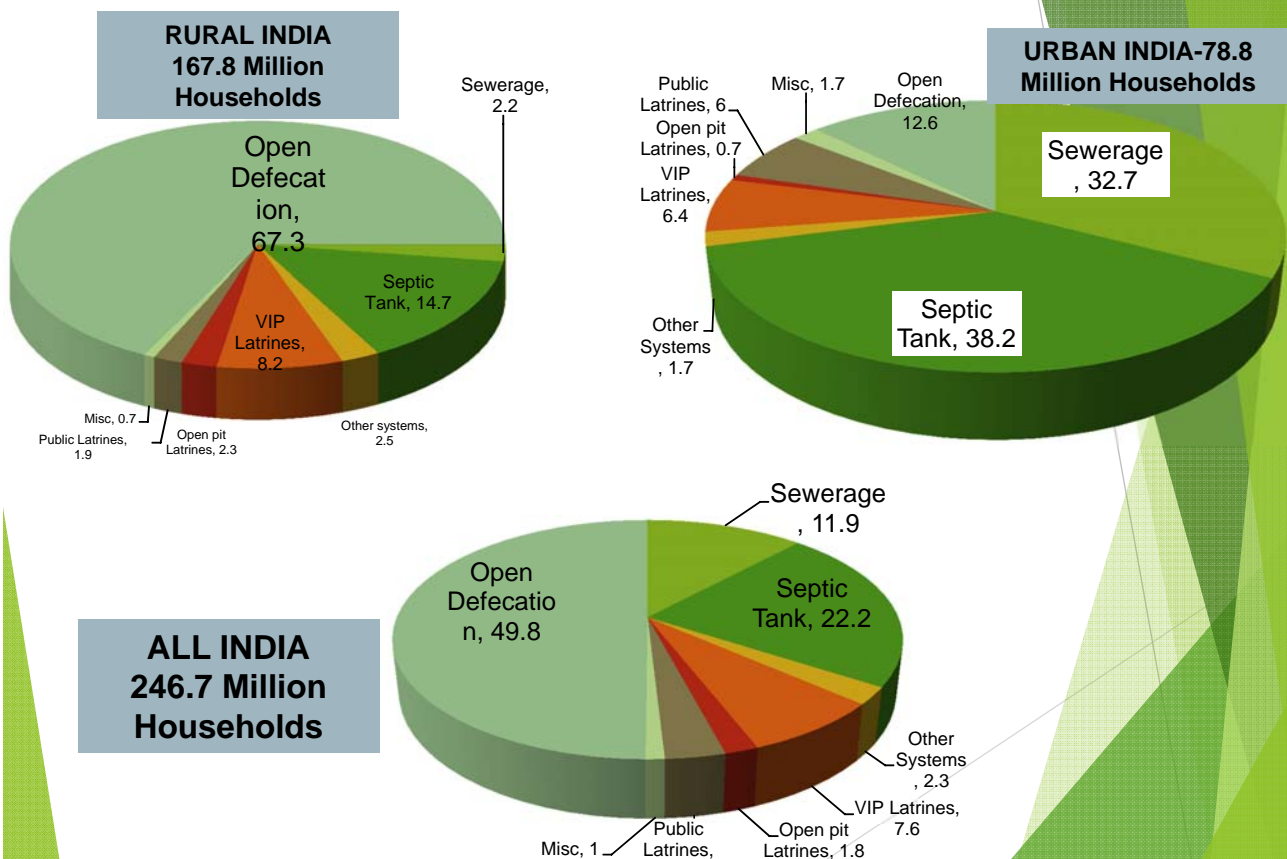


On-Site Domestic Wastewater Treatment in India

A. A. KAZMI

DEPARTMENT OF CIVIL ENGINEERING
IIT ROORKEE

AVAILABILITY & TYPE OF TOILETS-2011 (%)



FLUSH TOILET + SEPTIC TANKS

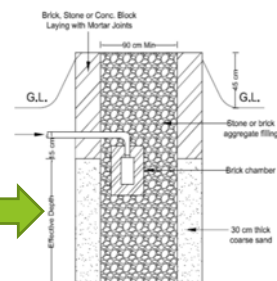
FLUSH TOILET + TWIN PIT LATRINES



Discharge to Soakage Pit



Septic Tanks



Discharge to Stormwater Drain



<http://sulabhinternational.org>

SEPTIC TANK EFFLUENT DISCHARGE

SURFACE WATER POLLUTION



Moti Jheel- Lucknow



Phutala Lake- Nagpur



Pond outskirts of Village

**GROUND
WATER
POLLUTION:
Coimbatore-
CPHEEO & NEERI-
2005**

Total Coliforms (CFU/100 ml)	Post Monsoon	1080	1100	1500	1600	900	620
	Winter	1150	1440	1660	1750	tnc	730
	Summer	TNC	TNC	TNC	TNC	TNC	520
	Monsoon	1100	1500	700	1000	1100	630
Faecal Coliforms (CFU/100 ml)	Post Monsoon	840	1102	590	780	860	400
	Winter	910	1000	600	840	TNC	420
	Summer	TNC	216	230	450	TNC	140
	Monsoon	940	1100	570	800	890	410

