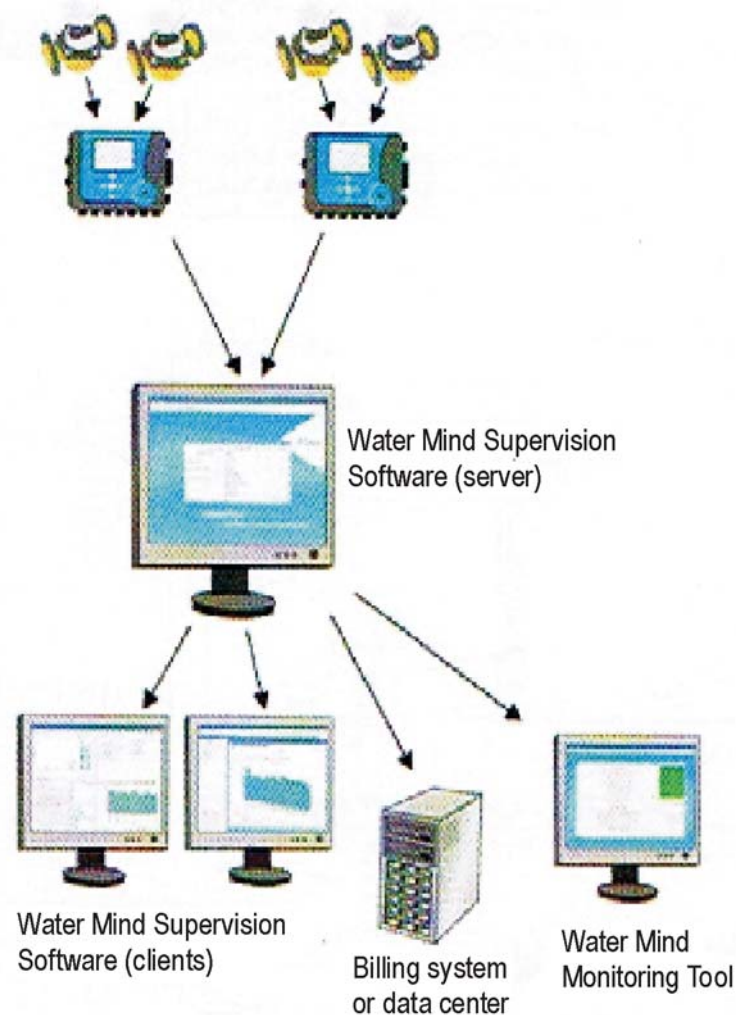
C-7, Sector-3, Noida-201301, Uttar Pradesh

Phone: 91-1204656666, FAX: 91-1204656640

Mob; 9811663508, Email: pawan.mathur@itron.com

15.0 Water Mind System

- ❖ The Water Mind conducts the analysis based on real flow rates on the field device and transmits via GSM/GPRS, they analyse data with hourly basis to the server.
- ❖ Water Mind interprets the reading data automatically utilizing pre-defined meter profiles. It compares actual flow rate with target flow rate to ascertain if the meter is the correct size and technology.
- ❖ Water Mind can high light leakages, peak flows, low flows all of which may have an impact on the profitability of water supplying agency and the consumer.
- ❖ Water Mind can have an optional pressure sensor to assist with pressure monitoring and it can send alarms via GSM/GPRS to the Engineer concerned.



Contact details :

Itrom India Pvt. Ltd., Noida

C-7, Sector-3, Noida-201301, Uttar Pradesh

Phone: 91-1204656666, FAX: 91-1204656640

Mob; 9811663508, Email: pawan.mathur@itron.com

16.0 Water ATM based Hub-and-Spokes Model for safe water delivery

Sarvajal Water ATM devices are cloud connected, solar powered, RFID-enabled, unmanned, automated vending devices . The 5 stage purification mechanism ensures that both ionic and biological contaminants are removed from the raw water. Additionally , a PLC based remote tracking device capture the vital machine health parameters to provide preventive maintenance.

Description of Hub-and-Spokes Model:

- ❖ A water delivery vehicle to transfer purified water from the machine installation site to the remotely installed water ATM units. However, in case the ATMs are

installed at the water purification plant site, the connection can be directly made through a water pipeline.

- ❖ Sarvajal Water ATM devices enable 24 x7 access to safe drinking water at the last mile using a cashless mechanism. The idea is to create unmanned water kiosks at multiple convenient locations within the community to avoid long queues and fights over drinking water access.
- ❖ The most vital aspect of this solution is the in-built monitoring and evaluation capabilities which ensure price transparency, quality accountability, negligible service down time and real time user transaction tracking.



Sarvajal water ATMs has provided more than 200,000,000 liters of clean drinking water. The unfiltered water is collected, filtered and distributed to people via one way water dispensers in measured quantities. Water is sold through these water ATMs for as low as 25 paise per litre which is 0.5 US cents, notably Sarvajal receives no subsidies or support from Indian government and all of its operational costs are being managed by the startup only which is a great success for an social startup this is the reason the company has been named as one of the World's top10 most innovative companies in India for 2013.

Contact details :

Piramal Water Pvt. Ltd.

17.0 Water Purification plant systems

These systems are ideal for flood and earthquake relief operation due to the units mobility to purify almost any source water and ease in set up and operation. The units can also be configured as a standalone basis for water treatment for the permanent public health water supply installations. The entire treatment system can be mounted on a truck and can be moved from one village to another. The system design allows the plant to work for surface water as well as ground water.

- Arsenic Removal Systems: WSI patented Reverse Osmosis technology
- Resin based BOR system for Arsenic Removal System: The system can be attached to Hand pump and hence O & M is very less hence no expenses on manpower, electricity and spare parts except chemicals replacement that are necessary once in six months. Technological is patented.
- Patented Reverse Osmosis technology for fluoride removal
- Desalination plant: **Patent**

Contact details :

Water System India Pvt. Ltd, Chennai

18.0 Integrated Drinking water disinfectant system with solar pumping and water disinfection by UV

A system has been developed integrating.

