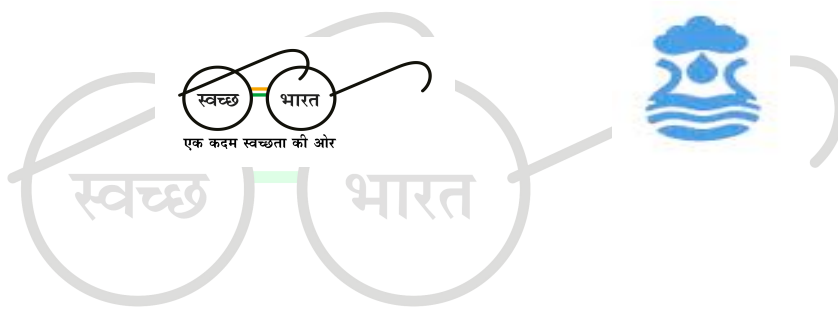




# Innovation / Srijan Bharati- 2015

## Rural Technologies in Sanitation and Drinking Water Quality for Transforming India



एक कदम स्वच्छता की ओर  
Ministry of Drinking Water and Sanitation

Govt. of India

## **1.Capacitive Deionization Technology (CDI) using carbon aerogel material**

**Name of the Firm: Aquas Technology, Mumbai**

### **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 m<sup>2</sup>/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 electrodialysis, 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.

## 2.1 Jal-TARA Water Filter

### Name of the Firm: Development Alternatives, New Delhi

**Background:** Sand filters commonly used for water treatment are of two types a slow sand (2 to 6m<sup>3</sup>/ m<sup>2</sup>/ day) and rapid sand (100 to 150 m<sup>3</sup>/m<sup>2</sup>/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 Developed 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 m<sup>3</sup>/ m<sup>2</sup> /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.

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

## 2.2 Aqua+ and Antenna WATA Technology

### Name of the Firm: Development Alternatives, New Delhi

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 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 \***

### 3. P&G sachets for purification of water for drinking purpose

#### Name of the firm: Apro Green Tech Mumbai

##### 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 Uttrakhand 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.



#### 4. Supremus Aqua standalone water purification system

**Name of the firm:Supremus Group**

Supremus Aqua standalone water purification system is an Ultra Filtration Membrane based system under the brand name of Supremus Aqua having capacity of 1000 LPH. The system is based on low pressure Ultra –Filtration Technology meeting WHO requirements for safe drinking 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. It operates without electricity and only requires daily back wash as part of its maintenance. There is no wastage of water.

##### **Technology**

The technology is based on chlorine disinfection combined with a self-contained low-pressure membrane filtration system which operates under minimal feed pressure without the need for power and conditioning chemicals. Water permeates billions of microscopic pores in the outer walls of thousands of tiny hollow fibers where eventually collecting in a canister at one end and flowing out as drinking water.

##### **Features:**

A life span upto 10 Years with proper maintenance, requires less than 1 hour training, units can be clubbed to increase the output, no wastage of raw water. The unit operates without electricity. It can be installed in Urban Slums, Refugee Camps, Disaster relief, religious and Pilgrimage, schools, residential houses, clubs and Pre-Filters for RO systems & small communities .

The product has been installed by Govt. of West Bengal at North Bengal Medical College and Hospital and B J Medical College and Sassoon General Hospital (Pune). The results have been certified by these institutions. The product has been installed by Govt. of West Bengal at North Bengal Medical College and Hospital and B J Medical College and Sassoon General Hospital (Pune).



##### **5. Name of the firm: ASHTECH (INDIA) PVT LTD**

##### **Name of the Technology: Prefabricated, Precast Modular Toilet with Bio digester(DRDO) approved**

Name of the Product: PRECAST ECO TOILET & PRECAST ECO BIO TOILET

Abstract of the Technology/Product:

This is a Ecofriendly long duration maintenance free , weather proof Technology. Septic tank is replaced by DRDO approved Bio-digester which contains bacteria. These bacteria produce Bio gas and water from the waste material. That water can be used for flushing and gardening.

Merits over other similar technology/product (USP):

- Eco Friendly
- Maintenance Free
- Life About 50yrs.
- Pathogen Free
- Pollution Free
- Cost Effective

Suitability of the product in rural areas:

Our product is portable, have long life, maintenance free. So it is more suitable product for people.

Eco/Energy friendliness: As it contains Fly ash as a part of material, it is the more Eco-Friendly product.

Capacity of the product : Average 5 to6 members of the family can use it for life time.

Reject management protocol: It can be replaced by our company if rejected / damaged.

Ease-of-0 & M: Very easy to operate, requires less water , Flush & forget Technology.

Capital cost and Cost of treated water per kiloliter: Average Rs.40,000/- for Eco Toilets and Rs.50,000/- for ECO'B~O

### **6.1 Integrated Drinking water disinfectant system with solar pumping and water disinfection by UV**

**Name of the Firm: Sintex**

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.

### **6.2 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.

### **7.1 Iron Removal by using Iron Specific Resin (INDION ISR)**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

The Iron Specific Resin works as a catalyst to promote the oxidation of Iron. Basically, iron and Oxygen are attracted to resin catalytic moiety which enhances the oxidation of dissolved iron and convert the soluble iron into insoluble ferric ions. The above resin acts as the media and it can be easily back washed.

This technology has the following limitations.

- It can tolerate TDS upto 2500 PPM
- The suspended solids and turbidity should be upto 10 PPM and 20 NTU respectively.
- Minimum 15% of iron level oxygen should be there in feed water.
- Organic matter, H<sub>2</sub>S, oil and grease should be in trace.

### **7.2 Fluoride Removal using ion exchange resin (INDION RS-F)**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

An ion exchange resin (INDION RS-F) is designed selectively to remove fluoride from water. This resin performs well even in the presence of common ions such as chloride, sulphate and nitrates. After exhaustion the resin can be regenerated using poly aluminium chloride solution. Due to effects of mass action and shift of equilibrium the fluoride is extracted from resin and exchanged with chloride, this system can be provided as attachments to Hand Pumps and also to Power Pump schemes. Solar power operated system is also available.

This technology has following limitation

- The media can tolerate chloride levels upto 1600 PPM, TDS upto 2500 PPM, alkalinity upto 450 PPM and sulphate upto 500 PPM.
- Absorption capacity is maximum when pH is between 5-6.
- For better results, the feed water should have turbidity of 1-2 NTU, organic nil, iron and heavy metals < 0.5 PPM

### **7.3 Arsenic removal using an ion exchange resin (INDION Arsenic selective media)**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

This ion exchange resin is designed to selectively remove arsenic from ground water. Arsenic III & V ions, co-precipitates on resin matrix, forming chemical bond which after exhaustion will not leach out arsenic as a result it does not decontaminate ground water. It performs well in spite of presence of common ions such as chlorides, sulphates or bicarbonates. No pretreatment is required for conversion of arsenite to arsenate. The media has affinity towards trivalent and pentavalent arsenic and can tolerate maximum 3000 ppb of arsenic. This technology has the following limitations.

- Phosphate and Nitrate concentration should be <25 PPM and <50PPM respectively.
- TDS should be within 1000 PPM-1200 PPM and no single ion concentration greater than 1000 PPM.

#### **7.4 Nitrate Removal using any ion exchange resin (INDION NSSR)**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

This resin is designed to selectively remove nitrate from potable water, proper mix of physico-Chemical properties give ideal nitrate exchange to this resin. After exhaustion the resin can be regenerated using common salt. This system can be provided to Hand Pumps and to Power Pump schemes. It can be operated using solar power also. However presence of high level of suspended solids, biological organic matter may foul the resin. Hence pre treatment is required for removal of suspended solids.

#### **7.5 Disaster Management Unit-product (DMU)**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

This system operates with UF and RO followed by ozonation. It can produce 5000 lit of pure water per hour with surface water having low (< 200 PPM) TDS and produce 200 lit/hour of pure water when the raw water TDS is as high as 2000 PPM.

#### **7.6 Ultra High Rate clarifier (UHRC)**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

This system combine technology of solid contact and plate clarifier and hence give improved performance. This clarifier combines, mixing, flocculation and sedimentation in a single basin. The sludge settled at bottom is removed at regular interval.

#### **7.7 Lampak Treatment Unit**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

This unit consist of pump, mixer, flocculator, lamella clarifier, gravity sand filter and dosing system. It is designed to produce 25 cu.m /hour of pure water from raw water having TSS as high as 500 mg/l

### **7.8 Continuous sand filter**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

The sand filter is a continuous up flow deep bed granular media filter. The back wash is also continuous. The filter media is moving in down ward direction and also continuously cleaned by recycling the sand.

The water introduced into the lower part of filter bed through riser tubes. Filtration takes place upwards through the sand bed which is moving in down ward direction. Most of the suspended solids will be removed near the feed level and therefore dirtiest sand will be found at lower part of the filter.

The filtered water is passed through activated carbon filter for the removal of any odor, colour or organic matter.

### **7.9 Lamella clarifier**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

The Lamella clarifier contains a series of inclined overlapping plates, which are arranged to form a separate sedimentation chamber. These plates provide large settling area within a relatively small floor area compared to a conventional settling tank of equal floor area. Before reaching the Lamella Clarifier, water is first fed to Flocculation Tank and then enters the Lamella from the bottom section of plates and flows in upward direction between the plates. As the feed water moves upwards, solids settle downward and descend along the surface of the plates. The settled solids reach the collection hopper at bottom. Near the top of each plate, water leaves through opening in the sides of clarifier.

### **7.10 Desalination using R.O Technology**

**Name of firm:- Ion Exchange India Ltd., New Delhi**

The conventional Membrane Technology is adopted to remove TDS.