SEPTAGE MANAGEMENT: PRESENT SCENARIO



Disposal of Septage by vacuum truck

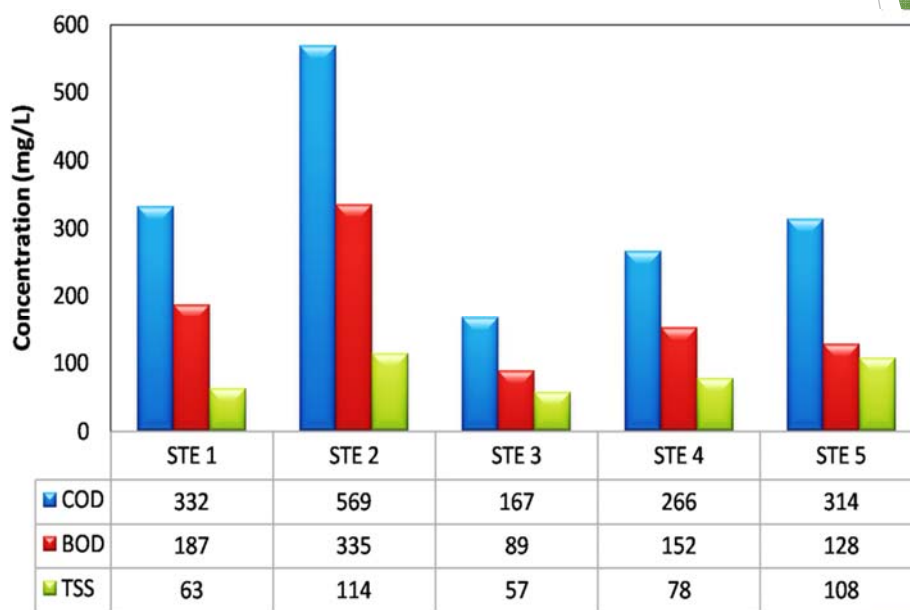


Open dumping of Septage in low lying area



Unaesthetic & Hazardous conditions

FIELD EVALUATION OF CONVENTIONAL SEPTIC TANKS



STE: Septic Tank Effluent



GOVT. OF INDIA MINISTRY OF DRINKING WATER SUPPLY & SANITATION INITIATIVES

Swachh Bharat (Clean India) Mission (Rural)

❖ **Swachh Bharat Mission launched on 2nd Oct, 2014
by the Prime Minister of India;**

Objectives

- ▶ **To make India Open Defecation Free (ODF) India by 2019, by providing access to toilet facilities to all;**
- ▶ **To provide toilets, separately for Boys and Girls in all schools by 15th Aug 2015**
- ▶ **To provide toilets to all Anganwadis (Courtyard shelters for Children)**
- ▶ **To keep villages clean Innovative: Low cost and User friendly technologies for toilet and Solid and Liquid Waste Management to be pursued.**

Technical Options for
Solid and Liquid Waste Management in Rural Areas



Ministry of Drinking Water and Sanitation,
Govt. of India

August 2013

Technical Handbook- With coverage
of advanced on-site sanitation

RELATED CHAPTERS IN THE BOOK

2.5 On-site waste water treatment
systems

2.5.1 Septic tanks

2.5.2 Advanced on-site systems

2.5.2.1 Package type anaerobic filter
system


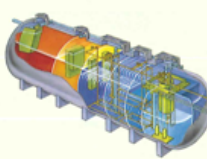

2.5.2.2 Package contact aeration system

2.5.2.3 Package anaerobic filter contact
aeration system

**GOVT. OF INDIA
MINISTRY OF URBAN
DEVELOPMENT INITIATIVES**

MANUAL ON SEWERAGE & SEWAGE TREATMENT- INTRODUCTION AND DESIGN FEATURES OF ADVANCED ON-SITE SYSTEMS

Table 9.9 Classification according to treatment capacity (Example of Japan)

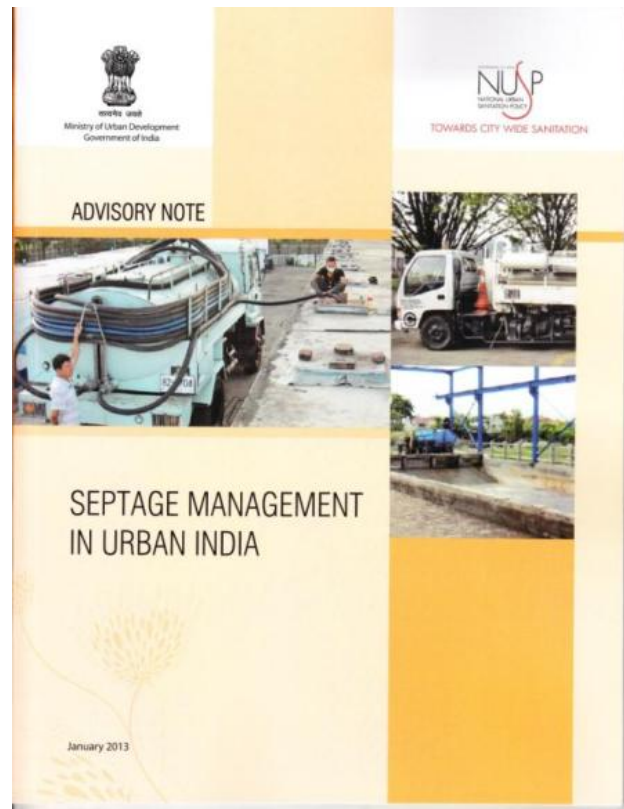
Package-type			On-site construction-type
Small-scale	Medium-scale	Large-scale	Medium/Large-scale
(About 5 to 50 people)	(About 51 to 500 people)	(Approx. 500 to 5,000 people)	(More than 500 people)
			