- Solar pumping for drawing water from ground water surface.
- Filtration unit
- Elevated storage tank on staging.
- UV disinfection unit powered by solar.
- Stand post or water hut for collection of water.

The total integration brings a complete holistic low cost solution for disinfected drinking water differentiating our system from the conventional or other offered systems, the system can be offered in different capacities and is designed for long trouble free life with minimum O& M requirement

Contact details :

Sintex Industries Ltd,

Plastic division (CSR & NBD) , Near seven granala, kalol (N. Gujarat)

District : Gandhinagar, PIN 382721

027-64253500

19.0 Integrated drinking water disinfection system with solar pumping and water disinfection by Electro chlorination.

Sintex has developed a system integrating

- Solar pumping for drawing water from ground water surface.
- Filtration unit
- Elevated storage tank on staging.
- Electro chlorination unit powered by solar power.
- Stand post or water hut for collection of water.



The total integrating bring a complete holistic low cost solution for disinfected drinking water differentiating our system from the conventional or other offered systems the system can be offered in different capacities and is designed for long trouble free life with minimum of O & M requirement.

Contact details :

Sintex Industries Ltd.,

Plastic division (CSR & NBD) , Near seven granala, kalol (N. Gujarat)

District : Gandhinagar, PIN 382721

027-64253500

20.0 Iron Removal by using Iron Specific Resin (INDION ISR)

INDION ISR iron removal technology that is far superior to the existing technologies which find its application in hand pump, tube well and tap as source of water.

As compared to the existing technologies, this technology is robust and can handle greater iron load per cubic feet of media used and also TDS of 2500 ppm. It is very simple to use

wherein no pretreatment is required and has zero operating cost. Being completely indigenous, this technology removes the dependence on foreign technologies and its superiority ensures tremendous potential in the foreign markets as well.

INDION[®] ISR*(Iron Specific Resin) is based on ion exchange resin technology and has manganese dioxide as a catalytic moiety. It works as a catalyst to promote iron oxidation. Basically, iron and oxygen are attracted to manganese dioxide, which enhances the oxidation of dissolved iron and converts the soluble iron (Fe^{++}) into insoluble ferric (Fe^{+++}), which can be filtered through the media that acts as catalyst in this process and does not get consumed. In this reaction, manganese dioxide is reduced to manganese oxide and ferric hydroxide is precipitated. During backwash, the surface of this material is scoured, converting it to MnO_2 , which is further used to oxidise the iron. Simple backwash regenerates manganese dioxide. No chemicals are required to regenerate the resin.

Key advantages:

- Affordable
- Treated water meets WHO drinking water standards
- INDION ISR is WAQ Gold Seal certified
- As hand pump attachment and tap attachment the technology does not require electricity
- No chemicals are required to regenerate the resin.
- Easy to maintain and operate



Contact details :

ION Exchange India LTD

Flat No.-8, Block-B, Naraina Local hopping Center, Ring Road, Nairaina Vihar, New Delhi -110028
Mb:9810305509

21.0 CSIR-NEERI Electrolytic De fluoridation (EDF)' OxiMax Systems

CSIR' -NEERI Electrolytic De fluoridation (EDF)' OxiMax Systems: The electro lite De-fluoridation process is based on the principle of electrolysis, using aluminum plate electrode

placed in raw water containing excess fluoride. During the electrolysis, anode gets ionized and fluoride is removed by complex formation, absorption, precipitation, coagulation, and settling. O&M is simple with sludge requiring removal only once in a while and replacement of the aluminum plates once in few months. The technology has been developed by CSIR- NEERI.

Contact details :

HES Water Engineers (India) Pvt. Ltd,
K-27, Five star Ind. Zone, MIDC butibori, Nagpur 441122

22.0 Iron and Arsenic Removal' OxiMax Systems

'Iron Removal' OxiMax Systems: OIRM' is a granular catalytic boosting oxidation process in aqueous solutions (Water)-'OIRM' is not a coated media. The active components are permanently fused to the surface and are not subject to depletion through abrasion during the services and backwash portion of service run. The media acts as an oxidation catalyst in the true meaning of the word and facilitates or enhance oxidation. The process used by the media to remove the iron and manganese is classic oxidation –precipitation –filtration. The media does not require periodic regeneration for reactivation (as the greensand does) and does not display a decaying activity to do its catalytic work. The media will only require periodic backwashing to remove the collected solids. Another function of the chlorine (fed as sodium hypochlorite(NaOCl using Electro chlorination systems) is that it keeps the media free from bacterial or slime growth and is also used in post-treatment of filtered) water. At the same time, the NaOCl is a source of oxygen more reactive than molecular oxygen. No regeneration required, only backwash with our technology not only removes the iron from the water, but also removes microbiological contamination from the water with the use of Electro chlorination. Hence, we give 2 benefits with a single technology. Being Manufacturer's of both the systems, our company is unique in providing such an offering.

Arsenic Removal' (OxiMax) Systems: The process used by the media to remove the arsenic, Arsenic and manganese is classic oxidation – the precipitation- filtration. The media does not require periodic regeneration or reactivation (as the greensand does) and does not display a decaying activity to do its catalytic work. The will only require periodic backwashing to remove the collected solids. Another function of the chlorine (fed as sodium hypochlorite (NaOCl)) using Electro chlorination systems) is that it keeps the media free from bacterial or slime growth and is also used in post-treatment of filtered water. At the same time, the NaOCl is a source of oxygen more reactive than molecular oxygen. No regeneration required, only backwash with our technology not only removes the arsenic from the water, but also removes microbiological contamination from the water with the use of Electro chlorination. Hence, we give 2 benefits with a single technology. Being manufacturer's of both the systems, our company is unique in providing such an offering.

