

# **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


unicef 

## **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>



# WHY DO MILLIONS OF INDIANS DEFECATE 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

### Toilet

excreta  
urine  
paper  
water

### Kitchen

greases & oils  
food scraps  
soil  
chemicals  
water

### Bathroom

bits of people  
soap  
soil  
chemicals  
water

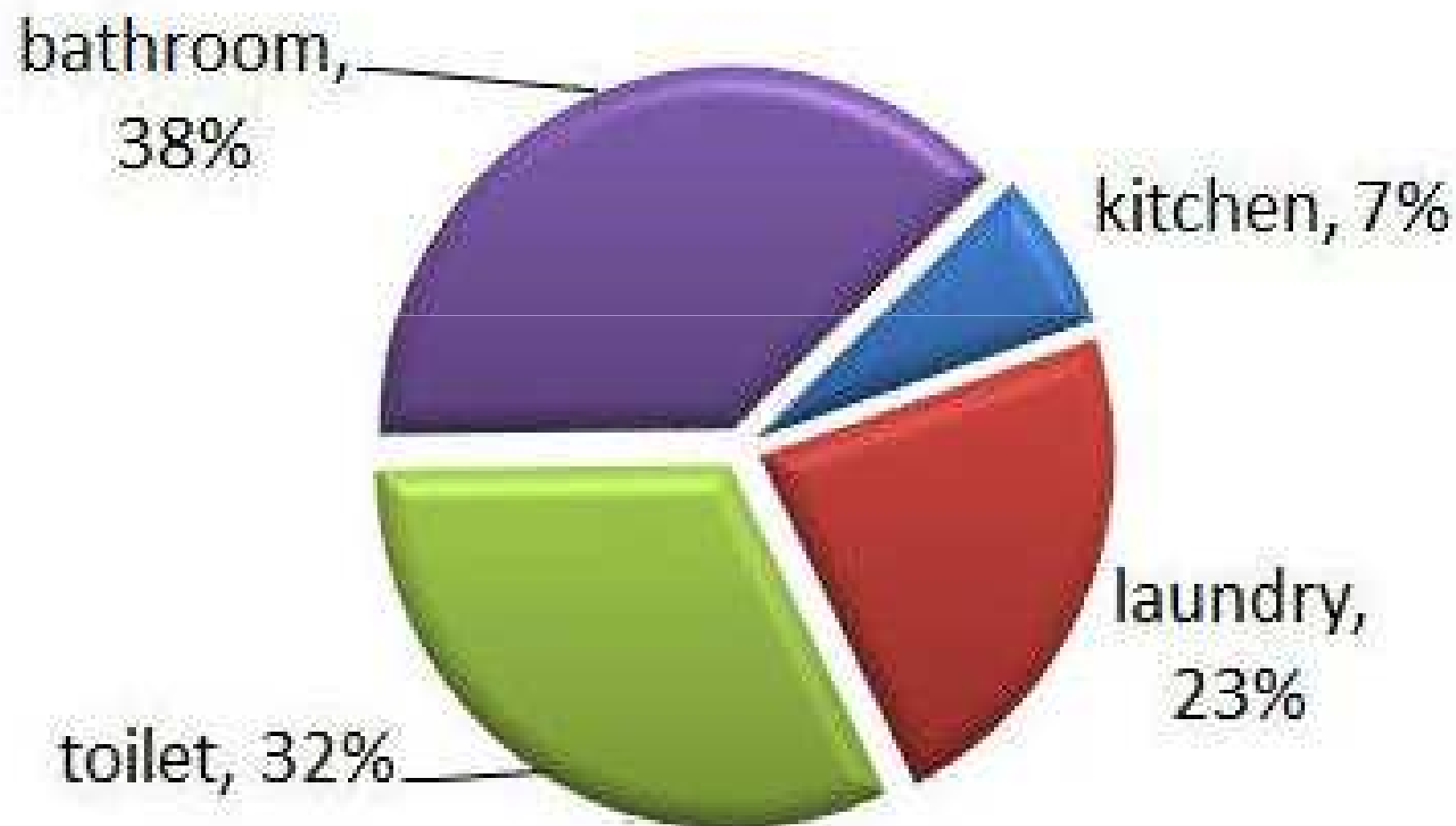