### **8. Name of the firm: United Waters India Pvt. Ltd.**

**Name of the Technology: BioEcoTech® and Iontex™**

**Name of the Product:** Biological and patented water purification technologies without using any chemicals producing zero sludge and zero environmental pollution

**Abstract of the Technology/Product:**

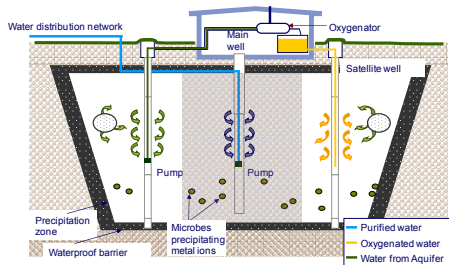
### BioEcoTech®

The BioEcoTech® is a so called “in situ” process to purify groundwater or infiltrated surface water utilising semi aerobic microbes naturally occurring to purify contaminations. The technology only uses biological resources that are found in the earth, without adding any harmful chemicals in its purification process. Different live organisms, present on earth since billions of years, act as a natural purifying agent.

The principle behind the BioEcoTech® is to control the microbial oxidation of dissolved substances such as iron, manganese, arsenic and fluoride in a zone around a production well. This is achieved by regulating the oxygen content in the aquifer to a level where the naturally occurring contamination oxidizing microbes thrive. The zone is maintained by intermittent injection of aerated water into a number of satellite wells surrounding the production well. Effectively this works as a “safety bio-zone” around the production well, which prevents leakage of untreated water. The aerated water that is injected optimizes the complete removal of substances such as iron, manganese, fluoride, nitrates, pesticides, hormones and arsenic before the groundwater reaches the main production well. A complex simulation model allows the BioEcoTech® system to structure and optimize each purification plant to produce a reliable and sustainable purification process.

References: More than 50 plants have been installed in Europe and China from capacity ranging from 500 m<sup>3</sup>/day to 82,000 m<sup>3</sup>/day. Our focus size is upto 50,000 m<sup>3</sup>/day.

The BioEcoTech® system is based on a natural biological process constantly occurring in the soil utilizing semi aerobic microbes to purify water. What takes at least 100 years to be purified in nature, BioEcoTech® is able to captivate and accelerate in only a matter of days. The below figure provides an overview of the functionality of the water plant.



The BioEcoTech® system supplies purified water in bulk to industries and Governments.

The benefits of the technology are:

- No chemicals, no waste and no water loss

- Bottled water quality – meeting all EU and Global Standards
- 50-80% energy savings – lower CO2
- 20-30 year warranties – service and quality guarantees
- Life cycle savings of 3-5 times (compared to conventional technologies)

### **Iontex™**

IONTREX™ is a low flow filter solution that doesn't use any chemicals in the purification process, nor does it produce any sludge. The IONTREX™ technology is used to remove traces of heavy metals like Iron, Manganese, Fluoride and Arsenic. The specialized filling material, which is very porous and robust, enables a reduction of the heavy metal content from ground water.

The process is based on Oxygenation (a patented Oxidation enhancement process). A simple backwash procedure using a small amount of purified water enhances the plant's life-span and allowing for minimal operation and maintenance.

The process has in addition a bacteriostatic effect working as a "common sand filter" which also reduces the particle load of the water. The purification will enable delivery of clean drinking water according to BIS standards and EU Standards.

**The IONTREX™ plant is built into a 20ft / 40ft containers.**

The benefits of the technology are:

- Patented high porosity filter providing for sustainable and low energy system with up to 70% energy savings
- No sludge, No chemicals (caustic and acid) and no harmful by-products
- Very low water loss of only 0.15% (90-99.5% less than conventional systems)
- Small foot print (30-60sqm)
- Steady and reliable flow of water; no corrosion, no clogging, no creation of deposits

**Merits/edge over other similar technology/product (USP):**

**BioEcoTech®&Iontrex™**

	Conventional Technology	Iontrex™	BioEcoTech®
Water Loss during Purification.	10-50%	<1%	0%
O&M requires presence Of skilled manpower, a constraint in many areas	YES	NO Automated Operations PLC- driven	NO Automated Operations PLC- driven
Design Life limit	5-10 years, With media replacement costs 1-2 years	> 15 years Filter replacement 6+ years	≥ 30 years No filter replacement
Life Cycle Cost	HIGH	LOW	LOW
Use of Chemicals + Generation of Toxic sludge	YES	NO	NO
Energy Cost	HIGH	LOW (upto approx. 70% energy savings)	LOW (upto approx. 80% energy savings)

**Suitability of the product in rural areas:**Our technologies are applicable for multi village schemes or clusters (not for population below 2000).

Rural areas are faced with various problems related to groundwater contamination and un-monitored withdrawal of groundwater leading to various problems.

1. Spiraling costs for water well for farmers with exposure to contaminated water at higher depths despite shallow aquifers
2. Escalating energy consumption due to drilling extensively to avoid contaminated areas
3. Escalating energy cost for daily operation of conventional treatment plants and pumping of water over large distances; leading to high O&M cost
4. Conventional technologies require constant up-gradation with multiple contamination and hence design life is limited to about 1 – 5 years
5. Multiple contamination resulting in spiraling cost for technology during the entire life cycle of a conventional plant owing to high addition and replacement costs of media, filters or membranes
6. O&M not undertaken regularly leading to plants being obsolete within 1 or 2 years

Hence there is an urgent need to deploy a technology which can be deployed at site, and where continuous O&M is assured by the company to ensure sustainability of the technology ensuring clean drinking water for many years to come. United Waters’ patented technologies offer a long term sustainable solution while providing O&M for 15-20 years

**2. Eco/Energy friendliness:**United Waters patented technologies are completely biological without use of any chemicals or production of any harmful sludge. Also our technologies lead to energy saving of approx. 70% compared to conventional treatment solutions.

**3. Capacity of the product:**

The Iontrex™ plants come in pre-built containerized units of 20 ft / 40 ft with capacities ranging from 300 KLD to 2700 KLD.

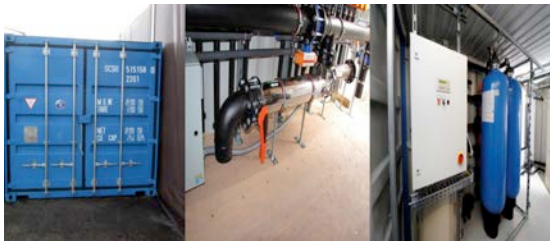
The BioEcoTech® caters for larger populations with sizes from 2500 KLD to 82,000 KLD.

4. **Reject management protocol:**The BioEcoTech® is completely biological and uses no chemicals and produces no sludge or reject material. The Iontrex™ is an ecological system without using any chemicals and thus produces no harmful sludge or reject material.
5. **Ease of O & M:**Both the BioEcoTech® and Iontrex™ are PLC driven systems enabling remote monitoring, thus ensuring quality control. UWI will train local O&M persons to oversee and service the plants.
6. **Capital cost and Cost of treated water per kilolitre:**The plant costs will be decided based on volume, contaminations and geo-hydrological conditions.

**BioEcoTech®**



**Iontrex™**



### **9.1. Solar powered salt water purification unit**

**Name of the firm:** SI ProConsulting Management Pvt. Ltd/ Trunz Water Systems AG

Name of the Technology: Trunz Salt and Brackish Water Units  
Name of the Product: TSU 001, TBB 003, TSB 003, TBS 300, TSS 300,  
Aquifier 200.



**Abstract of the Technology/Product:**

All of the salt and brackish water treatment units are capable to treat saline surface- and wellwater to drinking water. The units can treat water up a salinity of 42'000ppm TDS. The units are exceptionally energy efficient, of very high quality and easy to be operated. All the units can be powered purely by renewable energy supply (solar) but have the possibility to be powered with grid- or generator power as well. The units are very compact and easy to deploy. The mobile units (including energy supply) can be taken into operation in less than 15 Minutes and are therefore specifically designed for emergency operations. The units are modular and can be adapted to different raw water qualities. No chemicals are being required for the water treatment. If the application is laid out correctly, the units will reach at least a drinking water quality which is recommended by WHO. With an energy consumption up to 900W only, the units are most probably the most efficient desalination solution worldwide. The Swiss quality ensures a long lifetime expectancy of 10 years. The operation of the equipment is due to a high degree of automation very easy and therefore designed for the usage in deep remote areas as well. The maintenance costs are as low as they can possibly be.

**1. Merits/edge over other similar technology/product (USP):**

- Highest energy efficiency in the world
- Salt water desalination up to 42'000ppm TDS with solar power
- Certified quality according to Swiss/European quality requirements (CE)
- Modular and compact design
- Ready to use without additional infrastructure
- Easy operation in the field
- Low maintenance costs
- Long lifetime expectancy (>10 years)
- No chemicals used for water treatment.

**2. Suitability of the product in rural areas:**

They are designed for rural and deep rural usage.

**3. Eco/Energy friendliness:**

Highest energy efficiency in the world. All the systems can be powered by renewable energy only.

**4. Capacity of the product :**

Between 30l/h (Aquifier) and 650l/h (TBB 003)

**5. Reject management protocol: N/A**

**6. Ease of O & M:**

The units are normally operated by local people from remote villages. Maintenance and Service is provided every 3 – 6 months by our trained technical staff.

7. Capital cost and Cost of treated water per kiloliter:  
Cost per 1'000l of purified drinking water (incl. energy supply and maintenance) is between 50INR and 350INR (depending on the options).