Contact details :

HES Water Engineers (India) Pvt. Ltd,
K-27, Five star Ind. Zone, MIDC butibori, Nagpur 441122

SANITATION

1.0 Soil Bio Technology for sewage treatment/effluent treatment

This technology has been developed by IIT, Mumbai. SBT engages three fundamental process of Nature – Photosynthesis, respiration and mineral weathering. This is achieved by soil micro-organisms which are regulated by soil micro –organisms (geophagus earthworms).

Primary and Secondary treatments are achieved in the SBT. The organic & inorganic in waste water is consumed and converted into useful by-products and simultaneously water of desirable quality is produced. SBT thus removes BOD, COD, Ammonia, Nitrogen, Nitrate nitrogen suspended solids bacteria, colour, odour. The SBT is ideal for treating waste water less than 5 MLD.

Soil Bio Technology (SBT) is an efficient process of synthesis to completely utilize solids and liquids. It is economical in capital and recurring costs. It has a simple looking construction, free from conventional electro-mechanical systems which are prone to breakdowns. It efficiently integrates the physical, chemical and biological processes into a single aerobic system based on natural biophysical and bio-chemical principles. A specified additive is added in a predefined proportion. SBT is a synthesis process which harnesses the energy, carbon and other elements of the waste and converts them to precious “Bio-energy” products like vegetation, energy rich soil, complete Bio-fertilizer and water. It offers a bacterial removal of approx. 99.99 % thus ensuring a healthier environment in a sustained manner without any side effects.

Salient features of SBT :

- ❖ Rejuvenation/creation of soil.
- ❖ Can be utilizable for all sorts of organic and inorganic molecules present in the effluents.
- ❖ No requirement of electricity and chemical (Electricity requirement only for pumping).
- ❖ Generate Bio-energy
- ❖ Little space area as per requirement per person (100 litre per day) is 0.021 m²
- ❖ Natural process based wastewater treatment
- ❖ No mechanical aeration involved yet enough oxygen produced in the bioreactor
- ❖ No sludge generation and smell or odour
- ❖ Process can be run both on batch or continuous mode
- ❖ Overall time operation (wetting cycle) is 6-7 hours
- ❖ Capable of handling shock load of 50 per cent over or under design load for a few days automatically
- ❖ Land area requirement range from 1500-2500 sq.m per MLD.

- ❖ Minimal energy consumption (40-50 KWh per MLD to pump the wastewater for distribution over reactor bed)
- ❖ O&M cost of SBT plant costs Rs 2-4 per KLD per annum (Rs 4000 per MLD per annum)
- ❖ No skilled labour requirement for O&M.

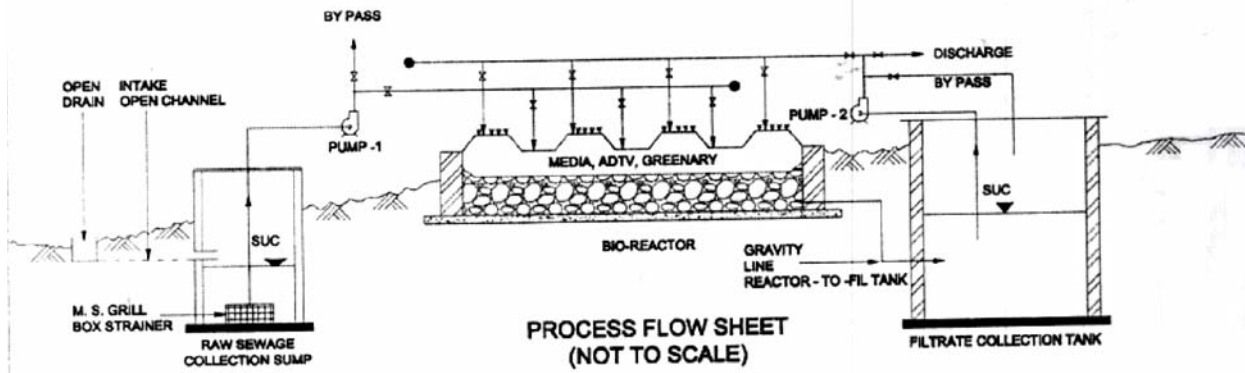
The technology combines sedimentation, infiltration and biodegradation process. It works with formulated geological environment wherein fundamental reactions of nature, namely respiration, photosynthesis and chemical mineral weathering are responsible for bioconversion of sewage. Suitable mineral constitution, culture containing native microflora, geophagus worms and bioindicator plants are the key components of the media. Bioconversion takes place by bacterial processing of organics and oxidisable inorganics via natural oxygen supply wherein mineral weathering reaction serves to regulate pH, while green plants serve as bioindicators. The high toxic potential, the neutral pH together with ecology of environment leads to significant reduction in the organic matter, nutrients and pathogens from wastewater.

SBT can be designed to treat any type of wastewater provided the wastewater is not saline (i.e. having total dissolved solids (TDS) = 1000 mg/L typically) and as long as the water is not toxic to micro organisms. SBT process requires temperature, between 20-45 degree Celsius (in low / very low temperature a greenhouse infrastructure appropriate for the local conditions can house SBT plant. The process can also work at high ambient temperatures.

- ❖ The SBT plant requires minimal O&M periodically that includes cleaning of pipes, scraping of the top surface to remove the settled suspended particles. The microbial culture is tested and recommended to be changed every 8-10 years. The system does not require highly skilled labour.
- ❖ Easy operation is the main feature of SBT. To ensure smooth functioning of the system, it is checked that there is adequate water in the raw water tank. The system will automatically shut off if the level of water falls below a minimum safety threshold in the raw water tank.