ii. Performance

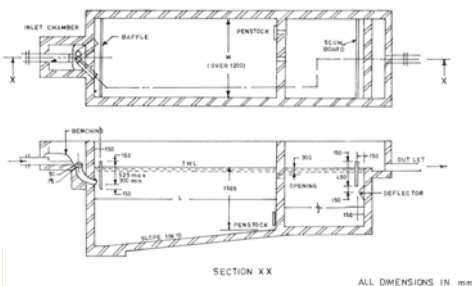
Treatment processes are classified into three kinds according to performance: a process that mainly removes BOD-related contaminants, a process that removes BOD-related contaminants and nitrogen, and a process that removes BOD-related contaminants, nitrogen, and phosphorus.

SEPTAGE MANAGEMENT

ADVISORY NOTE ON SEPTAGE MANAGEMENT



TYPICAL ON-SITE SYSTEMS IN INDIA



Structure of a septic tank,
Source: CPHEEO, 1993



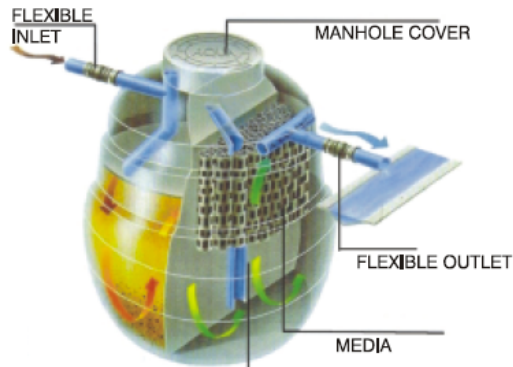
Precast Septic Tank

Vinayakashot Private
Limited, Ltd



Prefab Polyethylene
Cast Septic Tank
Sintex Pvt. Ltd

ADVANCED VERSIONS



Flexible - In & Outlet



Pall Ring Media



SETTLER-ANAEROBIC FILTER

- The capacity ranges from 800 to 6000 l/d.
- Claims: Good performance through massive reduction of BOD around 70-80%

SETTLER- CONTACT AERATION

- The capacity ranges from 800 to 6000 l/d.
- Effluent can be used for irrigation, gardening.

Source: Sintex Pvt. Ltd

PERFORMANCE EVALUATION

MODIFIED SETTLER-ANAEROBIC FILTER COMBINED SINGLE HOUSEHOLD WASTEWATER TREATMENT

Background: Where ground conditions do not permit infiltration of treated wastewater, additional treatment in the form of a **constructed wetland or anaerobic filter** could be provided prior to discharge into a drain or watercourse.

Technology Option for Urban Sanitation in India

Technology Option for Urban Sanitation in India, Ministry of Urban Development, Govt. of India

BACKGROUND INFORMATION

- ▶ **Single Household: Middle Class**
- ▶ **Water Supply – 135 Litre/Cap.day**
- ▶ **Members: 5**
- ▶ **Size of Tank – 1200 L**
- ▶ **Tank Material : Polyethylene**
- ▶ **Media of Anaerobic Filter: Polyethylene**
- ▶ **Specific Surface Area of Media - $100 \text{ m}^2/\text{m}^3$**