### Laundry

soil  
sweat  
detergents  
bleaches  
lint

Blackwater

Greywater

## DOMESTIC WATER USAGE



# 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 AND 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

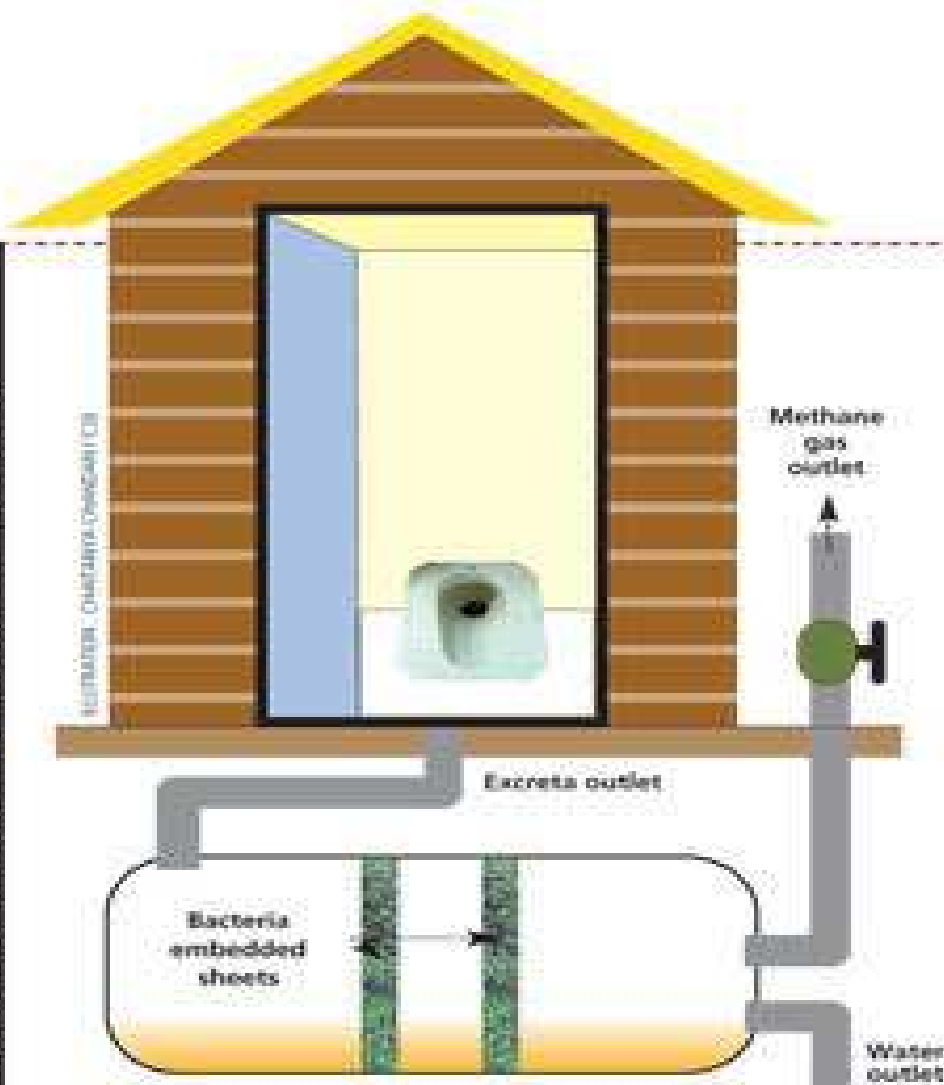
The common signs of a soak failure are;

- 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

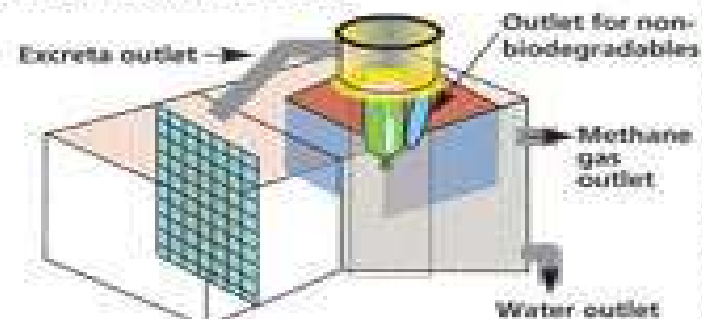
## ENVIRONMENTALLY FRIENDLY WAY TO TREAT WASTE