Application of SBT



Design of a typical SBT

Contact details :

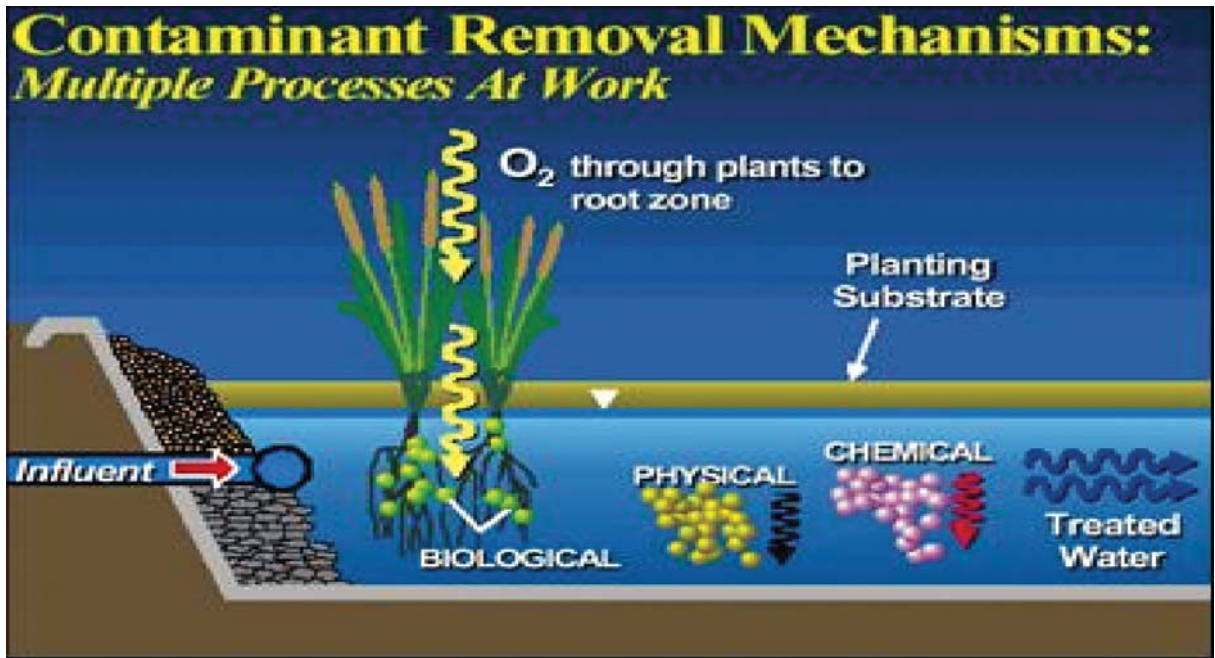
1. Inoic Permatit System Pvt Ltd. B-337, MIG, DDA, chitrakoot, Delhi- 110093.
Ph. 011-22814116,
2. Life link Eco-Technologies (P) Ltd.
c/o B.B. Mohanty plot no. 604, Rasulgarh, Bhubaneshwar- 751010, Odisha,
Mb. 08280249331

2.0 Phytorid Technology for Wastewater Treatment

Phytorid technology is developed by NEERI for sewage treatment. NEERI is a government research institute under Council of Scientific and Industrial Research. This is one of the most reputed laboratories for environmental research and consultancy. This technology has world patent to its credit. The national environmental policy recommends use of constructed wetland systems for efficient sewage treatment.

Simple Solution for sewage treatment: The main objective of the proposed project is to provide a simple, feasible, practically sound, eco-friendly, maintenance free and cost-effective technology, which can handle the sewage waste water treatment leading to reuse of treated water for purposes like gardening. Phytorid is a scientifically developed systematic treatment methodology for waste water.

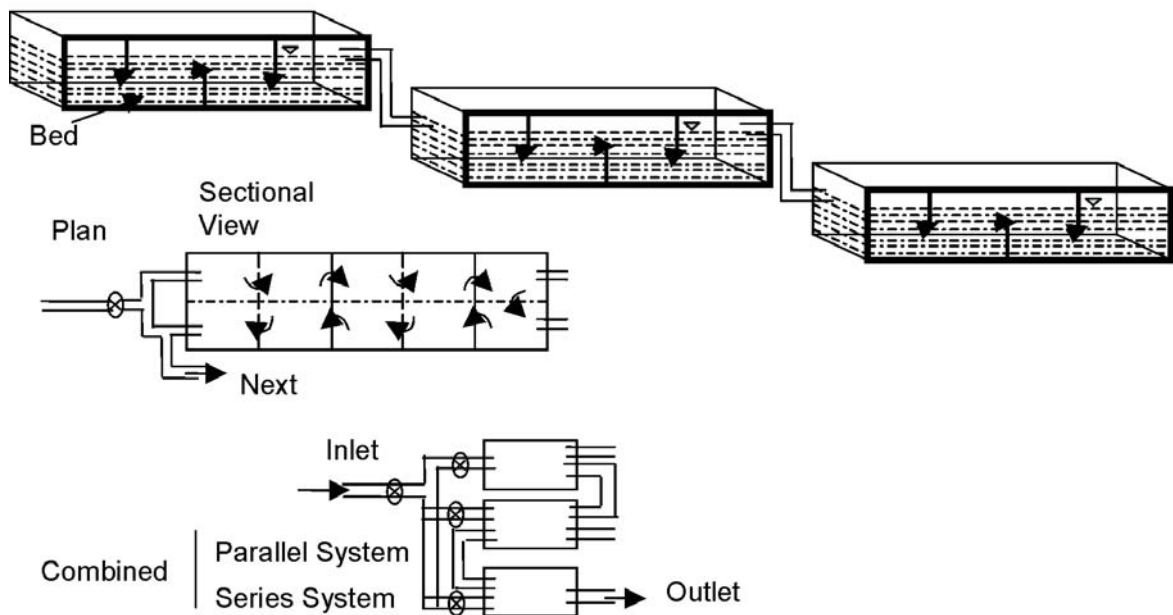
- Phytorid combines Physical, Biological and Chemical processes
- Works on gravity
- No electric power requirement
- Scalable technology
- Easy to maintain
- Adds to aesthetics
- Cost effective



Typical Design features

The general concept design for the Phytotrid system is presented in Figure 1. However, the design maybe further modified as per specifications and land availability.