**INLET & OUTLET
CONNECTIONS**

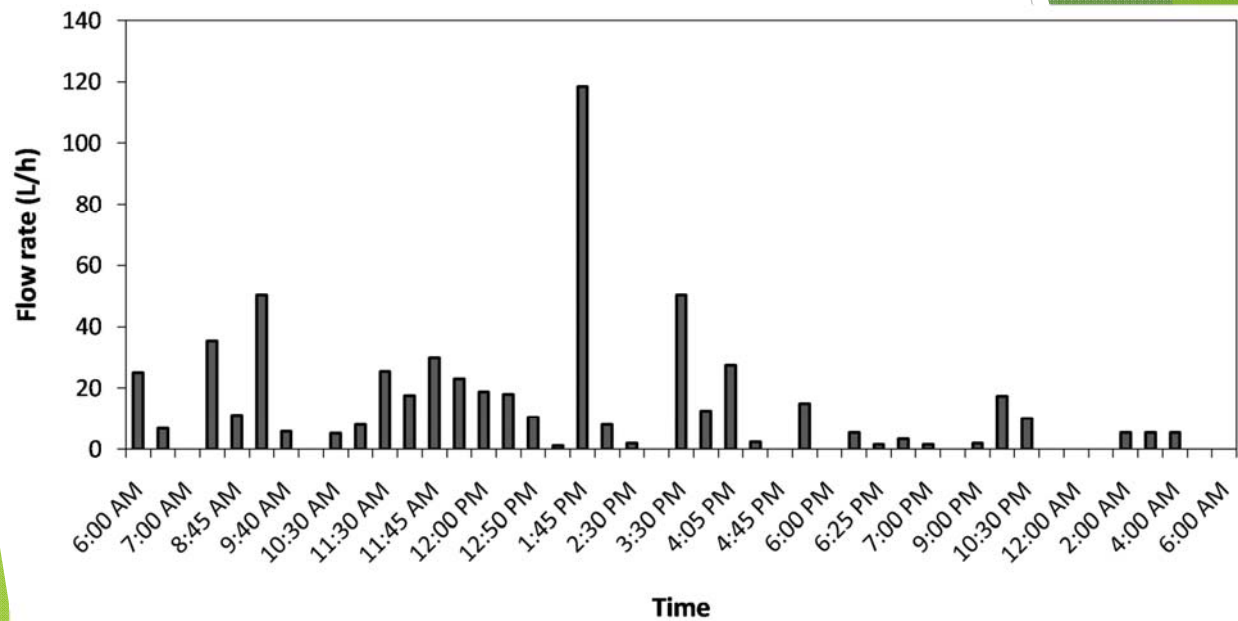


MANHOLE

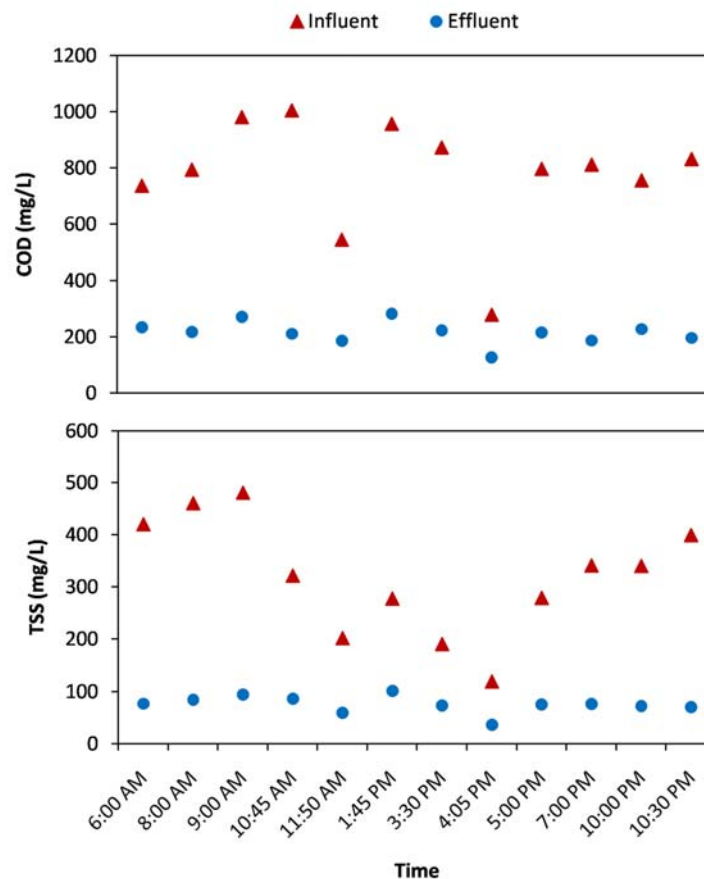


WASTEWATER

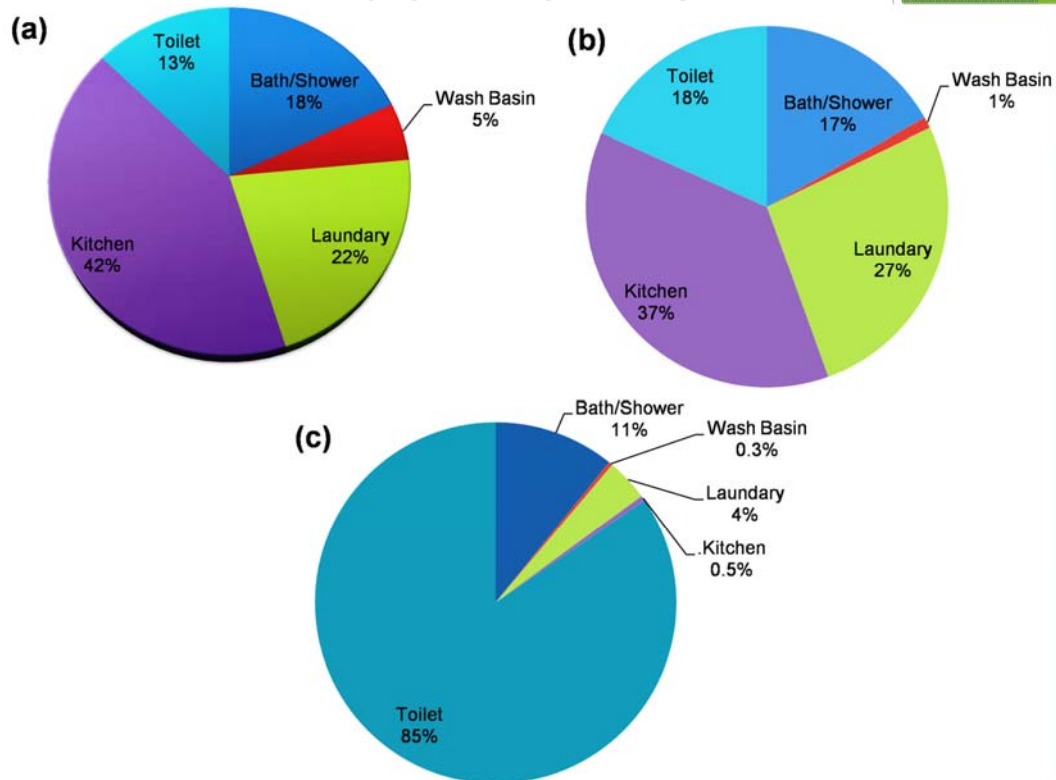