BIODIGESTER TOILETS DESIGNED BY DRDO



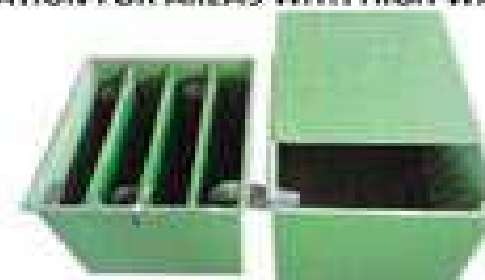
The toilet has a tank fitted below the commode. The tank has sheets with bacteria embedded. When waste comes in contact with bacteria it gets converted to water and methane

### 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.



## TECHNOLOGY IMPLEMENTATION

- 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 bio-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-TOILET**



# Bio-digester technology Developed by DRDO



**RECYCLING USE  
FOR TOILET**



**BIO-  
DGESTER**



**TREATED WATER  
STORAGE**



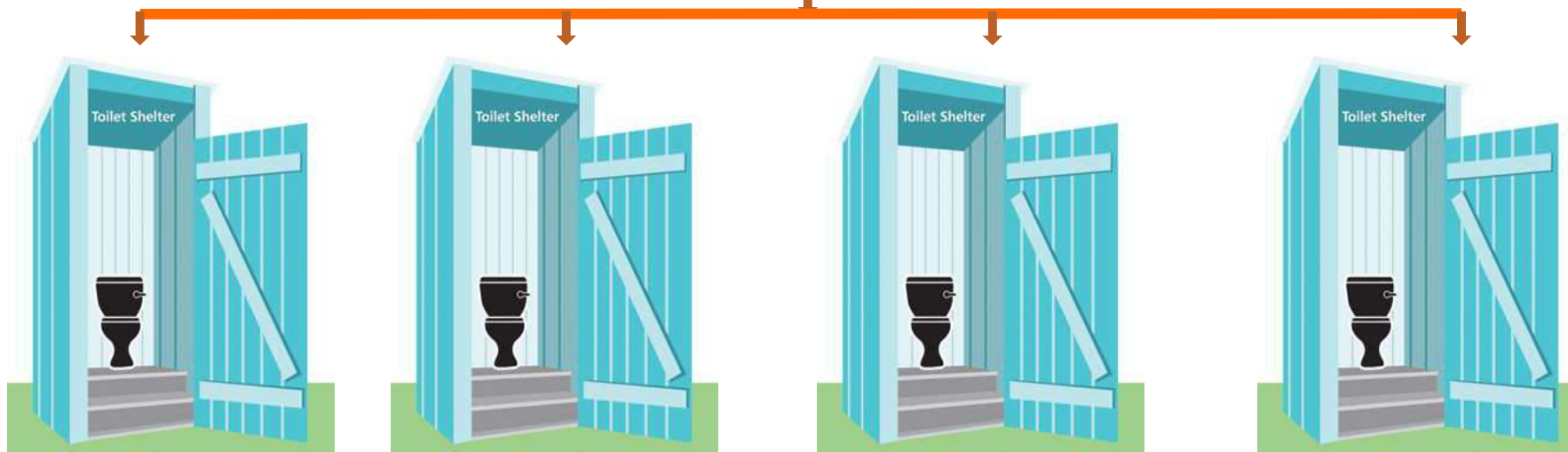
**OR**

**FOR GARDEN USE**



# Community Toilets

Recycling of water for  
flushing