Figure 1: Cross Sectional View of Phytotrid System



The sub-surface flow type, Phytotrid system is proposed for the treatment of sewage or domestic wastewater which will consists of a basin or a channel with a barrier to prevent seepage, but the systems / cells / beds contain a suitable depth of porous media. A primary treatment facility would also be constructed along with basic for effective removal of solids and thus reduces the marginal BOD.

The porous media also supports the root structure of emergent vegetation. The design of the Phytorid system assumes that the water level in the cells will remain below the top of the filter media.

The vegetation to be utilized for the said Phytorid system is very important. Various species of aquatic plants have been utilized to attain maximum efficiency in the treatment of domestic wastes. These include species like *Phragmites australis*, *Phalaris arundinacea*, *Glyceria maxima*, *Typha* spp., *Scripus* spp., other common grasses etc.

Advantages of Phytorid Technology

- Treatment efficiencies of the removal of fecal coliforms, BOD, COD, nutrients are up to 80%, which is greater than the traditional chemical methods
- It is a very cost effective technology when compared with the traditional wastewater treatment methods.
- Since it utilizes natural vegetation and rhizosphere microorganisms, it is eco-friendly method of treating sewage.
- An important factor to be considered is the aesthetic improvement that is provided by this methodology.
- No mosquitoes and odor nuisance
- The treated water can be used for enhancement of environmental architecture such as roadside fountains.
- The quality of treated water is comparable to irrigation standards.

Methodology:

The treatment process consists of primary treatment plant followed by Phytorid treatment system. The hydraulic loading shall be started with 40% capacity in the beginning till the time of acclimatization of the plants to the hydraulic load and shall be later increased to 100%. The further loading and efficiency shall be monitored to establish how much more of either hydraulic or BOD load can be effectively used. This would entirely depend upon the variation in the sewage characteristics used for treatment.

Land area requirements:

The total areas required for sewage treatment plant for a capacity of 25m³/day is approximately 30 m². The area includes area requirements settler tank, Phytorid bed and treated water collection tank.

Treatment efficiencies:

Phytorid system being natural method, the final efficiencies as indicated in Table 1, will be achieved after the system is stabilized which may require a period of 6 months after commission.

Table: Performance of Phytorid Technology

| Pollutant | Performance (% removal) |
|---------------------------|--------------------------------|
| Total suspended solids | 75-95 |
| Biochemical oxygen demand | 70-80 |
| Chemical oxygen demand | 60-75 |
| Total nitrogen | 60-70 |
| Phosphate | 50-60 |
| Fecal coliform | 85-95 |

Operation and Maintenance :

This technology is natural system; as a result operation is mostly passive and requires little operator intervention. Requirement for area can change on various factors such as load (kg BOD / day), ambient temperature, topography of the region, flow characteristics, etc. Maintaining uniform flow across the Phytorid system through inlet and outlet adjustment is extremely important to achieve the expected treatment performance. Sampling of inlet and outlet will be carried out for a period of 3 months every fortnight after stabilization of the treatment systems of first one year.

Contact details:

1. Crest Enviro Trans-Formations (I) pvt Ltd,
B-5, Svchindram, Shiksham Nagar, Soc. Paramhans Nagar, Kothrwd, Pune – 411 038
2. Ecologique Science Technik (I) Pvt. Ltd,
39, Agnelaynt, New Khamla Road, Nagpur – 440 025

Note: Other License Holders of NEERI for Phytorid Technology may also be contacted. (List of License holders is separately distributed along with Compendium)

3.0 Bio Digester System for human waste disposal (developed by DRDO).

This technology is for disposal of human waste in Eco-friendly manner at location where temperature is as low as -40°C. This technology is has two major components.

- (i) Anaerobic Microbial Inoculums
- (ii) Biodigester Tank.

Why and how DRDO developed human waste disposal technologies:

First and prime goal/ responsibility of DRDO are to develop the technologies for meeting the requirement of Armed Forces. However spin- off benefits is transferred to civil sector also. During 1984, when Indian Army positioned itself at Siachen Glacier, the problem of human waste disposal became a serious issue due to prevailing subzero ambient temperature (-30 to

-50°C). Such a low temperature does not allow natural microbial decomposition of waste which continues accumulating throughout the ice layers and risks the soldier's health as ice being the single drinking water source for him beside aesthetic nuisance. Various options were experimented by Indian Army based on suggestions by institutions/ agencies like chemical treatment and incineration but being practically unsuccessful, the task of biodegradation was assigned to DRDE Gwalior. In the absence of any prevalent (national / international) technology DRDO developed BIODIGESTER TECHNOLOGY for application in low temperature high altitude areas that was subsequently modified and expanded to plains and mobile systems.

Anaerobic microbial consortium:

Anaerobic microbial consortium has been developed by acclimatization of slurry of biogas plants operating at low temperature areas and further modified by incorporating the bacteria isolated from Antarctica, Siachen and other remote high altitude locations. The microbial consortium (inoculums) works in a wide temperature range (5 to -50 deg. C), resist temperature fluctuation, freezing-thawing and also tolerate the limited quantity of antiseptics. The mother culture is being maintained at DRDE Gwalior by operating two reactors, one of size 14 m³ and another of 75 m³