DIURNAL FLOW VARIATION



DIURNAL INFLUENT & EFFLUENT WATER QUALITY

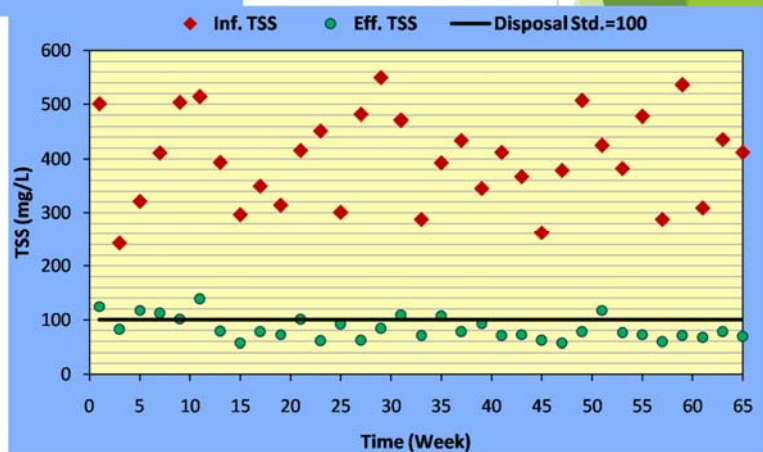
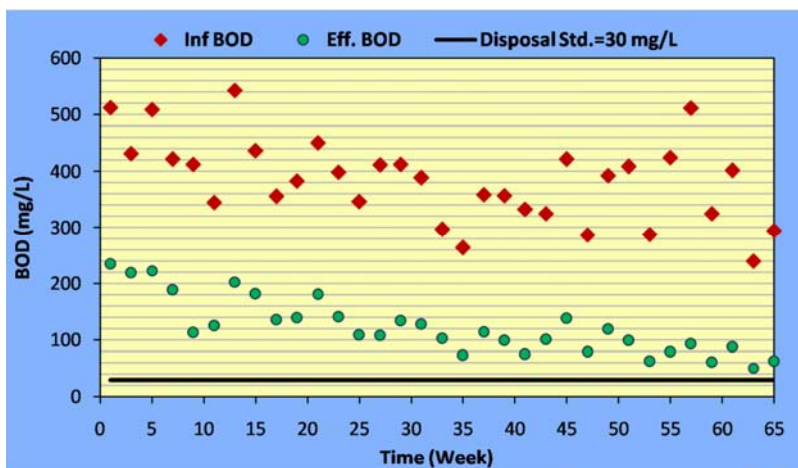