Pictures: Venezuela: Orinoco Delta, solar powered water treatment system

## 9.2 Handheld fresh water purification unit

**Name of the Firm: Si Pro Consulting (I) Pvt. Ltd./ Katadyn Product Inc.**

Name of the Technology: Katadyn high-performance Water Filter

Name of the product: Mini, Base Camp, Expedition

Abstract of the technology/product:

Endurance Series products from Katadyn offer ultimate reliability and durability. Our comprehensive filter range is divided into three requirement categories – Endurance, Backcountry and Ultralight. All of the handheld, long-lasting fresh water treatment units are capable to treat non saline surface- and well water to drinking water. The products are especially designed for everyday operations and emergency preparedness/response for individuals, small - or large groups. The maintenance costs are as low as they can possibly. Swiss Made, unique 0.2 micron silver incorporated micro ceramic with 99.9999% removal of bacteria, Giardia, sediments, algae and Cryptosporidium. Reduce radioactive particles as well.

- Merits/edge over other similar technology/product (USP):
  - The Swiss quality ensures a long lifetime expectancy of up to 20 years.
  - NATO certified
  - Ready to use without additional infrastructure
  - Easy operation in the field
  - Low maintenance costs
  - Robust, from 7000 up to 100'000 liters / cleanable and therefore reusable – longtime
  - independence for spare elements and therefore also very economical
  - Pore size and silver incorporation
  - One unit is for one person or for a Group.
  
- Suitability of the product in rural areas:  
They are designed for Jungle, rural and deep rural usage.
  
- Eco/Energy friendliness:  
All the systems can be operated by hand or as a gravity system.
  
- Capacity of the product:  
Between 0.5l/min (Mini) and 5l/min (Expedition)
  
- Reject management protocol: N/A
  
- Ease of O & M:  
The units are normally operated by Individuals and Groups. Every User can check out the functionality of the filter with the integrated measuring gauge. After sales support replacement of the filter is provided by our trained technical staff.
  
- Capital cost and Cost of treated water per kiloliter:  
Cost per 1l of purified drinking water is between 0.5INR and 4INR (depending on the unit and the water quality).



Picture: For Military Operations

## **10. Portable Solar Powered Water Purifier**

**Name of the firm: AQUALITY WATER SOLUTIONS Pvt Ltd**

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1. Name of the Technology : Point of Use Water Purification using renewable energy
  2. Name of the Product : Solar Powered Water Purifier

*Patent Application No 695/CHE/2014 Published in Journal No - 9/2014 IPI*

*( Joint Innovation by B M Balakrishna and Mohammed Naser Azeez )*

3. Abstract of the Product :

Providing pure and safe drinking water in times of emergency/disaster relief, remote areas with non-existent or erratic power supply is one of the biggest challenges to administration and

agencies. Transporting water in such situation is practically not possible and cannot be a reliable option for meeting the daily requirement. Mobile purification plants of high capacity have been used but still they require fuel to power the generators which produce electricity to run the plants. In such cases fuel availability becomes another concern while accessibility of the needy to the point of supply is again a herculean task. In absence of fuel the systems stop working until any other alternate source of supply is made available. One more drawback is the bulk of these systems which require special transportation or dedicated vehicles which need proper access routes to reach places.

To overcome all the above limitations we have designed first of its kind “Mobile Solar Powered Water Purifier” which has a purification capacity of 50liters per hour and runs on solar power. This unit is a very compact unit with dimensions of less than a 1mtr x 1mtr x 1mtr (in closed position) and a weight of less than 75kgs. The innovative design has 5 panels of 12V x 37 watts which are mounted in such a way that they open up during operation and close down while moving the system which has wheels for ease of mobility. The panels are mounted in frames which are supported with hydraulic pistons for opening and closing. In open position the unit stretches to 4 times its size to give maximum sunlight exposure. The purification system consists of 5 Micron sediment Filter, A UF membrane, pressure pumps, RO membranes and Activated carbon filter. The entire system runs on DC power which is generated directly from the solar panels without the need for any other components. These panels open up with hydraulic supports to collect solar energy which powers the DC pumps directly which generate the required pressure for reverse osmosis purification. The raw water from any source like bore well, river, rain water etc., can be poured in to small tank kept outside the system. The water flows out through a pipe into the Unit which filters it through 4 stages and gives 100% pure and safe drinking water. This Solar Powered Mobile Water Purifier removes suspended particles, bacteria, virus, cysts, dissolved impurities, chemicals and toxins etc., Works upto a TDS of 1500PPM

A very compact portable model which is an inline purification unit without storage has also been developed which weighs less than 18kgs and can be carried in the trunk of a car.

An option to connect a battery and charge controller to store power is also available. Also there is an inlet port where regular single phase supply can be connected to run the system during night or cloudy days if any other source of electricity is available.

#### 4. Merits over other similar product (USP) :

- Compact design for ease of transport and handling
- Runs on renewable energy as well as conventional sources
- Plug and play fully automatic system requires minimal training for operation and maintenance

- Comes in 3 different models with varying capacities and features
- Occupies very less space: < 1 Sq. Meter

- Suitability of the product in rural areas : Ideally for rural areas
- Eco/Energy friendliness : Runs on Solar Energy
- Capacity of the products : 25 LPH and 50LPH Models
- Reject management protocol : Can be collected from Reject outlet and utilized
- Ease of Operation : There is no other operation required except for connecting an external water source , opening of panels and flipping of switch.

Maintenance : Very Minimal training is required for a technically skilled person to maintain this system

10. Capital cost and Cost of treated water per kilolitre:

50LPH Model Rs. 72-96,000 Unit Cost Running Cost : Rs. 0.00  
(12 Ltrs Storage Pressurized storage)

25LPH Model Rs. 45-64,000 Unit Cost Running Cost : Rs. 0.00  
(6 Ltrs Storage Pressurized storage)

25 LPH Without storage Rs. 24-38,000 Running Cost : Rs. 0.00  
(Inline purification system)

\* Free raw water source should be available

50LPH Model with inbuilt pressurised storage of 12 Ltrs



25 LPH Portable inline purifier



### 11. 'OS' (OS) Arsenic Filter

**Name of the firm: Mobile Plus Pvt. Ltd. (Vas Bros Enterprises Private Limited)**

Name of the Technology: 'OS' (OS) Arsenic Filter

Name of the Product: 'OS KIOSK' Community based Arsenic Filter Kiosk.

Abstract of the Technology/Product:

The technology is developed at IIT Kharagpur and the research was supported by Department of Science & Technology, Govt. of India. For last 2-3 years technology demonstration and pilot units have been Supported by UNICEF in the 24 North Paragana District and Malda District at West Bengal. 2 patents are filed for the Technology.

The key features of 'OS' are:

- Removal capacity of Arsenic (total) 32.5 mg/g.

- Arsenic concentration in filtrate is always within the WHO permissible limit for drinking water (10 ppb).
- Capable to remove iron below the permissible limit in drinking water
- Capable to remove more than 98% of pathogenic contaminants
- Capable to remove heavy metals like Lead, Chromium etc.
- Extremely low cost of the filter media compared to available such filters.
- No power requirement (Except storing Raw Water for filtration).
- Removal of arsenic, iron and bacteriological contamination together in a Arsenic concentration of filtrate is always within the WHO drinking water permissible limit, independent of the ground water concentration.
- Extremely long life of the filters. Approximately 4 years, depending on the concentration of arsenic in ground water.
- No regeneration of the adsorbent (filter medium) is required
- Upon exhaustion of the filter, the filter medium can be safely dumped without any risk of leaching and further contamination.
- Easy operation and maintenance.

Merits/edge over other similar technology/product (USP):

- Best, Cheapest & Longest life as compared to any other technology available
- Back washing is not required in OS Media' whereas other alumina products requires 1-3 times backwashing every week.
- Extremely long life as compare to any other product.

Suitability of the product in rural areas:

- This product is very suitable for rural areas. In fact all the pilots installed with the help of UNICEF so far are in rural areas only.
- Also with an additional capital investment of 20-25% on solar Integration, 'OS KIOSK' can be the best technology solution for rural areas.
- 'OS' is a Pollution free product. Unlike other alumina based products, absorbed Arsenic in 'OS' media doesn't go back to the nature while backwashing. Arsenic is fully absorbed and contained in OS media and after saturation, it could be safely dumped.
- Except Lifting Raw Water and coin vending machine, Energy is not used anywhere in the process. The filtration process works fully under gravity



Capacity of the product: Filtered water ranging from 100 – 10,000 liters per day depends on capacity installation.

Reject management protocol: ZERO reject.

Ease of O & M: The proposed 'OS KIOSK' model is fully automated system. Cost of electricity to lift the Raw Water, refilling of sand and charcoal media shall include to the maintenance cost of almost 10-15% of capital cost per annum.

Capital cost and Cost of treated water per kilolitre: Capital cost per kiloliter is approximately Rs. 100, Treated water per kiloliter is almost 5 paisa per liter.



**12.1 Name of Product: Solar powered water disinfection equipment. (SENCO).**

**Name of firm : Sre Senthil Engineering Company**

Name of Technology : Solar powered water disinfection equipment using silver ionization process

Abstract of product / Technology:

This is a water disinfection equipment for drinking water powered by solar module, very much suitable for all solar pumps. The Government of India has envisaged a mission of installing about 20,000 solar powered pumps throughout India for providing drinking water through taps. Water from bore wells were thought not to contain bacteria since it is coming from deep inside the soil, but a study conducted by the Tamil Nadu Water Supply and Drainage Board said about 55% of the bore well water was contaminated bacteriologically due to various reasons and are also prone to contamination in the raiser main, pumping main, storage tank, distribution taps and also by human hands while taking the water. Hence to provide Bacteria free drinking water the water can be disinfected using Oligodynamic technology so that water can be made Bacteria free and can be protected from secondary contamination also. This water will be as per **IS 10500** standards for bacteriological quality

Our equipments consume very little power and can be incorporated with the existing solar modules used for solar pumps. These pumps are mostly controlled by the level controller sensors fixed at the storage tanks. So these equipments will function when the water flows in the chamber only. The life of the electrode can be manufactured as per the client's requirements.

#### Merits:

Powered by Solar.

