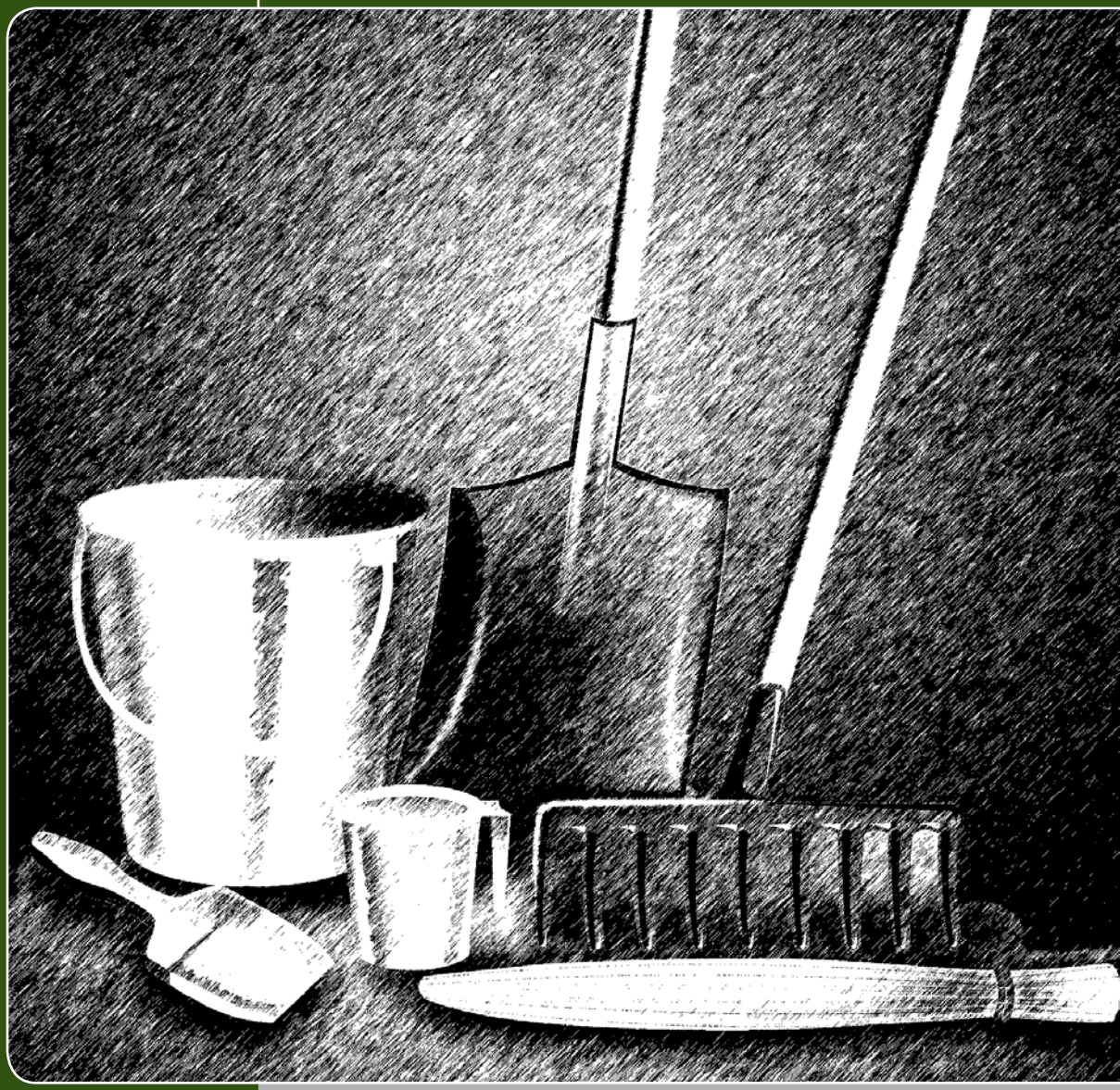
Operational Tasks for the Upkeep of Decentralised Wastewater Treatment System (DEWATS)



CONSORTIUM FOR
DEWATS
DISSEMINATION
SOCIETY

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Foreword

Around 300 Decentralized Wastewater Treatment Systems (DEWATS) have been constructed in India over the past 7 years, with the intention of providing treatment to wastewater generated from various sectors like hospitals, hotels, institutions, small and medium scale enterprises, community based sanitation complexes, individual houses and housing colonies. In most of the DEWATS units, reuse infrastructure is provided in order to ensure a holistic approach to environmental sanitation. A DEWATS that is operated and maintained efficiently has the potential to be productive and sustainable economically, environmentally and socially.