**BIO-  
DIGESTER**



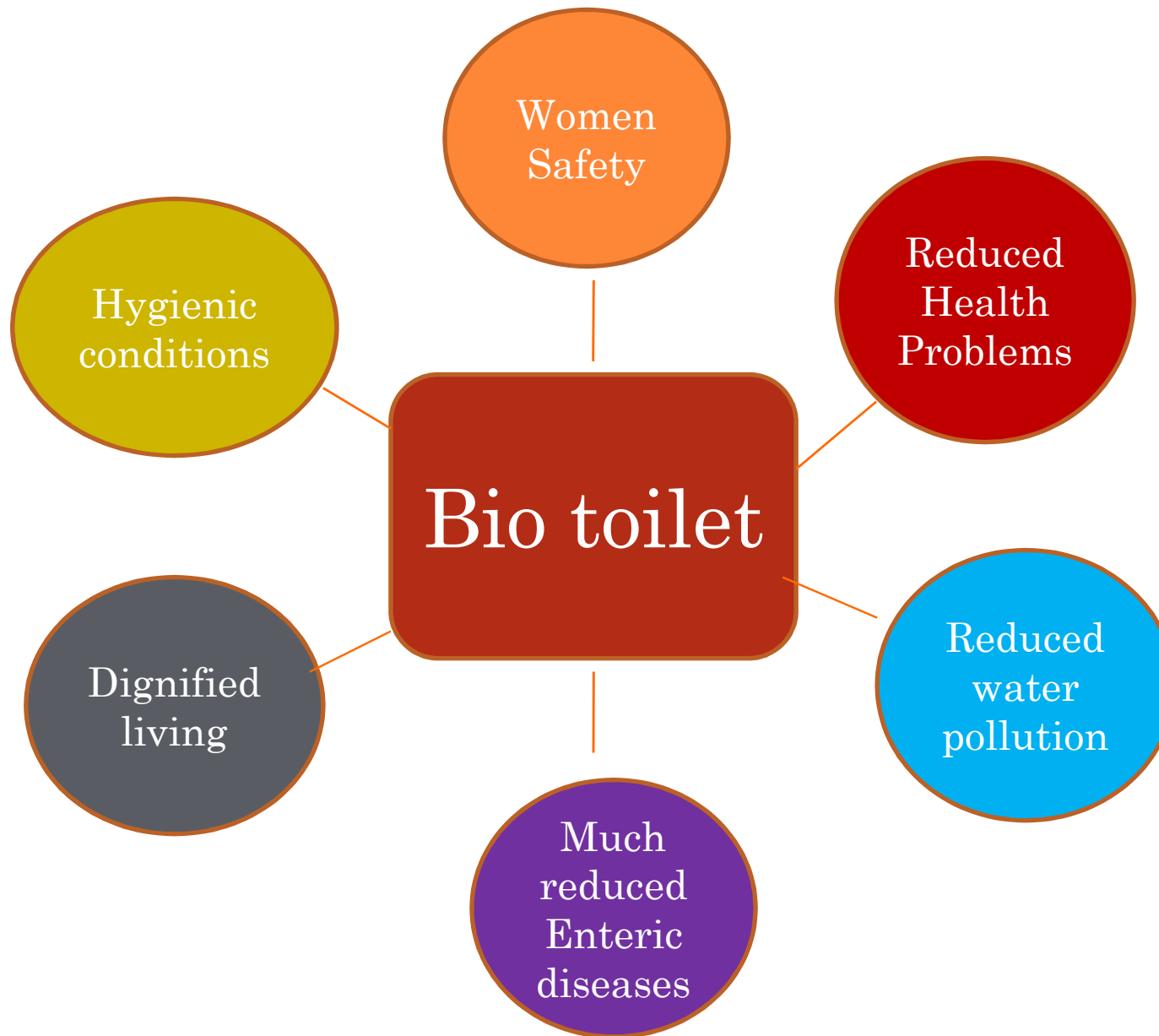
**TREATED WATER  
STORAGE**

OR



**FOR GARDEN USE**

## COLLATERAL BENEFITS



# BENEFITS OVER EXISTING APPROACH

Flush Toilet	Dry Latrine	Bio-digester
High maintenance	low maintenance & unhygienic	<b>Very low maintenance</b>
Difficult to construct	Easy to construct	<b>Easy to construct</b>
Unhygienic if not maintained	Highly unhygienic	<b>Hygienic</b>
Heavy water requirement	Little water requirement	<b>Little water requirement</b>
Prone to spreading diseases if not maintained	Highly prone to spreading diseases	<b>All pathogens are killed during the process</b>
Smelly septic tank(end product)	Highly smelly process	<b>No smell as end product is methane and carbon dioxide</b>