- Consumes current in mille amps only. (Negligible)
- Disinfection equipment is controlled by the level controller.
- Disinfects all pathogens and produces water as per IS 10500 standards.
- (Bacteriologically)
- No disinfection by products are formed.
- No salt or chemicals required.
- Electrodes can last for 3 years to 5 years.
- No operator assistance required.
- Good residual effect hence protects water from secondary contamination.

#### Suitability of the product in rural areas:

- Very much suitable
- No Moving parts
- No External Electricity
- No wearable parts
- No cleaning
- Functioning indication in LED
- No daily regeneration
- Electrode replacement once in 2 years/3 years /5 years

Eco / Energy friendliness :

- Very much eco friendly
- No harmful chemicals
- No disinfection by products
- Not Carcinogenic

Capacity of Product : 500 – 2000 Litres Per Hour

Reject management protocol: No reject

Ease of O & M :

- No labour required for operation.
- Operates when water flows and disconnects when water stops flowing.
- change of electrode, once in a predetermined life.

Capital cost and Cost of treated water per kilo liter: Capital cost of equipment without solar module Rs 59,000/- with Solar module Rs 63,000/-

Treated water cost up to ten million liters Nil

For next ten million liters is Rs. 15,000/



## **12.2 Name of Technology : Ultra filtration with Oligodynamic Disinfection**

**Name of firm : Sre Senthil Engineering Company**

Abstract of product / Technology: . This filter is made up of food grade polymeric hollow fiber with a pore size of 0.01micron, which can work with minimum pressure , housed inside a food grade poly propylene housing to remove suspended solids, bacteria and virus which are much bigger than the pore size. To reduce the load on this UF filter we provide a 10 micron cartridge filter. The maximum operating pressure can be 4kgf/cm<sup>2</sup> and minimum can be 0.5kgf/cm<sup>2</sup>. The operating pressure is 2kgf/cm<sup>2</sup> and can provide an output of 2m<sup>3</sup>/hr at this pressure. This system is followed by a oligo dynamic disinfection unit, which can provide very good residual protection for the treated water.

This can be put into use in Japanese encephalitis affected areas and also as a treatment plant for all power pumps /solar pumps. We have various capacities of equipment with provision for backwashing and chemical dosing .

5 Merits / edge over other similar technology/ product (USP): This technology removes the bacteria and virus from water and test reports show more than 6 log reduction. The USP is, it is a dual disinfection equipment which can be incorporated for solar pumps

6. Suitability of the product in rural areas: Very much suitable for rural areas.

Can be maintained even by ladies and children.

No reject water

Membrane needs cleaning only once in a week or 10days according to the usage.

Cheap capital cost.

Eco / Energy friendliness :

- No harmful chemical
- No power required for filtration.
- minimum power is required for disinfection
- No harmful rejects
  
- Capacity of Product; 1000lph,2000lph, 3000lph or can be designed to the actual need of the Customer.
- Reject management protocol: No reject
- Ease of O & M : Very easy to operate and maintain
- Capital cost and Cost of treated water per kilo liter:  
1000 LpH UF + Disinfection Rs 70,000.00  
2000 LpH UF + Disinfection Rs1,30,000.00

- 3000 LpH UF + Disinfection Rs1,95,000.00
- Cost of treated water per kilo litre Rs.1.50



**13. Name of the firm: Vestergaard Asia Private Limited/LifeStraw India Pvt. Ltd**

**Name of the Technology: LifeStraw®**

Name of the Product: LifeStraw® Community, LifeStraw® Family 1.0 and LifeStraw® Family 2.0

**Abstract of the Technology/Product:** The LifeStraw® technology converts contaminated water into clean and microbiologically-safe drinking water.

It meets:

The criteria of "highly protective" for microbiological performance under WHO guidelines for household water treatment methods;

US Environmental Protection Agency's (USEPA) standards for drinking water quality

The LifeStraw® ultrafiltration technology removes:

- 99.9999% of bacteria (>6 log reduction)
- 99.999% of viruses (>5 log reduction)
- 99.99% of protozoan cysts (>4 log reduction)
- turbidity by filtering particles of approximately 0.02 microns

The LifeStraw® technology does not use any chemicals for filtration LifeStraw® Community has a capacity of 50 litres and can filter upto 72,000-100,000 litres of water, sufficient to serve large groups of children for several years.

LifeStraw® Family 1.0/2.0 have a lifetime capacity of 18,000/25,000 litres and are sufficient to serve a family of 5 for at least 3 years

**Merits/edge over other similar technology/product (USP):**

- Have low aftersales maintenance cost; users can maintain the units themselves
- Function without electricity, batteries, running water/ piped water supply and
- Are easy to install and use

**Suitability of the product in rural areas:**

- LifeStraw® water purifiers do not require electricity or chemicals for water
- They do not require constant re-intervention of experts to maintain
- End-users can maintain the water purifier by using simple backwash lever
- Eco/Energy friendliness:
- LifeStraw® water purifiers are gravity-based technology
- They do not require electricity or batteries for the product to filter water
- The wastewater can be retreated by pouring it back in the unit require no lifetime indicator filtration

**Capacity of the product :**

LifeStraw® Community: Purifies between 70,000-100,000 litres of water, enough to serve community settings for several years , Has a total capacity of 50 litres (25 litre dirty water tank and 25 litre safe storage tank); and has a filtration rate of 12 litres/ hour

- a. LifeStraw® Family 2.0: Purifies between 24,000-30,000 litres of water, enough to serve a family of five for three years , has a total capacity of 11.5 litres (6.5 litre dirty water tank and 5 litre safe storage tank); and has a filtration rate of 2.5 litres/ hour
- b. LifeStraw® Family 1.0: Purifies upto 18,000 litres of water, enough to serve a family of five for three years, has a total capacity of 2 litres, and Has a filtration rate of 8 litres/ hour

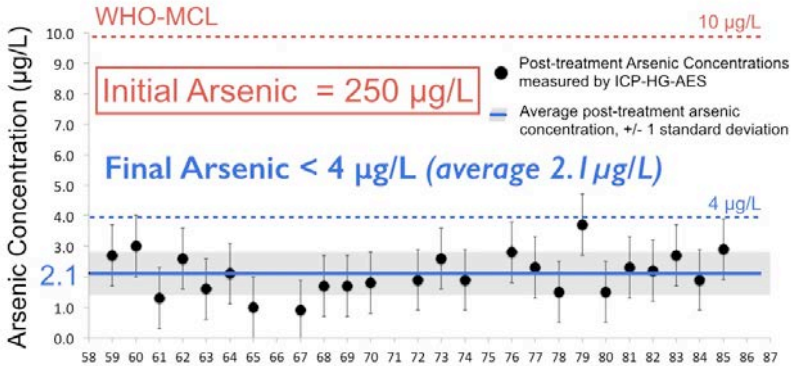
**Reject management protocol:**

LifeStraw® water purifiers are based on ultrafiltration membrane technology which essentially traps all harmful micro-organisms in raw water and flushes them out with the use of the backwash lever. The dirty water that comes out of the purifier can be poured back into the unit for retreatment. This implies after filtering 50 litres of water, about 250 ml of water is thrown out on pushing the backwash lever which can be re-filtered.

**Ease of O & M:**

LifeStraw® water purifiers are easy to install and use. These units do not require any infrastructure and are suitable for use in remote/rural areas with infrastructural challenges. As an example, LifeStraw® Family can be installed using a

rope or two nails. Further, using the simple backwash lever daily can ensure trouble-free running of the purifier.



ECAR 600L Reactor - Dhapdhapi High School 2013 - Experiment Number

Capital cost and Cost of treated water per kilolitre: Cost per litre is nearly 200 INR per kilolitre





#### 14. Name Of The Firm: Aquasphere Greentech Solutions Pvt. Ltd.

Name Of The Technology: Plimmer® Cdi.

##### Abstract Of The Technology

Plimmer® Is A New Generation Of Water Treatment System That Can Treat Ground Or Surface Water Containing High Dissolved Salts To Produce Clean Drinkable Water That Meets WHO Standards. This High Recovery System Does Not Use Any Chemicals, Consumes Very Low Power And Has The Lowest Operating Cost For Treating Water When Compared To Any System In The Market Today.

Plimmer® Is Based On A Technology Called Capacitive Deionization. Capacitive Deionization Is A Technology For Removing Salinity From Water. This Innovative Technology Is Used To Desalinate Water Without Using Resin Or Membrane Filters. It Does Not Require Chemicals To Treat Water And Uses Very Low Power To Separate Salts In Water.

The System Takes Out The Following Salts (Not Limiting) In A Single Process. By Controlling The Flow And Managing The Contact Time, It Is Possible To Ensure The Required Salts Be Retained In The Output Water That Is Good For Consumption.

Table Below Shows Some Examples Of Salts And Metals Removed Using Plimmer®

Salts	Metals	Others
<ul style="list-style-type: none"><li>• Total Dissolved Solids</li><li>• Total Hardness</li><li>• Calcium Carbonate</li><li>• Magnesium Carbonate</li><li>• Sodium Chloride</li><li>• Phosphates</li><li>• Sulphates</li><li>• Chlorides</li><li>• Nitrates</li><li>• Fluoride ...</li></ul>	<ul style="list-style-type: none"><li>• Chrome</li><li>• Iron</li><li>• Arsenic</li><li>• Nickel</li><li>• Copper</li><li>• Zinc</li><li>• Cadmium</li><li>• Mercury</li><li>• Manganese</li><li>• Lead</li><li>• Vanadium ....</li></ul>	<ul style="list-style-type: none"><li>• Bacteria</li><li>• Viruses</li><li>• Ammonia</li><li>• Chromium 6 ...</li></ul>

##### How Capacitive Deionization Works

Cdi Cells Uses Different Coupled Electrodes Contained In A Pressurized Container, Supplied With Direct Current At A Potential Difference Of 1.6 Volt. The Electrodes Are Placed At A Distance At An Order Of Magnitude Of 0.1mm.

