Biodigester- DRDO technology
An Eco-friendly Solution for Human Waste Management

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SHAMEFUL FACTS

595 million people do not use toilets in India, this is more than half the total population.

Open defecation causes chronic diarrhoea that leads to stunting.

1000 young lives are lost every day due to diarrhoea.

About 22 million girls do not have access to a separate toilet facility in school.

25% of all children under-five years of age died of Diarrhoea in 2012.

40% of children suffer from Stunting.

50% of Malnutrition is attributable to water, sanitation and hygiene.

UNICEF's vision for Water, Sanitation and Hygiene in post 2015 World:
- No one should be defecating in the open.
- Everyone should have safe water, sanitation and hygiene at home.
- All schools and health centres should have water, sanitation and hygiene.
- Water, sanitation and hygiene should be sustainable.
- Inequalities in access should be eliminated.
TWO MAJOR CHALLENGES OF INDIA- TODAY

Sanitation:
○ India is The open defecation capital of the world.
○ 50% of population not having proper sanitation facility.
○ Other 50% who have cause severe fresh water wastage.

Water & wastewater:
○ Many states and towns are reeling under severe water shortage
○ Roughly 80% of fresh water that reaches households leaves as waste.
○ Distance from source to consumption point of fresh water is increasing alarmingly.
○ Complete disconnect between water supply and sewage management.

○ Drowning India in its own excreta.
LIVING TOGETHER
**DID WE KNOW?**

In our culture some times We take the pride and being happy that if a child leave faeces on the relative

- One GRAM of faeces contains:
  - 10,000,000 viruses
  - 1,000,000 bacteria
  - 1,000 parasite cysts

- Child faeces contain more germs than adults’.

[http://unicef.in/Whatwedo/11/Eliminate-Open defecation#sthash.r2LcadT6.dpuf](http://unicef.in/Whatwedo/11/Eliminate-Open defecation#sthash.r2LcadT6.dpuf)
Why do millions of Indians defecate in the open?

- Apart from poverty and lack of lavatories, one of the reasons often cited to explain open defecation in India.
- The ingrained cultural norm making the practice socially accepted in some parts of the society.
- "Just building toilets is not going to solve the problem, because open defecation is a practice acquired from the time you learn how to walk."
Effects of Open Defecation

Human excreta

Mixing with water sources lead to contamination of Ground water, River and ponds

Human consumption of the contaminated water

Human water borne disease like Diarrhea, Bacterial and viral diseases
DOMESTIC WASTEWATER

**ALL WASTEWATER**

**Blackwater**
- Toilet
  - excreta
  - urine
  - paper
  - water

**Kitchen**
- greases & oils
- food scraps
- soil
- chemicals
- water

**Bathroom**
- bits of people
- soap
- soil
- chemicals
- water

**Laundry**
- soil
- sweat
- detergents
- bleaches
- lint

**Greywater**
Domestic Water Usage

- Bathroom: 38%
- Kitchen: 7%
- Laundry: 23%
- Toilet: 32%
SEPTIC TANK SYSTEM
SEPTIC TANKS AND OTHER ON-SITE SYSTEMS

- **Septic tank**: a primary treatment system that operates in an anaerobic mode
- Provides a storage of solids more dense than water settle to the bottom and light materials float to the surface to form a scum.
FAILURE OF SEPTIC TANK AN SOAK PIT

- the septic tank periodic maintenance
- the soil type and quality
- the height of the monsoon water table
- the specification of the septic system itself

The common signs of a soak failure are:

- effluent pooling on the ground surface, foul odours (bad smells) coming from the septic tank or drains,
- slow flushing toilets and gurgling sounds from the drains,
- overflowing toilet, shower, bath or any other waste water,
- dips in the ground surface near to the septic tank and drain runs
Biodigester- DRDO Technology
Environmentally Friendly Way to Treat Waste

The toilet has a tank fitted below the commode. The tank has sheets with bacteria embedded. When waste comes in contact with bacteria it gets converted to water and methane.

Modification for Railways:
A special lid allows for non-biodegradables like plastic bottles to be flushed out. The excreta enters through a separate opening into the digester tank.

Modification for Areas with High Water Table:
The tank has several chambers. This increases the retention time of the waste and provides more surface area to break down the waste.
THE TECHNOLOGY....