DISTRIBUTION: FLOW, COD, FECAL COLIFORMS



a) Water requirement ; b) COD Load; c) FC Load

LONG TERM PERFORMANCE EVALUATION



MODIFIED SETTLER-ANAEROBIC FILTER BLACKWATER TREATMENT- COMMUNITY SCHOOL

Size of Tank – 1200 L

Material : Polyethylene

Media of Anaerobic Filter: Polyethylene

Modified Inlet Arrangement

Specific Surface Area of Media - $100 \text{ m}^2/\text{m}^3$

PRESENT SCENARIO : SANITATION IN RURAL SCHOOL



Community septic
tank

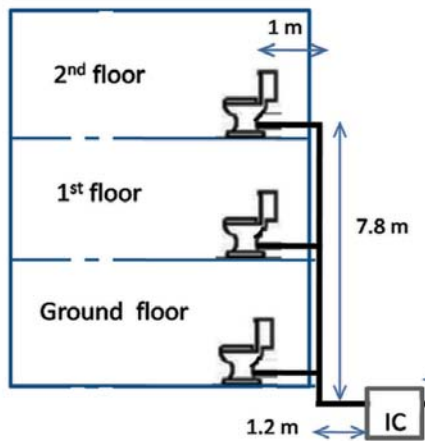


Soak Pit



Open drain disposal

SAMPLING



Navodaya Boys
hostel

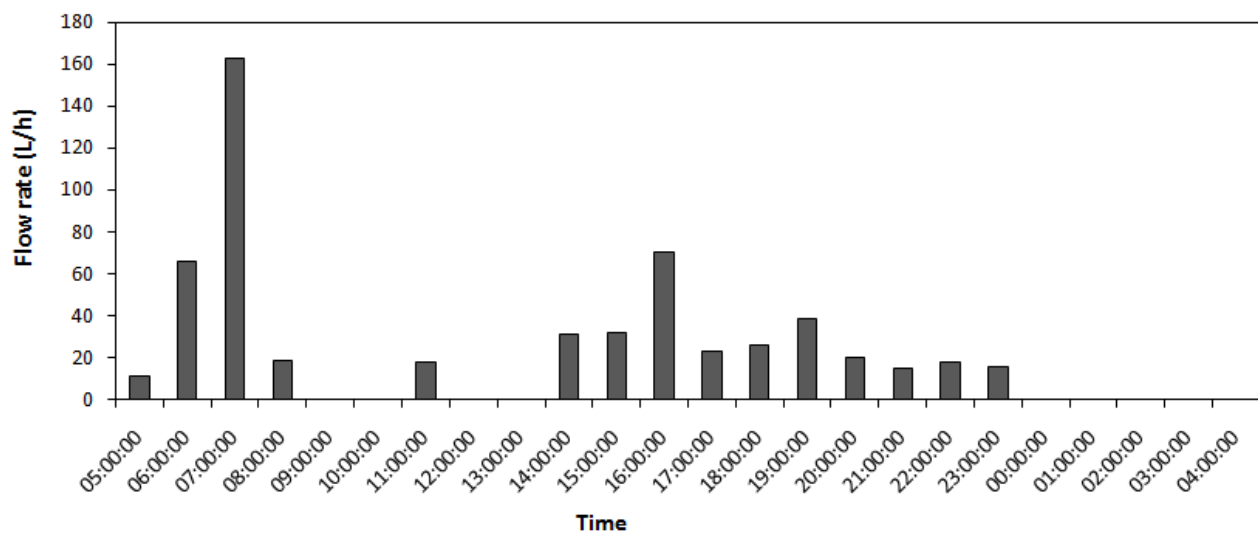
Inlet chamber



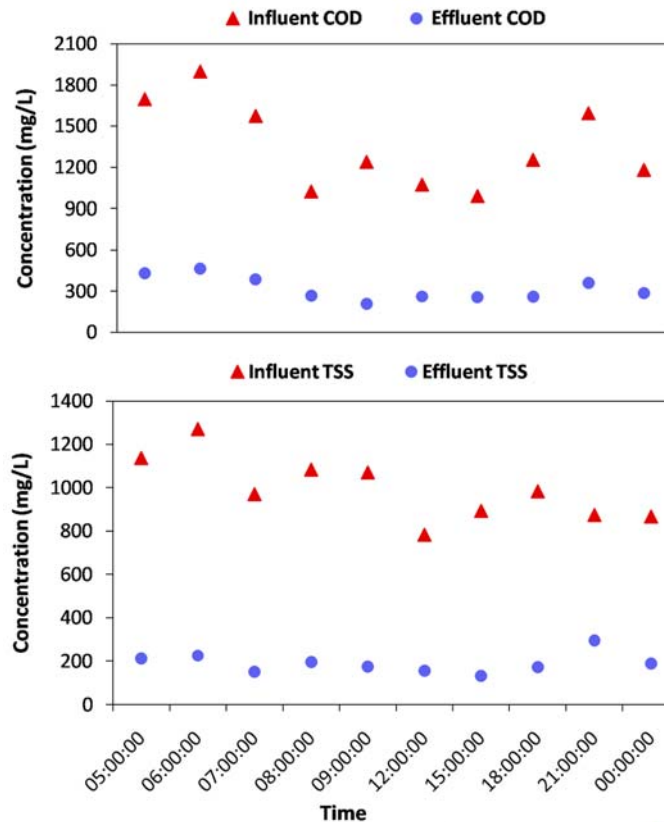
Black water collection



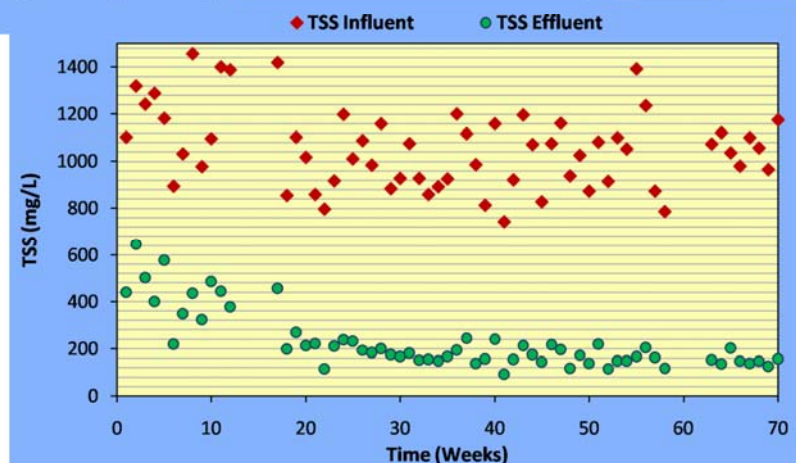
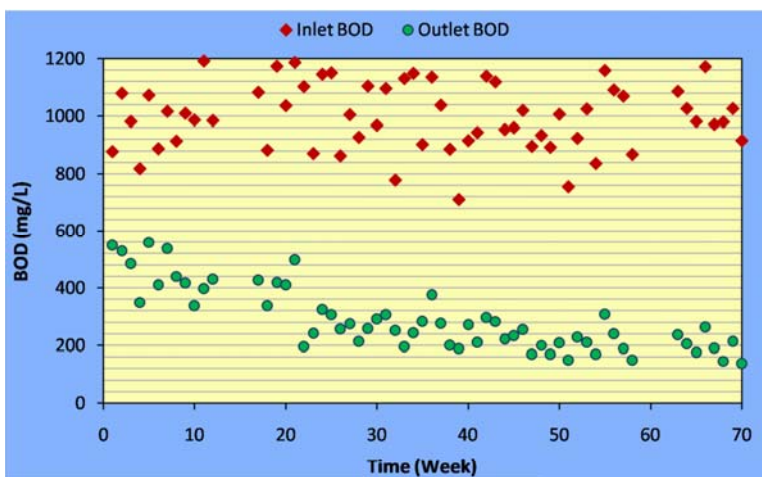
DIURNAL FLOW VARIATION



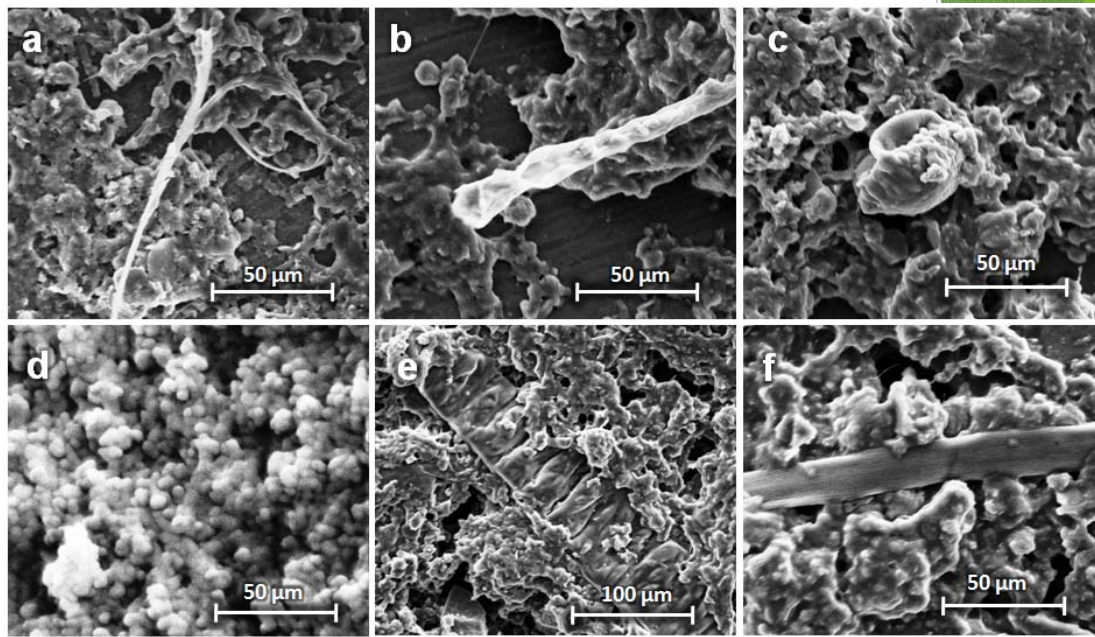
DIURNAL INFLUENT & EFFLUENT WATER QUALITY