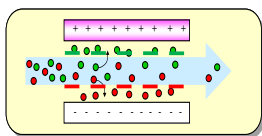
By Powering The Electrodes, An Electrostatic Field Is Created. The Salts Contained In The Water, That Possess An Electric Charge, Will Be Attracted By The Electrode With Opposite Charge And Blocked Its Surface By The Electric Field.

Operating As Low Voltages, Electrolysis And Gas Production Will Not Occur. The Result Is The Partial Or Total Demineralization Of The Water (Step 1 In Picture Below)

Once The Electrodes Are Saturated With Ions, The System Will Automatically Short-Circuit The Electrodes (Step 2 Picture Below) Releasing The Ions And After That Will Reverse The Polarity And Move All The Salts To The Drain (Step 3 Picture Below) In A Small Amount Of Water (Around 20% Of Income Water). At The End Of Step 3, Electrodes Are Regenerated, The Polarity Is Reversed Back To Normal And The Cycle Starts Again.

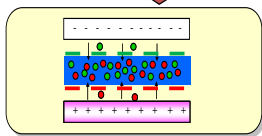
The Whole Process Takes Place Automatically At A Frequency Of About One Minute.

Purification cycle → 3 main steps



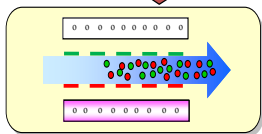
Step 1  
Ion removal

When Water passes between the electrodes, the ions get attracted to opposite charged electrodes. The water void of these salts and metals come out of the system



Step 2  
Regeneration

With more and more ions sticking to the electrodes, they become saturated – when this happens, the system automatically changes the polarity. The ions sticking to the electrodes fall off.



Step 3  
Flush

Water is then flushed between the electrodes and the wasted ions are flushed to drain. The Polarity is reversed back and the Ion removal process (Step 1) starts again

### Merits/Edge Over Other Similar Technology / Product (Usp)

- Low Water Wastage  
Compared To Conventional Ro Systems That Waste 60% - 70% Of Water, The Maximum Water Wastage In Plimmer® Is 20%. This Results In Long-Term Conservation Of Ground Water.
- Low Power Use  
Plimmer® Operates On Low Pressure And Requires Low Power To Operate. It Needs Single Phase Power And Can Also Work In Low Voltage Situation. The Entire Unit Can Run Using Solar Power.

- **Low Operating Cost**  
The Consumables Required To Operate Plimmer® Is Very Less. The Cdi Cells Need Not Be Replaced For 10-12 Years And There Is No Usage Of Chemicals During Treatment. All This Results In A Low Operating Cost To Run The System Year On Year.
- **Simplistic Operation**  
Plimmer® Has A Built In Controller That Automates The Working Of Plant In Typical Indian Conditions. There Is No Major Skill Required To Operate The Plant. The System Can Be Managed And Operated By Local Resources Where Plimmer® Is Installed.
- **Handles Multiple Contaminants In Water – Retains Adequate Salts Required For Body**  
Plimmer® Reduces All Dissolved Salts Like Calcium, Magnesium, Fluoride, Nitrates, Arsenic And Other Contaminants Typically Found In Ground Water – But Yet Retains The Desired Levels Of Minerals Required For Human Body.

#### **Suitability Of Product In Rural Areas**

Plimmer® Is Ideally Suited To Operate In Rural Areas For The Following Reasons:

- Uses Less Power To Operate The Plant. A Single Phase Power Connection Is Enough To Operate Plimmer®
- Low Voltage Situation. Most Villages Get Single-Phase Power And Also Have Low Voltage Situation. Plimmer Can Handle Voltages From 110-230volts
- The System Can Also Be Run Using Solar/Alternate Energy.
- Low Reject Ensures Ground / Surface Water Levels Are Preserved For A Longer Time
- Need No Special Skills To Operate The Plant. Local Resources Can Be Trained To Manage And Operate The Plant
- Less Consumables Requirement Ensures Less Overheads And Storage Of Consumables.

#### **Eco/Energy Friendliness**

Plimmer® Is Highly Energy Efficient. It Can Operate In Single Phase, Low Voltage Situations That Are Typically Encountered In Villages. The Operating Voltage Ranges From 110v-230v

#### **Capacity Of The Product**

Plimmer® Comes In A Modular Fashion Starting From 100 Lph / 2000 Lpd To 2000 Lph / 48000 Lpd. This Will Ensure Adoption From Small Villages To Gram Panchayats

#### **Reject Management Protocol**

The Overall Reject From Plimmer® Is Less Than 20%. With This Small Quantity Of Reject We Can Manage It In Following Ways:

- Route The Reject To Local Toilets For Flushing
- Since The Reject Water Does Not Contain Any Harmful Chemicals It Can Be Used For Watering Trees Like Coconut, Areca Nut Etc. (Depending On The Water Quality)
- For Building And Construction Activities
- Mixing With Stp For Reuse

#### **Ease Of O&M:**

To Help Reduce O&M And Need For Skilled Resources, The Following Has Been Adopted In Plimmer®

- a. Low Consumables Required For Day-To-Day Operation. This Will Ensure Less Constant Monitoring
- b. The System Is Fully Automatic. The Complete System Works Automatically And Starts /Stops Based On Conditions Set In The Field
- c. The Complete System In Web Enabled Ensuring That The Regional Support Centre Identifies Or Knows How The System Is Performing – This Will Ensure Preventive Maintenance And Smooth Running Of Plant
- d. The Entire System Can Be Managed By Local Resources Thereby Ensuring Employment As Well As Local Upkeep Of The System

**Capital Cost And Cost Of Treated Water Per Kiloliter**

The Cost Of Treated Water Per Kiloliter Works To Less Than Rs. 40 / Kiloliter Or 4 Paise Per Liter.





15.

## **SANITATION**

### **1. Soil Bio Technology for sewage treatment/effluent treatment**

**Name of the Firms: Ionic Permutit System Pvt.Ltd., Delhi and Lifelink Eco Technology, Bhubaneswar**

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 & inorganics 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.

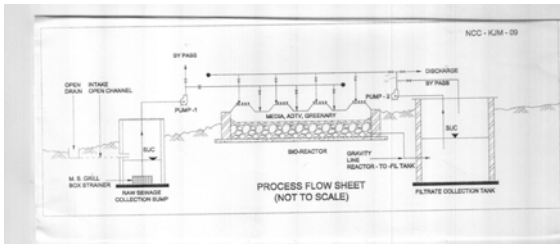
Soil Bio Technology (SBT) is an efficient process of synthesis to completely utilize solids and liquids. It is economical in capital and recurring costs. It has a simple looking construction, free from conventional electro-mechanical systems which are prone to breakdowns. It efficiently integrates the 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.

Some of the salient features of SBT :

- ❖ Rejuvenation/creation of soil.
- ❖ Can be utilizable for all sorts of organic and inorganic molecules present in the effluents.
- ❖ No req. 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 m<sup>2</sup>



Application of SBT



Design of a typical SBT

## 2. Phytorid technology for wastewater treatment

**Name of the Firm: NEERI**

'Phytorid Technology' is developed by NEERI (National Environmental Engineering Research Institute of India) which is a CSIR Lab. The technology has 'Australian Patent' (Australian Patent No. AU 2003223110 A1, 2005) & 'European Patent' (European Patent No. WO2004/087584A1, 2005) to its credit. National Environmental Policy recommends constructed wet land system for effective sewage treatment.

- The technology involves a constructed wetland exclusively designed for the treatment of municipal, urban, agricultural and industrial wastewater. The system is based on the specific plants such as Elephant grass (*Pennisetum purpurem*), Cattails (*Typha* spp.), Reeds (*Phragmites* spp.), Cannas pp., Yellow flag iris (*Iris pseudocorus*) normally found in natural wetlands with filtration and treatment capability. Furthermore, some ornamental as well as flowering plants species such a

Golden Dhuranda, Bamboo, Nerium, Colosia, etc. can be used for treatment as well as landscaping purposes.

- The Phytoid Technology treatment consists of three zones (i) inlet zone composed of crushed bricks and different sizes of stones (ii) Treatment zone consist of same media as in inlet zone with plant species and (iii) Outlet zone

- The reduction on the treated effluent for the Total suspended solids(TSS) varied from 70% to 80 & BOD from 78% to 84%, Nitrogen from 70% to 75%, Phosphorus from 52% to 64% and Fecal Coliform from 90 % to 97%.

1. Merits/edge over other similar technology/product (USP):

Sr No	Conventional	Phytoid
1	Batch Processing	Continuous processing
2	Electricity essential	Can work with gravity
3	Alternate supply through DG Set	Can work with Solar
4	Continuous monitoring	Not required
5	Skilled Manpower required	Unskilled can operate
6	Air Pollution – through Aerators	No Air Pollution
7	Regular Maintenance required	Negligible maintenance
8	Mosquito nuisance – open to air	Sub surface flow
9	Odour is sure	No odour

2. Suitability of the product in rural areas: **All weather all Geographic conditions**

3. Eco/Energy friendliness: **No Energy required / Solar Energy adaptability**

4. Capacity of the product : **Best suited for Decentralized solutions**

5. Reject management protocol: **N.A.**

6. Ease of O & M: **5% of conventional technology**

7. Capital cost and Cost of treated water per kilolitre: Mostly RCC structure hence varies from place to place . As standard it is 25,000 per KLD and reduces with Volume





Contact details:

1. Crest Enviro Transformation India Pvt Ltd., Pune
2. Ecologique Science Technic (I) Pvt. Ltd, Nagpur.

### **3. Bio Digester System for human waste disposal (developed by DRDO).**

**Name of the firm: Alfa-Therm Ltd., New Delhi**

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.