- Zero-waste bio-digester technology breaks down human excreta into usable water and gas through anaerobic process.
- The microbial culture to survive cold or hot climate and feed on waste to perform the anaerobic digestion. Ranging from 0°C to 55°C.
DRDO and Union rural development ministry signed an MOU to build 100,000 biodigester toilets in 300 gram panchayats of the country in the next two years under the Centre’s flagship Total Sanitation Mission.

Indian railways has also signed an agreement with DRDO to retrofit these toilets in 50,000 coaches over five years.
BENEFITS OF ANAEROBIC DIGESTION

(1) improved water quality,
(2) decreased odor,
(3) reduced greenhouse gas emissions, and
(4) AEROBIC PATHOGENS REDUCTION
(5) BIOCYCLING OF WATER
CENTURY’S ROLE

- We are the only licensed technology holder in Gujarat.
- We prepare the efficient microbial cultures for Anaerobic digestion.
- We provide support services for designing and implementing the biogas digesters and toilet structures.
BIODIGESTER TANK MANUFACTURING SITE
SUITABILITY

- Individual houses
- Schools/ Colleges/ Public buildings/ Public Places
- Small Community/ Large Residential Colonies
- Industrial establishment (only for human & kitchen waste)
- Religious places
- Temporary large gatherings of people.
Bio-digester technology
Developed by DRDO

BIO-TOILET

Recycling use
for toilet

Bio-digester

Treated water
storage

OR

For garden use

Century
Pharmaceuticals Limited
Recycling of water for flushing

Community Toilets

BIO-DIGESTER

TREATED WATER STORAGE

FOR GARDEN USE
COLLATERAL BENEFITS

Bio toilet

- Women Safety
- Reduced Health Problems
- Reduced water pollution
- Much reduced Enteric diseases
- Dignified living
- Hygienic conditions
<table>
<thead>
<tr>
<th>Benefits Over Existing Approach</th>
<th>Flush Toilet</th>
<th>Dry Latrine</th>
<th>Bio-digester</th>
</tr>
</thead>
<tbody>
<tr>
<td>High maintenance</td>
<td>low maintenance &amp; unhygienic</td>
<td>Very low maintenance</td>
<td></td>
</tr>
<tr>
<td>Difficult to construct</td>
<td>Easy to construct</td>
<td>Easy to construct</td>
<td></td>
</tr>
<tr>
<td>Unhygienic if not maintained</td>
<td>Highly unhygienic</td>
<td>Hygienic</td>
<td></td>
</tr>
<tr>
<td>Heavy water requirement</td>
<td>Little water requirement</td>
<td>Little water requirement</td>
<td></td>
</tr>
<tr>
<td>Prone to spreading diseases if not maintained</td>
<td>Highly prone to spreading diseases</td>
<td>All pathogens are killed during the process</td>
<td></td>
</tr>
<tr>
<td>Smelly septic tank (end product)</td>
<td>Highly smelly process</td>
<td>No smell as end product is methane and carbon dioxide</td>
<td></td>
</tr>
</tbody>
</table>
Bio toilet with biodigester at IFFCO plant
IMPLEMENTED SITES......

HALOL NAGAR PALIKA
Installed bio-toilets with digesters

Installed at Himmatnagar

Installed at Rajkot

Installed at Sureli
ECONOMIC MODELS

Rs16000/
=  

Rs25000/
=  

Rs20000/
=  

Century Pharmaceuticals Limited
Rs65000
/=Rs30000/
SINGLE DIGESTER

Specifications:

1. **Size**: 1000(L) x 1000(W) x 700(H) x 6 (Thk) + 1% (from top)
   
   951(L) x 951(W) x 700(H) x 6 (Thk) + 1% (from bottom)

2. **Inlet pipe size**: OD ø 110 mm  **Outlet size**: OD ø 75 mm

3. **Partition wall size**: 1004(W) x 700(H) x 3-5 (Thk) mm (from top)
   
   955(W) x 700(H) x 3-5 (Thk) mm (from bottom)

4. **Shape**: Rectangular

5. **Volume**: Total volume : 667L
   
6. **Effective Volume**: 493L

7. **Max. No. of water flushes permitted**: For 8 litre cistern – 30/day

8. **Material**: FRP for tank, cover plate & partition walls:
   
   Commercial PVC with ISI mark for all pipes
## Volume estimate for the Septic tank