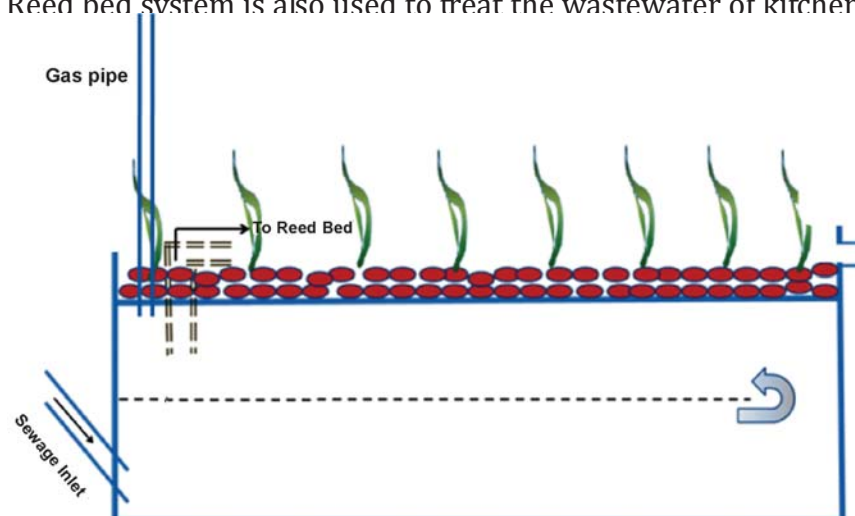
Bio-Tank System:

The present biodigesters involve fabrication of main tank either of mild steel or FRP from industry and its transportation to the place of installation. As an alternative to overcome the cost of industry and transportation and to have longer life, a modified septic tank technology (**Bio-Tank**) has been developed. Bio-Tank construction is done at the site of its use by any local

mason. It is *initially charged with anaerobic microbial consortium* (only once) and put up for use like any other septic tank. The Bio tank is also having the special designs for the microbial attachments. Number of benefits of this technology over conventional septic tank system can be enumerated as follows:

- Design wise, it is a simple rectangular tank having 1 to 4 partitions (lengthwise or breadth wise) keeping in mind of the treatments of various uses i.e., human waste &/or bathroom water &/or kitchen water. Construction is also very simple.
- The size of the Bio-Tank is approximately 1/3rd of conventional septic tank and hence, material cost and space requirement for building the Biotank will be lower as compared to septic tank.
- Bio-Tank can be customized for use, either for single house or multistoried complexes.
- The technology works at wide range of temperature
- No need to evacuate the tank, which is required for conventional septic tank at periodic intervals.
- Comparatively, very little quantity of H₂S is produced as compared to septic tank.
- Toilet cleaning by routine cleansing agent in nominal quantity is permitted.
- If large number of toilets are connected, sufficient biogas can be generated, which can be used as an alternate energy source.
- Finally, the Bio-Tanks are maintenance free installations.

The alternative system also includes natural reed bed system to perform secondary treatment of the wastewater that is coming out of the biotank. The reed bed system comprises of bed of sand and pebbles along with reed plants capable of natural amelioration of the wastewater that is coming out of the digester tank by *totally reducing smell, suspended particulates, pathogenic microorganisms (more than 99% of pathogens (disease causing bacteria)) and agents causing sudden nutrient enrichment &/or pollution to the water bodies (eutrophication)*. BioTank cum Reed bed system is also used to treat the wastewater of kitchen and bathroom.



Natural reed plants-microbial consortium work efficiently at *wide range of temperature and effluent is very safe to discharge into environment* and may be used for irrigation purposes.

Fig: BioTank cum Reed Bed system: in this fig., biotank is horizontally separated by an incomplete partition wall. The water from the biotank, (after travelling the long path) is released into reed bed. The water from the reed bed may be stored to a tank for further use or may be released directly to the agro fields for irrigation.



Fig. BioTank cum Reed Bed systems functioning at Defence Research Laboratory, DRDO, Tezpur, Assam

Contact Details:

Alfa-Therm Ltd,

6, Community Centre, Mayapuri, Phase-I, New Delhi-110064.

Ph: 011-28115222, Email: alfatherm@vsnl.com, Website: <http://www.alfathermltd.com>

Note: Other ToT Holders of DRDO for stationery Bio-digester toilets, a list of which already been communicated to all the States vide Ministry's reference no.W.11044/1/2012-CRSP (vol.II)/dated.12th August 2014 may also be contacted. (List of ToT holders is separately distributed along with Compendium)

4.0 Biogas Technology

Quantum of energy utilised is regarded as socio-economic status of any society. Due to lack of fuel, people in villages spend most of their valuable time to collect fire woods for cooking. In villages, most of the people use animal dung- cakes for cooking purpose. Such animal dung along with human wastes can be effectively used for biogas generation through on-site biogas plant linked with toilet. Biogas plant is important in providing sustainable energy sources in rural communities. Generation and utilization of bioenergy has multiple advantages. It helps improve sanitation, provide bioenergy at almost nil recurring expenditure and finally slurry / effluent of biogas plant has plant nutrient value to be used for agriculture purposes. Thus toilet linked biogas plant has additional benefits in terms of improving sanitation. In villages where

household wastes contain mainly organics, they are also suitable for biogas generation. Such wastes can also be mixed in the same biogas plant to generate biogas production. In case of community toilets, biogas generation from human waste is sustainable option.

Biogas is a mixture of gas produced by methanogenic bacteria while acting upon biodegradable materials in an anaerobic condition. Biogas is mainly composed of 50 to 70 percent methane, 30 to 40 percent carbon dioxide (CO₂) and low amount of other gases. Biogas is an odourless and colourless gas that burns with clear blue flame similar to that of LPG gas.

Quantity of biogas production from different feed materials

- i. From animal dung- per animal, per day, around 10 kg dung is produced. Gas production rate from dung is about 1.4 cft per kg, i.e., per animal per day, 14 cft biogas is produced.
- ii. From per person per day 0.3 kg of waste is generated that produces 1 cft of biogas.
- iii. A total amount of biogas of one cum can be produced per day from a family having 4 members and 2 cattle heads.

Utilizations of biogas

One cum of biogas per day can be utilized in a family as follows:

- a. Cooking of 3-4 family members for two times a day
- b. Mantle lamps (2nos.) can be used for 6 hours per 24hrs. Such mantle lamps give illumination equivalent to 40 watt bulb at 220 volt of electricity.