The day-to-day operational tasks are adopted for smooth functioning and upkeep of DEWATS. The tasks are simple and require basic training. However, they are critical in ensuring the continuing high performance of the treatment system.

This Manual is intended for use by the operators/caretakers and maintenance personnel, to facilitate them to carry out the routine specific and critical tasks.

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Abbreviations

BORDA	Bremen Overseas Research and Development Association
CBS	Community Based Sanitation
CDD	Consortium for DEWATS Dissemination Society
DEWATS	Decentralized Wastewater Treatment System
O & M	Operation and Maintenance

1.0 Introduction

DEWATS is designed such that by maximizing the reliance on natural processes, operational tasks are minimized. However, these minimal tasks are critical to ensure that DEWATS operate efficiently. A properly operated DEWATS is a productive system economically, environmentally and socially for 20 years or more.

It must be borne in mind that ensuring high performance of DEWATS requires a wide range of site specific tasks that go beyond the activities outlined in this Manual. For example, in a Community Based Sanitation (CBS) project, the task of emptying a dustbin regularly ensures that people do not throw garbage into the toilets thus preventing blockages in the DEWATS modules. Although there may be a longer list of site specific operational tasks, this Manual deals only with tasks, which have to be performed to ensure that the DEWATS modules functions properly.

How to use this manual, and by whom?

This Manual is intended for use by the beneficiaries of DEWATS, in particular caretakers and operators. Each operational task is addressed in terms of where and when it will occur, how the task should be performed and why it is needed. Simple information about DEWATS modules and how they function is outlined in the Appendix 1.0. For further information which may be beyond the scope of this Manual, one may directly contact Consortium for DEWATS Dissemination (CDD) Society.

For the majority of DEWATS, the guidelines given here will keep the system working effectively. However, changes in quantity or quality of the wastewater flowing into the unit and drastic changes in the climate may also affect the system's performance, mainly extending or shortening the intervals of the operational tasks.

Your DEWATS has been customized for your special requirements. Therefore you may not have all the modules for which operational tasks are presented in this manual.

Task 1. **Check for free wastewater flow**

Removal of obstacle from the sewer pipeline

Cleaning of inspection chambers

Where should this task be done?

- Sewer systems[1]
- Inlet, outlet and at distribution channels of all DEWATS Modules (Modules explained in Appendix 1.0).

When should this task be done?

- Once in 30 days, during peak usage (normally in the morning)
- Or, in the following cases
  —There is overflow in the inspection chamber(s)
  —There is overflow in the inlet or outlet of DEWATS modules
  —There is no wastewater flow in the inspection chambers or DEWATS modules.

Why should this task be done?

- To identify possible obstructions in pipes and DEWATS modules
- To allow required free flow of wastewater through the entire system (all DEWATS modules)
- To identify possible damages or leakages.

How should this task be done?

STEP 1

1. Open the manhole cover of inspection chambers
2. Open the manhole cover at inlet and outlet of each DEWATS module (settler, baffle reactor etc.).

STEP 2

1. Check for obstructions like solid materials, floating materials, deposition at all the points
2. Check if the wastewater has its usual flow (compare with what was observed in earlier inspections).

STEP 3

1. Remove obstruction if any, using an appropriate tool. (eg. shovel, stick, broom)
2. If no flow is observed, check whether the system is in use and if so, report to CDD Society or its certified service provider
3. If an unusual flow (extremely low, high or much dirtier than usual) is observed, repeat Step 1 and Step 2 for 3 days. If unusual flow continues during observation for 3 days report to CDD Society or its certified service provider.

NOTES

1. **Sewer system**: Pipelines used to carry the wastewater and inspection chambers provided at certain intervals for regular check up.