A consortium of anaerobic bacteria has been formulated and adopted for this and this acts as a inoculums to the biodigester and converts the organic waste into methane and carbon dioxide. The Bio digester provides anaerobic conditions and required temperature for the bacteria. The human waste enters the tank from top and the inoculums inside the tank starts treating the waste. The Biogas (methane) generated is used for energy intensive activities like lighting water and room heating. The liquid effluent is drained from the side to any surface or soak pit and it can also be used for landscaping and irrigation purpose.

### **4. CAMUS SBT Technology**

**Name of firm: Vision Earthcare**

**Name of Product:** CAMUS Water Purifier , CAMUS Waste Water purifier, CAMUS Sanitizer

**Technology:** In SBT fundamental reactions of nature viz. respiration, mineral weathering, photosynthesis are synergized to bring about waste conversion and resource recovery. Accordingly process engages soil type formulated media using local supplies ,soil micro-and macro organisms formulated catalyts and additives, green plants to develop ecology for the purification. CAMUS SBT is an advanced version with high rates which uses only local supplies Technology was developed at IIT Bombay by Prof Shankar and his students. Technology is backed by 2 US and 2 Indian patents. Technology can be used for drinking water including iron and arsenic removal, waster water and also for solid organic waste processing including hospital wastes. Maharashtra government has selected SBT of Vision Earthcare for rural sanitation in 95 villages and Phase I work, L1 contractors are being awarded the contracts.

**Merits:** Technology uses very little energy compared to conventional mechanical aeration technology. Energy consumption of 0.1 kWh/ kL compared to 2 kWh/kL in other technologies. Evergreen ambience, very long media life, gardening like skill for operation, very quick startup, no lag time for startup if unused due to power trips etc

**Suitability for Rural Areas:** Highly suitable due to close similarity with agriculture.

**Eco/ Energy Friendliness:** Can be run on solar power so extremely friendly due to low power usage

**Capacity of Product:** Household to municipal sizes already tested and running for many years

**Reject Management:** No rejects

**Ease of O&M :** Gardening type skills so very high ease of O&M

**Sewage**

Capex 1.0 Lakh per kLD for home clusters to 0.15 Lakh per kLD for larger 1 MLD needs. Opex for home units small to municipal works Rs 1.5 per kL grid power inclusive

**Drinking Water Treatment**

Capex 0.6 Lakh per kLD for home clusters to 0.10 Lakh per kLD for 1 MLD type needs.

Opex for home units small to municipal works Rs 0.5 per kL grid power inclusive

**Iron Removal from drinking water**

Capex 1.0 Lakh per kLD for home clusters to Rs 0.15 per kL for municipal needs

Opex for home units small to municipal works Rs 1.5 per kL grid power inclusive

**Arsenic Removal from Drinking water**

Capex 1.5 Lakh per kLD for home clusters to 0.25 Lakh per kLD for 1 MLD type needs.

Opex for home units small to municipal works Rs 3.5 per kL grid power inclusive.



Vision Earthcare CSRE Bldg, SINE IIT Bombay

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Tel+91- 22-27718444, Cell +91- 9920028242, +91-9769605447,+91-9867106420,+91-7506371431

## **5. Name of the firm: Shrishti Eco-Research Institute (SERI)**

### **Name of the Technology: Ecotechnology**

**Name of the Product:** Soil Scape filtration

#### **Abstract of the Technology/Product ( Max. 1 page)**

Soil scape process is an ecotechnological treatment involving the filtration of wastewater through biologically activated filtration medium supported by soil gradient. It harnesses the process ecological principles of biodegradation, biotransformation and bioconversion at various tropic levels occurring in detritus food chain by treating, transforming and detoxifying the pollutants using solar energy.

In Soil scape filter combination of green plants and bacterial culture is used to remove organic matter and pollution. Soil scape filtration is vertical eco-filtration of wastewater through the layers of bio-active (i.e. biologically activated) soil - ORGANOTREAT® and fragmented rock materials which gives purified water. As the wastewater passes through the layers of biologically activated filtration medium the pollutants are adsorbed and degraded. This biodegradation process releases nutrients in simple forms which can be absorbed by plant for their growth. So there is no production of any kind of sludge in this treatment system.

This patented technology is invented by late Shri. Sandeep Joshi, Green surgeon & Environment Technologist.

This treatment system can achieve pollution reduction to the tune of 90-95%. It removes fecal coliforms (bacterial indicator of pathogens) upto 99.5%. The smell reduces upto 90-95%. The colour reduction is about 90-95%. The oxygen content increases from zero to 4-5 mg/l. The toxicity of wastewater reduces by 90-95%.

This Soil Scape filter (vertical ecofiltration) water treatment system can be used as centralized or decentralized unit/s depending on site availability and ease of operations.

#### **1. Merits/edge over other similar technology / product (USP)**

- ✓ No chemicals, no machinery to maintain aerobic conditions,
- ✓ No electricity required for process
- ✓ No hazardous waste generated,
- ✓ 99% odour free treatment,
- ✓ 99% control of mosquitoes and flies
- ✓ Helps to reduce climate change (Green house effect)
- ✓ Short lead time, minimal operating cost, minimal maintenance
- ✓ Fast return on investment, tailor made solutions
- ✓ Enormously space saving, Single stage process

#### **2. Suitability of the product in rural areas**

- Treatment system is quite trendy – it is useful for any set of landscape, population ranging from one family (4- 5 persons) to 1000 families. It can work for grey water and black water separately or combine depending on the project and user requirements.
- Use of biological machinery so no breakdowns
- Use of natural energy like solar energy so no electricity is required
- Any trained unskilled labour can maintain the treatment system
- Economically viable and sustainable as operational expenses are very less

### **3. Eco/Energy friendliness**

- ✓ No Electricity involved in the treatment process; no use of mechanical energy – No energy foot print
- ✓ No addition of chemicals - No carbon foot print
- ✓ Area required for the treatment is very less - so reduction in space foot print
- ✓ The system does not generate sludge or any harmful residue or nauseating odour – socially acceptable
- ✓ Increases green cover and aesthetic look

### **4. Capacity of the product**

1 m<sup>3</sup>/day to 1 MLD

### **5. Reject management protocol**

This ecotechnological system is zero sludge. The topmost layer will be used as green manure in gardens and farms.

The system does not generate any harmful residue.

Backwash system isn't required for this system.

### **6. Ease of O & M**

- Natural, eco-friendly system using plants and bacteria
- Maintenance free, odourless process
- Stabilization of the process takes only a few days
- Unskilled Man-power requirement – hardly one hour per day to maintain the landscape or to cut densely grown plants
- In the absence of wastewater inputs, the system only needs to be watered daily for the survival of the plants. This is very much unlike the Root zone technology, wherein the requirement of continuous wastewater supply is mandatory for survival of the system.

### **7. Capital cost and Cost of treated water per kilolitre**

- Capital cost for installation of STP based on ecotechnology is Rs. 18,000/- per cu m/day site development & reuse facility costs
- Cost of treated water is less than Rs. 2.00/- per cu m/day



**6. Name of the firm: GADGIL LABS, Lawrence Berkeley National Laboratory, University of California, USA; Industrial Partner: LUMINOUS WATER TECHNOLOGIES (P) LTD., GURGAON, INDIA**

**Name of the Technology: Electrochemical Arsenic Remediation (ECAR)**

**Name of the Product: Livpure ECAR**

**Abstract of the Technology/Product:**

The Gadgil Lab at the University of California, Berkeley, and Lawrence Berkeley National Lab has developed and patented **Electro-Chemical Arsenic Remediation (ECAR)** technology to meet WHO and Indian (BIS) standards for arsenic in drinking water, while enabling a sustainable and scalable business model for scale up. In ECAR, a highly effective iron-based adsorbent is generated *in situ* at the time of use, with a small voltage applied (via solar or intermittent grid electricity) to steel plates immersed in arsenic contaminated water. Arsenic-III and Arsenic-V are both removed with high effectiveness owing to the complex electrochemistry that occurs during the process.

In the demonstration projects, arsenic-bearing groundwater is pumped out, processed on-site, and arsenic is removed to meet the WHO and BIS standards for arsenic in drinking water. No regeneration of any media is required, since the adsorbent is generated *in-situ* with a small amount of electricity, along with other electrochemical reactions that remove both species of arsenic.

ECAR performance has been verified using “worst-case” synthetic groundwater and real groundwater from Bangladesh, India, and Cambodia. Field trials of a 5500 liters per day ECAR system were completed at Dhapdhapi High School in West Bengal in 2012-2013. We are currently

working to demonstrate a 10,000 liters per day capacity ECAR system in West Bengal, India. ECAR technology was exclusively licensed for India and Bangladesh by Luminous Water Technologies Pvt. Ltd (LWT) in 2013.

#### **Merits/edge over other similar technology/product:**

The *in situ* ECAR process is (1) **highly effective** – ECAR reliably remediates groundwater bearing either or both arsenic-III and arsenic-V to concentrations below 5 ppb, (WHO-MCL is 10 ppb) in real groundwaters, (2) **locally affordable** - we estimate a sale price of ~Rs 1/L including all costs and business margin, (3) **simple to build** – ECAR uses off-the-shelf components that are readily available and repairable locally in India, (4) **simple to use** – ECAR can be fully automatable, and does **not need pH adjustment**, (5) **simple to maintain** – ECAR uses **no imported media**, requires **no regeneration**, and uses **no membranes** (the supply chain is simple and local), (6) **simple to monitor** – unlike adsorbent media filters, there is no possibility of arsenic-breakthrough - fresh adsorbent is generated continuously at the time of use, resulting in visible and easy-to-monitor indicators of successful arsenic removal, (7) **low waste** – produces very little waste sludge due to high efficiency that is non-hazardous per the USEPA's TCLP, and can be stabilized in concrete, if appropriate, in the future, and (8) **readily scalable** – because there is no special media required, there is no need to develop any central manufacturing facility for any media, or need to import foreign products, allowing rapid scale-up entirely with Indian know-how and Indian materials and engineering skills.