Manure value of sludge from biogas plant: Besides biogas, the manure of the biogas plant has much plant nutrient value. It is directly used for agriculture purpose. The following is the comparative value of plant nutrients (N, P, K, value) from biogas manure and other compost.

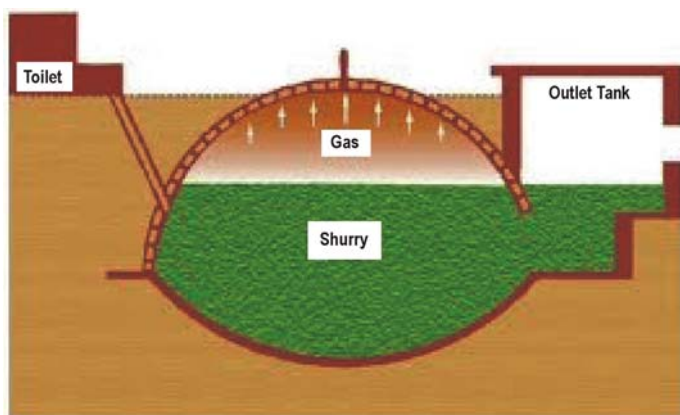
| Sl.No. | Name of constituent | Compost Manure (%) | Biogas slurry (%) |
|--------|---------------------|--------------------|-------------------|
| 1. | Nitrogen | 0.50-0.75 | 1.30-1.50 |
| 2. | Phosphorus | 0.70-0.80 | 0.85-0.92 |
| 3. | Potash | 1.20-1.50 | 1.50-1.65 |

Design of biogas plant For family size biogas plants there are basically two designs (1) Floating drum type popularly known as KVIC model and (2) Fixed dome type, popularly known as Deenbandhu Model.

In the KVIC model gas holder is made up of iron sheet (mild steel). During winter season when temperature fall down to 10 degree Celsius or so, this model ceases to function as the iron sheet gas holder acts as good conductor of heat and inner temperature of the digester also attains the same temperature. Secondly, this gas holder requires regular care and maintenance

to prevent from getting worn out because of corrosion. It has short working life. Manufacturing of gas holder requires sophisticated workshop facility that is rarely found in rural areas. Therefore, in rural or in urban areas the success rate of this model of biogas plant is far below the level of satisfaction.

Deenbandhu model - This model is predominately found in India. It is an underground fixed dome digester made up of complete brick or RCC structure. It is a permanent structure having almost nil operation and maintenance costs. There is no separate gas holder; biogas is stored inside plant through liquid displacement chamber. This design is suitable also for generation of biogas from human wastes along with cow dung and kitchen wastes. There is almost no effect of atmospheric variation of temperature on biogas generation during winter season. It has several advantages over the KVIC design. The following section describes different aspects of Deenbandhu biogas plant



Section of family size biogas plant of Deenbandhu Model



A family size biogas plant

Selection of site: Site of biogas plant should be selected properly, it should not be water logged and soil should be hard (high bearing capacity). It should not be constructed in a shaded area. Sunlight helps increase digester temperature therefore, production of biogas. Biogas plant should be as near to its use points- cooking area and mantle lamps lighting. Longer the distance between biogas plant and its use will reduce gas pressure in gas pipe and hence will create problem.

Selecting a biogas plant size: A biogas plant of specific capacity can be selected based on the daily availability of cattle dung, users of toilet (in case of toilet linked) and water requirements.

Materials required for biogas plant: The biogas plant can be set up with Bricks, Cement, Stone chips of 1/2" Coarse Sand, G.I. pipe 3/4" dia. sockets, 30 cm, A.C. / PVC pipe 6" dia, Iron bars (6mm dia) for outlet tank cover, Paint (gas leak proof dibhapyoxy), labour for digging pit, labour for construction, skilled masons, BG Stove, 10 m pipe line, lamp, accessories.

Uses of biogas for cooking: Common uses of biogas are for cooking and lighting through mantle lamps. Biogas cooking burners are available in markets. A cooking burner consumes 8-

24 cft of biogas per hour depending on its size. Biogas burns in blue flame without any shoot or odour like LPG. It contains around 1 % hydrogen sulphide that has pungent odour, but for cooking during burning there is no such odour at all such odour is useful to detect any leakage of biogas due to loose connection of pipe etc. In rural areas where people are mostly dependant on fire wood or



dung cake for cooking purpose, biogas is a boon in improving health, environment and is economical.



Use of biogas for lighting: Lighting through mantle lamp is another common use of biogas. Such mantle lamps are available in markets. A Mantle lamp consumes 2-3 cft of biogas per hour. It gives illumination equivalent to 40 watt bulb at 220 volt of electricity. In rural areas in most of the families student can't study in night due to unavailability of electric supply and high cost of kerosene oil, biogas is a sustainable option and boon for such communities

Contact details :