## BIO TOILET WITH BIODIGESTER AT IFFCo PLANT





# IMPLEMENTED SITES.....

## HALOL NAGAR PALIKA





# INSTALLED BIO-TOILETS WITH DIGESTER

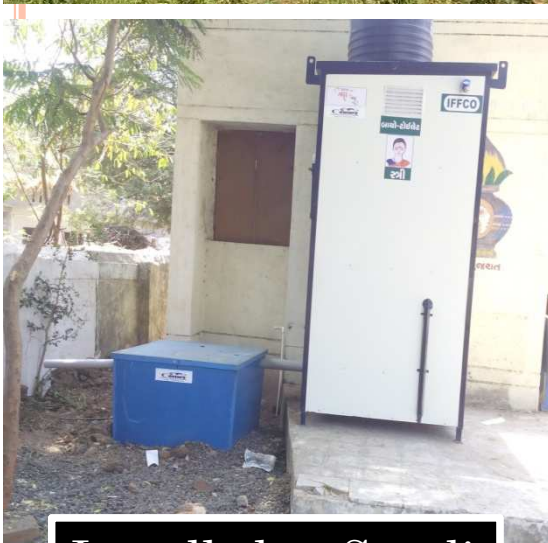
Installed at Himmatnagar



Installed at Rajkot



Installed at Sureli



# ECONOMIC MODELS

**Rs16000/  
=**



**Rs25000/  
=**



**Rs20000/  
=**





○ Rs65000  
/=



**Century**  
Pharmaceuticals Limited

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

Septic Tank Volume (litres)	Number of people in the household assuming each person uses a volume of	
	180l/ person/day (NORMAL)	250l/ person/day (HIGH)
2720/2800	4	3
3750/3800	9	7
4500/4600	14	10
6000	22	16
7500	30	22
9000	39	28

# BIODIGESTER AVAILABLE SIZES & USE

Sr. No	BioTank Capacity in liters	Inoculum required in liters	No of flush	Utility
1	700	125	10	Single family of five member
2	1000	150	15	Single family of more than five member
3	1500	175	30	Jointly family more than ten member
4	2000	200	40	Common biodigester system for three toilets
5	4000	250	75	Common biodigester system for five –eight toilets
6	8000	300	100	Community biodigester system for ten toilets
7	15000	500	225	Community biodigester system for twenty toilets
8	40000	1000	600	Community biodigester system for fifty toilets
9	60000	1500	900	Community biodigester system for more than fifty toilets

# BIODIGESTER: WATER QUALITY



	SEPTIC TANK	BIODIGESTER/BIOTANK	BIOTANK: REED BED TREATMENT
pH	6.7-7.5	7.0-7.2	7.0-7.5
Turbidity (NTU)	500-800	70-90	2-5
Total Suspended Solids (mg/L)	150-300	90-120	50-80
TDS (mg/L)	500-850	350-450	100-300
VS (mg/100ml)	50-60	20-30	5-12
COD (mg/L)	1200-2000	250-300	15-25
BOD <sub>5</sub> (mg/L)	350-500	70-120	2-4
Coliforms (MPN/ml)	>3000	300-500	0-12

# 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



## FAVOURABLE CONDITIONS

- 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



<b>Capital Costs</b>		
	<b>Single toilets</b>	
	<b>Multiple toilets</b>	
	<b>Row toilets</b>	
	<b>Mix Tank/ Collection</b>	
	<b>Over head tank Pump</b>	
	<b>Piping</b>	
	<b>Collection</b>	
	<b>Digester Tank</b>	
	<b>Cement Work</b>	
	<b>Cement</b>	
	<b>FRP tank</b>	
	<b>MS tank with FRP coating</b>	
	<b>Energy Conversion System</b>	
	<b>Solar operation</b>	
	<b>Product</b>	
	<b>Gas Pipes</b>	
	<b>Gas Pump</b>	
	<b>Gas Meter</b>	
	<b>Generator</b>	
<b>Overhead</b>	<b>Engineering</b>	
	<b>Maintenance/ Repair Costs Shipping</b>	
	<b>Costs</b>	
<b>Operational Cost</b>	<b>Labor Hours (in years)</b>	
	<b>Water usage</b>	
	<b>Land</b>	

# Simplicity of the technology

Delivery period - 10 – 15 days

Installation period - 3 hours

Ready to use technology

The first water output - On sixth day

No residue/ no addition of inoculum



# PROMINENT CUSTOMERS

- NGOs
- Corporate
- Schools
- Municipal corp.
- Private builders
- Welfare organization



***"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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