#### **Suitability of the product in rural areas:**

As described above, ECAR is **locally affordable, easy to operate and maintain or repair locally, produces very little waste**, and is **readily scalable**. In addition, ECAR does not require handling any strongly acidic or alkali chemicals, protecting the safety of local workers. The product fits well into a community microutility model based on a public-private partnership, relieving the end-user of undesired maintenance and eliminating the first cost barrier by allowing the user to “pay-as-you-go.” With another technology invented from the Gadgil Lab, a similar model is used to successfully sell safe drinking water to millions of people daily at locally affordable prices without subsidies in rural India, Bangladesh, and Ghana, through an exclusive license obtained for the technology by WaterHealth from the University of California.

#### **Eco/Energy friendliness:**

ECAR uses 25 – 50% less energy than reverse osmosis (RO) and produces significantly less waste. Reject water in ECAR can be as low as 0.4%, compared to up to 50% water loss for RO, all of which must be disposed of. In other processes, corrosive strong acidic or alkali materials must be handled by local people and disposed of for regeneration, pH adjustment, and local media manufacturing; no acidic or alkali materials are needed at any stage for ECAR.

#### **Capacity of the product:**

The ECAR process relies on non-equilibrium dynamics. Hence concepts such as adsorption capacity (which come from equilibrium adsorption isotherms) are not meaningful when applied to ECAR. Nevertheless, for normative comparison, when remediating groundwater with 600 ppb initial arsenic (equal parts III and V species) to 5 ppb final arsenic, we can remove 4.6 – 10.1 mg-As per g-Fe.

**Reject management protocol:**

ECAR produces very little dry waste and backwashing water is fed back into the ECAR system for retreatment and water recovery. The waste passes the TCLP protocol for non-hazardous disposal in the US. In India, waste is disposed of according to current applicable rules and regulations. Current Indian rules require the waste to be treated as “hazardous” so it is disposed of per applicable rules as hazardous chemical waste. The cost of this is included in estimates.

**Ease of O & M:**

The system is easy to automate, and can easily be operated and maintained by a local trained technician with a secondary school education. Materials needed for operation and maintenance (such as steel plates and non-ferric alum) are readily available throughout India. No regeneration is needed, and no corrosive acidic or alkali materials need to be handled.

**Capital cost and Cost of treated water per kilolitre:**

The estimated consumables cost (including electricity) for ECAR treatment producing drinking water with < 5 ppb arsenic is Rs 12 - 27/m<sup>3</sup>. The capital cost is estimated as approximately INR 30 Lakhs for a 10,000LPD capacity plant providing arsenic free drinking water as per Indian Standards IS 10500:2012

**7. Name of the firm: Organic Solutions**

**Name of the technology:** OS SMART Process for sewage treatment

**Name of the product:** OS GREEN STP

**Abstract :**

Organic Solutions is focussed on providing a system and treatment process for processing of domestic sewage waste water using green technologies for obtaining reusable water without formation of objectionable waste by-products like sludge thereby eliminating common operating problems like clogging, sludge disposal etc.

**OS SMART STP** is an innovative and cost effective treatment concept that processes waste water in an eco friendly and hassle free way. It is an amalgamation of the principles of fermentation by probiotic

microbes and simulation of natural filtration process through a well developed eco system of plants, microbes, earthworms, nematodes, actinomycetes etc.

It works in conjunction with OS1-WW™, a liquid concentrate of multiple strains of probiotic beneficial microbes. The bacterial strains have been carefully selected and have enhanced capability to metabolize the organic compounds present in the waste treatment plants and control foul odour.

In **OS SMART STP** a combination of probiotic microbes, green plants and other soil microorganisms is used to remove the organic matter and pollution load. It incorporates a sinusoidal bio- reactor followed by a vertical eco-filtration system with a combination of anaerobic and natural aerobic processes to remove the organic pollution.

It is a viable green alternative to conventional waste water treatment and has been tested for more than 10 years with numerous successful installations. The treatment plant does not require skilled manpower for operation and has no/low power consumption as compared to conventional treatment plants. It is an environment friendly and sustainable option which delivers reusable treated water which meets all regulatory norms without any sludge production.

### **Treatment Process and Units**

#### **Pre Treatment : Screening & Collection**

Manual Screens are provided at the inlet to remove in-organics and bigger debris like plastics, half-eaten food, glass etc. All the waste water from the units flows into the reactor by gravity. OS1-WW microbial culture is inoculated at the inlet.

#### **Primary Treatment : Sedimentation & Sludge Maintenance**

A pre-treatment device is used for sedimentation process to take place in which the heavy density solids are separated from the liquid. This phase is called the primary settler. In OS SMART treatment the settler is incorporated as the first section of the baffled reactor.

#### **First Treatment Cycle: Baffled Reactor**

In the first treatment phase, the biological processes are used to digest and remove the organic matter. Biomass of heterotrophic bacteria utilizes the organic matter during their metabolism. Fixed PVC media is provided in order to further improve the treatment efficiency.

#### **Secondary Treatment Cycle: Vertical Eco-Filter**

Vertical filtration of waste water is carried out through layers of biologically charged media. Biodegradable solids are processed and consumed by microbes and other soil organisms in the top layer of the media. This process breaks down complex organic matter into simpler nutrients which are absorbed by the green plants for their growth. There is no production of sludge in the system.

#### **Merits/Edge over other similar technologies (USP):**

- No Sludge production
- No air or sound pollution; no foul odour



- Significantly lower energy/power consumption
- No heavy mechanical equipment like blowers etc
- Not dependent on skilled manpower
- Lower capital costs
- Savings in O&M costs by over 50% as compared to conventional treatment
- Best option for decentralized treatment; scalable to any size of operation
- Integration in landscape

**Suitability of the product in rural areas:** As the treatment plant can be constructed using local construction materials and does not require any heavy mechanical equipment, setting it up in rural areas is extremely feasible. Moreover, the treatment process is not dependent on skilled manpower and high energy inputs. Therefore, operation and maintenance of these plants in rural areas is extremely viable.

**Eco/Energy friendliness:** The treatment process is a sustainable and eco-friendly alternative to conventional treatment systems. There is zero to low power requirement for the treatment process. The treatment is done without the use of any chemicals and also there are no harmful byproducts like sludge. There is no sound or air pollution and the treated water can be reused for horticulture and other non-potable uses. There is no emission of harmful green house gases.

**Capacity of the product:** It is an ideal decentralized treatment option. The treatment process can be setup to treat waste starting from 1000 litres to multiple MLDs. In case of very large flows, 2-3 smaller plants can also be setup to save on the piping costs.

**Reject Management Protocol :** N/A

**Ease of O&M:** The treatment plant is extremely user friendly and easy to operate. It does not require any skilled manpower and does not involve monitoring of complex parameters like MLSS/MLVSS etc. The daily O&M activities include dosing of bacterial solution and pruning of plants. There are no heavy mechanical equipments; therefore there is no wear and tear and breakdowns.

**Capital Cost and cost of treated water per kilolitre:** The cost of setting up the treatment plant is majorly dependent on the civil construction costs in the area. A general thumb of rule is Rs. 20,000-25,000 per kilolitre. The O&M cost is Rs. 4-5/Kilolitre and can vary depending on the scale of the plant.

## **8. Name of the firm: QUASH PRODUCTS INDIA PVT LTD**

**Name of the Technology: Bacteria Ledbio-Remediation / Bio-Augmentation, Reed Beds, Anaerobic Digesters**

### **Name of the Product:**

**i. BACTERIAL TECHNOLOGY: Waste Water Treatment (WWT), Formula – 33, Natural Ammonia Reducer, Microbial Hydrocarbon Reducer, Aqua Culture Management, Grease Trap Treatment**

**ii. REED BED TECHNOLOGY**

**iii. ANEROBIC DIGESTERS**

### **Abstract of the Technology/Product:**

**Bacteria Led Bio Remediation/Bio Augmentation:** Quash is using non-pathogenic bacteria, the affected water body (lake/river/drain/STP) is dosed with a bacterial soup. Quash offers PAT technology, usually in the cases of treatment in Sewage Treatment plants, Drains and other highly contaminated areas. The PAT system is a method of breeding bacteria specially designed to deal with specific problems. It can also be described as 'bulking up the good bacteria, and cutting-out the bad bacteria. Using scientifically "freeze-dried bacteria" specifically formulated by Quash as a seed source.

In short the process provides an on-site fermentation system which augments the bacteria, producing a highly active 'soup' which then is injected into the normal treatment process. Quash technology is unique where in bacteria breed on raw sewage. Bacteria from the breeder unit are acclimatised to the conditions in which they will have to work unlike the systems that require nutrients and clean water for breeding of bacteria. Bacterial consortium is fed into the system in peak growth condition, so that they breed rapidly.

In the cases of dosing lakes and fisheries the bacterial consortium can be fed directly into the water without any harm to water bodies. There is no need for bacterial activation in this process.