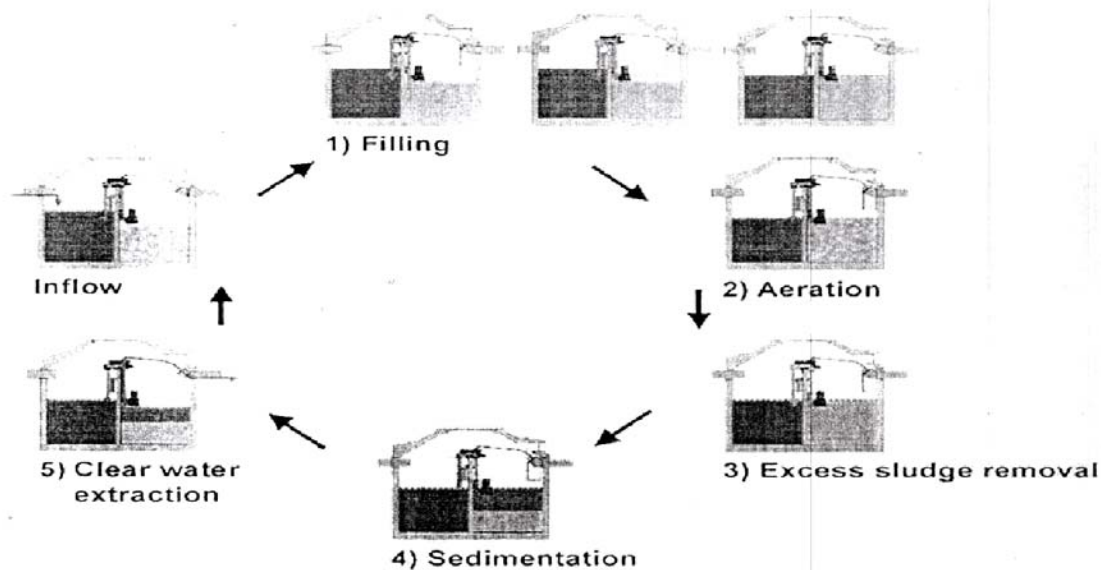
1. **Crest Enviro Trans-Formations (I) pvt Ltd,**
B-5, Svchindram, Shiksham Nagar, Soc. Paramhans Nagar, Kothrwd, Pune - 411 038
2. **Ecologique Science Technik (I) Pvt.Ltd,**
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5.0 Sequential Batch Reactor (SBR) Technology for Sewage Treatment

After the pre treatment, the sewage taken into sequential Batch Reactor. It provides highest treatment efficiency in a single step Biological process. The SBR system is operated in a Batch Reactor mode which eliminates all the inefficiencies of the continuous process. A batch reactor is a perfect reactor, which ensures 100% treatment. Two modules are provided to ensure continuous treatment. No additional settling unit / secondary clarifiers are required. The complete biological operation is divided in to cycles. Each cycle is of 3-5 hrs. duration, during which all treatment steps takes place.

Each cycle of operation comprises of three phases viz aeration, settlement and decanting. Liquid is filled in the SBR basin upto a set of operating liquid level. After aeration the biomass settles and once settled the supernatant is removed from the top using a decanter. Solids are wasted (taken out) from the tanks. The above three phases constitute one cycle which is then repeated. This technology is suitable where the available land is limited.

TECHNOLOGIES FOR RURAL & DRINKING WATER SUPPLY INCLUDING WATER TREATMENT



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6.0 Membrane Bio reactor (MBR) Reactor for wastewater

Sewage treatment plant with MBR technology called as SSEC membrane Bio-reactor (MBR) which can produce very good quality with highest possible bacterial reduction without adding any chemicals. (MBR) is the latest technology in wastewater treatment. It has many advantages such as high quality treated water, small space for installation and easier operation compared to conventional activated sludge process.

The characteristic of the MBR process is the use of revolutionary submerged polymeric hollow fiber membranes in the biological process water tank, so as to produce high quality permeate from domestic sewage, primary and secondary waste water, cooling tower blow down etc. SSEC MBR is also ideal for retrofitting/augmenting capacity/quality of existing wastewater plants. Other advantages are as below:

- It doesn't require clarifier tank where as conventional activated sludge process requires clarifier which further adds to the area requirement and cost
- Biological reaction in MBR can be carried out under the condition of 4 to 5 times of MLSS compared to conventional activated sludge process. In aeration tank, MLSS (Mixed Liquor Suspended Solids) in the range of 8000 to 8500 mg/l are maintained

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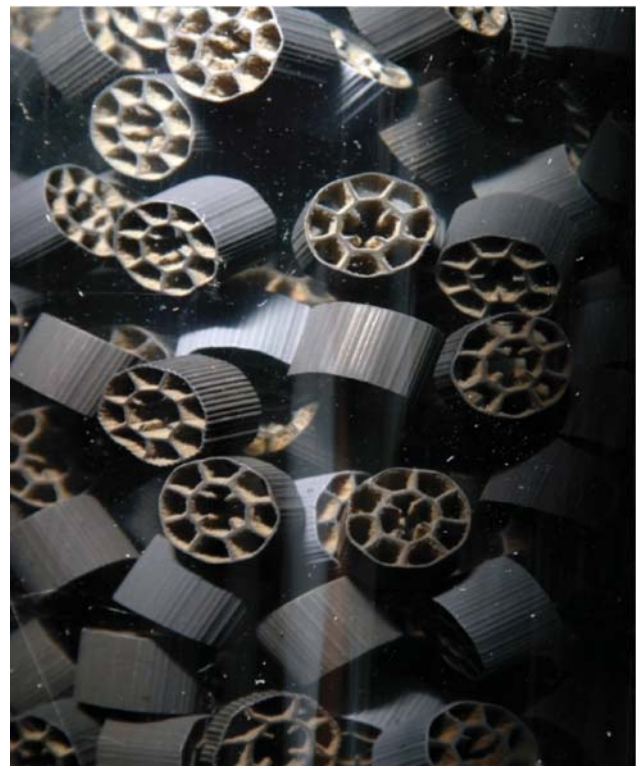
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7.0 Moving Bed Bio-film Reactor (MBBR) Technology for wastewater

MBBR technology employs thousands of polyethylene biofilm carriers operating in mixed motion within an aerated wastewater treatment basin. Each individual biocarrier increases productivity through providing protected surface area to support the growth of heterotrophic and autotrophic bacteria within its cells. It is this high-density population of bacteria that achieves high-rate biodegradation within the system, while also offering process reliability and ease of operation.

This technology provides cost-effective treatment with minimal maintenance since MBBR processes self-maintain an optimum level of productive biofilm. Additionally, the biofilm attached to the mobile biocarriers within the system automatically responds to load fluctuations.



Media in reactor with biofilm growth

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