LONG TERM PERFORMANCE EVALUATION

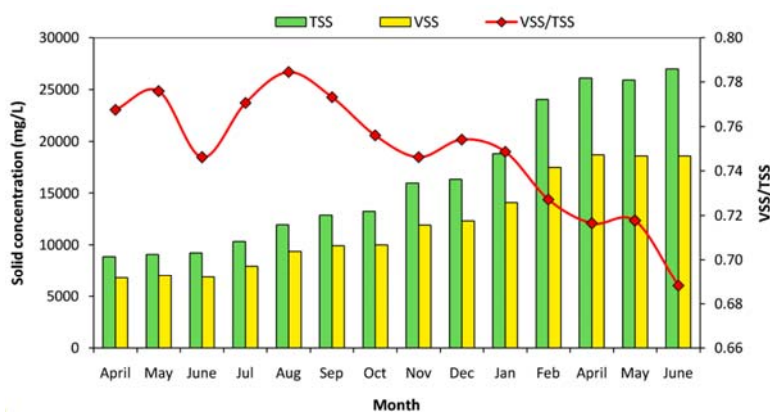


MICROBIAL COMMUNITY- Septic Tank Treating Blackwater



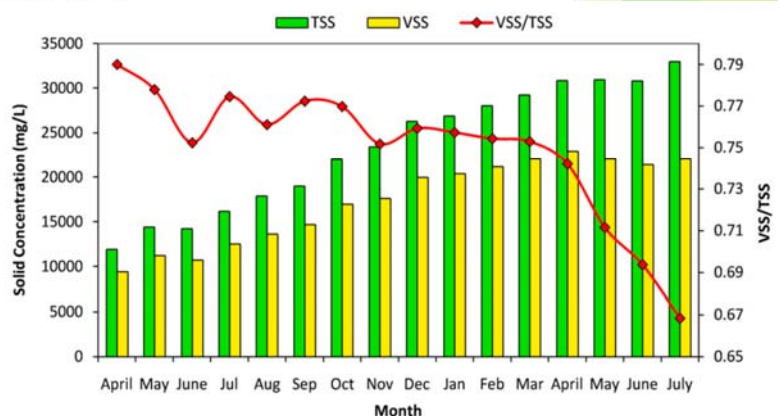
Micrographs indicated the presence of inert material with an aggregation of *Methanococcus*-like species with few *Methanobrevibacter*-like species (Fig. a & b) and coccoid-shape Archaeal species (Fig. c), *Methanosarcina* -like bacteria, (Fig. d), *Methanospir* (Fig. e), rod-shaped bacteria like *Mathanothrix*-(Fig. f),

SLUDGE CHARACTERIZATION



Septic Tank Treating
Combined Wastewater

Septic Tank Treating
Blackwater



DESLUDGING – 480TH DAY OF OPERATION



Sludge of septic tank



Vacuum Truck for desludging



Desludging of system



Before Desludging



After Desludging

SEPTAGE CHARACTERIZATION- From Septic Tanks Treating Combined Wastewater or only Blackwater

Constituents	Combined Wastewater	Black water	EPA Design Values
pH	6.6±0.4	6.7±0.4	1.5-12.6
Temperature	30.6±1.6	30.2±1.4	-
COD	20367±8431	29598±8355	1500-703000
sCOD	1833±759	2264±868	-
BOD	7332±3035	10655±3008	440-78,600
sBOD	917±379	1048±479	-
TSS	16425±6799	23430±7010	310-93,378
VSS	12135±4595	17397±4710	353-71,402
TKN	407.3±168.6	592.0±167	66-1060
NH ₄ -N	65.2±27.0	94.7±26.7	3-116
TP	203.7±84.3	296.0±83.5	20-760

MICROBIAL QUALITY OF SEPTAGE

Parameter	Unit	Domestic wastewater	Black water	USEPA range
TC	MPN/100 mL	1.5×10^6 - 1.5×10^8	2.4×10^7 - 7.5×10^9	10^7 - 10^9
FC	MPN/100 mL	2.3×10^5 - 1.5×10^7	9.6×10^5 - 1.9×10^8	10^6 - 10^8
FS	MPN/100 mL	1.1×10^5 - 2.5×10^6	3.4×10^5 - 4.1×10^7	10^6 - 10^7
E.Coli	CFU/mL	2.5×10^3 - 1.6×10^5	1.8×10^3 - 2.1×10^4	10^5 - 10^8
Salmonella	CFU/mL	1.3×10^1 - 9.0×10^3	9.3×10^2 - 1.1×10^4	1 - 10^2
Shigella	CFU/mL	1.0×10^3 - 1.6×10^4	1.8×10^3 - 2.1×10^5	-
HPC	CFU/mL	2.3×10^4 - 2.6×10^6	2.9×10^4 - 3.4×10^6	-
Staphylococcus	CFU/g	130-9000	99-11651	-

PRESENT NEED:

- ▶ To develop a new generation of:
 - ▶ Highly efficient- Media with Larger Specific surface area
 - ▶ Compact- In-situ Sludge Reduction methods
 - ▶ User friendly- Easy to install, better plumbing
 - ▶ Low priced treatment systems- Durable low priced Material
- ▶ Rigorous septage management strategy- Separate department in Government.
- ▶ Subsidy from the Government for rapid pollution control
- ▶ Capacity Building by the Government - Manpower Training
- ▶ Local Manufacturing of Blowers and other E&M Parts of the system
- ▶ Educational Programmes
- ▶ Mass production methods serve public:
 - ▶ reliable, effective.
 - ▶ robust and reasonably priced treatment plants