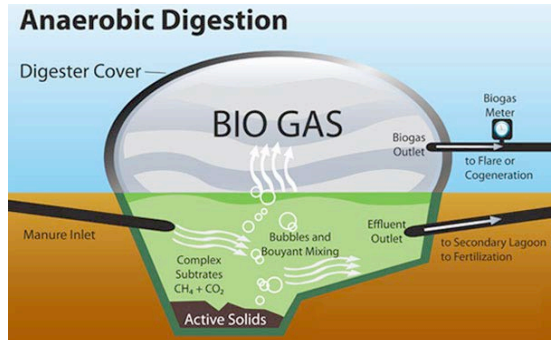
### **Reed Beds:**

Reed bed technology is based upon the cleansing power of three main elements: soil dwelling microbes, the physical and chemical properties of the soil, sand or gravel, and finally the plants themselves. The civil engineering surrounding a reed bed treatment zone is generally very simple, firstly an excavated void is lined to prevent seepage of wastewater to the environment, then this void is filled with appropriate gravel, soil or sand and the reeds are planted into this media. The water is delivered either over the surface of the system (vertical flow), or via a feeder trench at the

front end of the system (horizontal flow). The reed bed will use the Nitrogen and Phosphorus contamination in the water as a method of fertilizer, once the reed bed box has over grown it can be easily removed and replaced with another 'box' of reeds

#### **Anaerobic Digesters:**

The Quash is employing a bio digester system to clean up the contaminated rivers and produce clean biogas energy or manure from the waste. The bio digesters clean effluent waste water through bacterial process whilst degrading down solids to a fine silt like substrate. At the same time, biogas can be taken out of the process and used as fuel which helps in making that system more efficient and self-sustaining.



#### **Merits/edge over other similar technology/product (USP):**

- Easily implemented, once the primary survey has been conducted, water can be treated within 10days.
- No environmental impact to the environment, bacteria is natural occurring, similar to that to make yogurt.
- Minimum Human Intervention required in its administration and application
- Easily transported and stored.

#### **Anaerobic Digesters:**

There is no requirement for an anaerobic digester to be tied up to the main sewage grid, therefore minimal infrastructure is required. Any power consumption that is required can be supplied by solar technology.

#### **Suitability of the product in rural areas:**

- The product is suitable for rural areas as it requires minimal human intervention in its application, requires little or no electricity and does not require any infrastructure of its set up.
- Reed bed: Yes as reed bed grow wild, once the bed had over grown it can be replanted and added into the local flora of the region.

- Anaerobic Digester: Suitable for rural areas as decreases the need for centralisation of the small town or village onto the main “grid”. The village becomes self-sufficient in terms of effluent treatment and the bi-product can be used as fertiliser in farming activities.

**Eco/Energy friendliness:**

- As its biological non-pathogenic bacteria, the product is not harmful to the environment, flora or fauna. Also it is energy friendly, application of the product to a failing STP will decrease electricity consumption by minimising the need for massive aeration therefore reducing the need for blowers and aerators.
- Reed Beds: Are plants within pots effectively put in a final polishing unit. The plant itself is nontoxic and environmentally neutral.
- Anaerobic Digesters: Require minimal space for operation, therefore the need to disturb the environment is reduced.

**Capacity of the product :**

- 50 – 100 TONS / month depending on demand
- Reed beds: 50-100 reed bed “boxes” depending on demand
- Anaerobic digesters – depends on the size and implementation of the project.

**Reject management protocol:**

- Bacteria: it is naturally occurring. Which is 100 % biodegradable and therefore leaves no left over waste.
- Reed beds: once the reed beds grows they can be re-used in river side or lake side horticulture and replanted as necessary.
- Bio digester: the waste from as SBR treatment facility can fed into an Anaerobic bio-digester, which then filter down the sludge into a finest silt which can be used in agriculture as fertilizer.

**Ease of O & M:** O & M is extremely easy, it is easy to train to the uneducated or unskilled workers. The cost of O & M is also low in cases of the bacterial treatment, reed bed and anaerobic digesters.

**Capital cost and Cost of treated water per kilolitre:**

- Bacterial treatment = Rs 0.5/- per kilo litre\*
- Depending on the size of treatment areas and the level of contamination
- Reed Beds = Starting at Rs 40,000/- depending on the size of the treatment area
- Anaerobic Bio Digesters = Start at Rs30,000/-\*
- Depending on the size and population of the treatment area



## **9. Name of the Technology: Plastic Honeycomb**

**Name of the firm: Anjani Technoplast Ltd.**

Name of the Product: Toiletz

Abstract of the Technology/Product :

In continuum to our innovative products, we feel proud to share with you the technology that has been conceptualized, designed, developed and put to production indigenously by us. ATL is honored to introduce to Make In India - SWACHH BHARAT -

The first ever Ecological Toilets that are made out of aviation grade, thermally insulated, recyclable 'plastic honeycomb'.

Our Made In India ecological toilets are light weight and structurally strong and allow sufficient natural lights to pass through (hence requiring minimal lighting to be connected). In addition, they provide the following unparalleled features:

- a) Chemically inert
- b) Highly adaptable for any weather condition
- c) Highly price competitive
- d) Easy and quick installation
- e) Can scale up the construction process by over 200% in comparison to the traditional construction methodology
- f) Borer and termite proof

These toilets have exceptionally long life and require minimal maintenance, making them one of the most preferred pre-fabricated technology across the globe. More than anything, it is a revolutionary innovation from India to the world.

### **Other Applications:**

- a) Porta Cabin & Guard Post
- b) Shelters
- c) Low Cost Housing
- d) Sound barrier for Metro and Roads
- e) Hygienic water tanks for community

### **Merits/edge over other similar technology/product (USP):**

- a) Homogeneous Honeycomb Structure
- b) Light Weight yet structurally very strong
- c) Recyclable
- d) Green Product - No wood, Minimal carbon footprint (Need to check), Ozone Safe
- e) Allows natural lights to pass, hence, saving on electricity
- f) Borer & Termite Proof
- g) Chemically Inert

- h) Easy and quick on installation – Minimal Secondary processes involved in construction
- i) Highly price competitive

**Suitability of the product in rural areas:**

Owing to its basic construction and core material it is practical inert to all chemicals and has been developed for civil applications for being used in extreme conditions.

Our rural areas with limited access to the basic necessities like electricity essentially require a technology that does not only ease them off from being depended too much on electricity and also ensures on conserving the same. The Toilets made out of Plastic Honeycomb are not only strong but their basic inherent properties allows sufficient natural light to pass through without compromising on the privacy, with the virtue of its design it provides strong structural strength and being very light in weight makes it safer in terms of use. Being made out of plastic it is thermally and electrically insulated. Ease of installation, strong structure, recyclable material makes it an essential product for rural applications.

**Eco/Energy friendliness:**

The Plastic Honeycomb is made out of Polypropylene hence making it inert and in turn making it an eco friendly and green product. The manufacture and complete supply chain of the honeycomb panels leaves behind minimal carbon footprint and at the same time its applications too do not produce any or assists in producing green house gases.

The product allows sufficient natural lights to pass through, hence, eliminates the requirement of electricity for lightening during day and being plastic it is safe from electrical shots too.

**Capacity of the product :**

500 Toilets per day

**Reject management protocol:**

ISO Certified state of the art unit having robotics and cnc operated assembly lines.

**Ease of O & M:**

This is the material which practically does not require any maintenance and paint as such. If any paint is required the surface finish for paint affinity can be provided on request. The material is highly adoptable and does not require any routine maintenance and can be cleaned using water and mild chemicals. The toilet is designed in such a way that it is user friendly and can be used by any ordinary person in any geographical /climatic condition.

**Capital cost and Cost of treated water per kilolitre:**

Our range of toilet starts with Rs.15 Thousands (without Bio-Digester or Soak pit) and goes up to Rs.6.5 Lakhs with an option to customize and build as per the design.



**10. Name Of The Firm: Alfa Therm Limited**

**Name Of The Technology: Drdo Biotoilet/Biodigester**

Name Of The Product: Biotoilets

Abstract Of The Technology/Product: Bio Toilet/ Bio Digester Has Been Developed In Association With DRDO (Defence Research And Development Organization) – Ministry Of Defense , Govt Of India After 20 Years Of R&D. Bio-Digester Converts The Human Waste And The All Organic Waste In Clean Re-Usable Odour Free Water And Bio Gas.



Our Biotoilets Have Been In Successful Operation With Several Government Organizations In India: Indian Army, ITBP,BSF, DDA, MCD, Indian Railways , BPCL , SAIL To Name A Few. Several Corporate As Part Of Their CSR Activities Have Installed Our Biotoilets In Rural Areas. Our Installation Can Be Found In New Delhi ,J&K,Arunachal Pradesh, Sikkim, West Bengal, Gujarat, Rajasthan,Punjab

#### The Technology Has Two Major Components

- 1.Anaerobic Microbial Inoculum ( Bacteria)
- 2.DRDO Biodigestor Tank

Merits/Edge Over Other Similar Technology/Product (USP):

- One Time Charging Of Bacteria.
- Flush And Forget Technology.
- Does Not Require Any Sewage Connection
- Lesser Space Requirements
- Odourless, Colourless, Pathogen-Free Effluent.
- Digests Organic Solids In An Biological Way.
- Prevents Human Waste And Untreated Water From Contaminating Groundwater.
- Effluent (I.E. The Water) Can Be Used As Fertilizer For Soil, To Water Plants.
- Does Not Require Cleaning Or Evacuation Of Tank.
- Does Not Require Any Power Or Consumables To Operate.

Suitability Of The Product In Rural Areas: Challenges In Rural Sector - Plains

- No Energy Dependence
- Affordability
- Long Lasting (At Least 15 Years)
- Require Minimum Water For Cleaning
- Space Constraints
- All Weather System
- Allow Use Of Toilet Cleaning Agents For Better Hygiene
- Free Of Manual Scavenging / Evacuation And Maintenance

DRDO Bio-Digester Addresses All Above Challenges Adequately

- Eco/Energy Friendliness: It Is Eco-Friendly Toilet And Developed By DRDO.
- Capacity Of The Product : It Is Available In Various Capacity From 1 User To 3000 User Per Day.
- Reject Management Protocol: NA
- Ease Of O & M: It Is M Aintenance Free Biotoilet Technology.
- Capital Cost And Cost Of Treated Water Per Kilolitre: Cost Depends On Capacity.