<table>
<thead>
<tr>
<th>Septic Tank Volume (litres)</th>
<th>Number of people in the household assuming each person uses a volume of 180l/ person/day (NORMAL)</th>
<th>Number of people in the household assuming each person uses a volume of 250l/ person/day (HIGH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2720/2800</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3750/3800</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>4500/4600</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>6000</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>7500</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>9000</td>
<td>39</td>
<td>28</td>
</tr>
<tr>
<td>Sr. No</td>
<td>BioTank Capacity in liters</td>
<td>Inoculum required in liters</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>1</td>
<td>700</td>
<td>125</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>1500</td>
<td>175</td>
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<tr>
<td>4</td>
<td>2000</td>
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<tr>
<td>5</td>
<td>4000</td>
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<tr>
<td>6</td>
<td>8000</td>
<td>300</td>
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<td>7</td>
<td>15000</td>
<td>500</td>
</tr>
<tr>
<td>8</td>
<td>40000</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>60000</td>
<td>1500</td>
</tr>
<tr>
<td>Parameter</td>
<td>Septic Tank</td>
<td>Biodigester/Biotank</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>pH</td>
<td>6.7-7.5</td>
<td>7.0-7.2</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>500-800</td>
<td>70-90</td>
</tr>
<tr>
<td>Total Suspended Solids (mg/L)</td>
<td>150-300</td>
<td>90-120</td>
</tr>
<tr>
<td>TDS (mg/L)</td>
<td>500-850</td>
<td>350-450</td>
</tr>
<tr>
<td>VS (mg/100ml)</td>
<td>50-60</td>
<td>20-30</td>
</tr>
<tr>
<td>COD (mg/L)</td>
<td>1200-2000</td>
<td>250-300</td>
</tr>
<tr>
<td>BOD S (mg/L)</td>
<td>350-500</td>
<td>70-120</td>
</tr>
<tr>
<td>Coliforms (MPN/ml)</td>
<td>&gt;3000</td>
<td>300-500</td>
</tr>
</tbody>
</table>
Benefits of BioDigester

- Compact in size
- Quick installation
- Zero maintenance
- No need for big sewage treatment plants
- Mitigates pollution of underground & river water
- No residual solids waste
- No pathogens
- No foul smell
- Only water discharge
Temperature is one of the major factors affecting the growth of bacteria responsible for biogas production. Biogas production can occur anywhere between 4° to 68°C. As the temperature increases, the gas production rate also increases, up to a limit. The environment for which this digester will be operating which has an average temperature range from 2.8 to 28.5 °C with the record low and high being -16.1 to 40.5 °C.
## Cost of System to Be Estimated

<table>
<thead>
<tr>
<th>Capital Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single toilets</td>
</tr>
<tr>
<td>Multiple toilets</td>
</tr>
<tr>
<td>Row toilets</td>
</tr>
<tr>
<td>Mix Tank/ Collection</td>
</tr>
<tr>
<td>Over head tank Pump</td>
</tr>
<tr>
<td>Piping</td>
</tr>
<tr>
<td>Collection</td>
</tr>
<tr>
<td>Digester Tank</td>
</tr>
<tr>
<td>Cement Work</td>
</tr>
<tr>
<td>Cement</td>
</tr>
<tr>
<td>FRP tank</td>
</tr>
<tr>
<td>MS tank with FRP coating</td>
</tr>
<tr>
<td>Energy Conversion System</td>
</tr>
<tr>
<td>Solar operation</td>
</tr>
<tr>
<td>Product</td>
</tr>
<tr>
<td>Gas Pipes</td>
</tr>
<tr>
<td>Gas Pump</td>
</tr>
<tr>
<td>Gas Meter</td>
</tr>
<tr>
<td>Generator</td>
</tr>
</tbody>
</table>

| Overhead                                   |
| Engineering                                |
| Maintenance/ Repair Costs Shipping Costs   |

| Operational Cost                           |
| Labor Hours (in years)                     |
| Water usage                                |
| Land                                       |
Simplicity of the technology

Delivery period - 10 – 15 days
Installation period - 3 hours

Read to use technology
The first water output - On sixth day

No residue/ no addition of inoculum
"every Indian household, every village, every part of Indian society will accept the need to use toilets and commit to do so",
WHOM TO CONTACT

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