Task 2. **Check for grease formation**

Grease formation

Removal of grease

Where should this task be done?

- In the inspection chamber(s) and pipes before the grease trap[1]
- At the inlet, outlet pipes and inside grease trap chamber(s).

When should this task be done?

- Every day or at least once in 7 days (for hotels, canteen, hostels etc.)
- Or, in the following cases
  - —There is large quantity of grease observed in the grease trap chamber or in the next DEWATS module
  - —There is a bad odour and overflow from the top of the grease trap chamber
  - —There is backflow at source or in the inspection chamber before the grease trap chamber or no flow of wastewater into the next treatment module

Why should this task be done?

- To allow the required free flow (to avoid clogging) of wastewater through the treatment system and to avoid grease entering subsequent stages of treatment
- To avoid bad odour in and around the grease trap chamber

How should this task be done?

STEP 1

1. Open the manhole cover of the grease trap chamber and inspection chambers before and after the grease trap chamber.

STEP 2

1. Check for the presence of excess grease in the chamber
2. Check if the wastewater has its usual flow in the grease trap chamber and subsequent inspection chambers (compare the flow with what was observed in the earlier inspections).

STEP 3

1. Remove the grease from the chamber and from the inlet and outlet pipe of the grease trap chamber using an appropriate tool (eg. shovel, stick, broom)
2. Remove all grease from the inspection chambers and pipes prior and after the grease trap chamber
3. Dispose the grease and other waste safely into a pit, which is at least 30 feet away from dug or bore wells
4. If an unusual flow is observed, report it to CDD Society or its certified service provider.

NOTES

1. **Grease traps** are usually only installed at canteens, hotels and institutions with similar services (big kitchen).

Task 3. **Check for water seal level in the biogas settler**

Checking the level of water seal

Biogas settler neck chamber

Where should this task be done?

- Inside the neck (circular top chamber) chamber of the biogas settler.

When should this task be done?

- Once in 15 days
- In the following cases
  - —There is less than 2 inches (depth) of water in the neck chamber
  - —There is less or no biogas supply
  - —There is bad odour or bubbling sound near the biogas settler.

Why should this task be done?

- To keep the clay seal[1] wet
- To avoid cracks in the clay seal.

How should this task be done?

STEP 1

1. Insert a wooden scale or stick through the inspection hole provided in the top cover slab till it touches the base of the neck chamber.

STEP 2

1. Measure the water level on the scale or stick as indicated by the water mark (wet portion).

STEP 3

1. If the wet portion on the scale or stick is found to be less than 2 inches, then pour water till the water level reaches more than 4 inches
2. If the water level recedes frequently, report it to CDD Society or to its certified service provider.

NOTES

1. **Clay seal**: It is the mixture of clay and water which is used to seal the voids that may be present in the neck of the chamber.

Task 4. **Check for gas leakages at the water seal in biogas settler**

Bubbles indicating gas leakage in the water seal

Filling water to required depth

Where should this task be done?

- Inside the neck chamber (circular top chamber) of the biogas settler.

When should this task be done?

- Once in 60 days
- Or, in the following cases
  - —There is less or no biogas supply
  - —There is bad odour or bubbling sound near the biogas settler.

Why should this task be done?

- To identify possible leakage of biogas in the neck chamber.

How should this task be done?

STEP 1

1. Close the main biogas valve near the biogas settler
2. After two hours from the time of closing this valve, open the manhole cover of the biogas settler neck chamber.

STEP 2

1. Check for any bubbles on the water surface.

STEP 3

1. If no water is found in the biogas settler neck chamber, pour water till it stands for around 4 inches from the base and check for bubble formation on the water surface
2. If bubbles are observed on the water surface, report to CDD Society or to its certified service provider.

Task 5. **Check for release of condensed water in the biogas supply pipe**

Condensed water release valve

Release of condensed water

Where should this task be done?

- At the water traps provided for your biogas pipe line.

When should this task be done?

- Once in 7 to 15 days
- Or, in the following cases
  - —There is little or no biogas supply
  - —There is water bubbling sound heard in the biogas supply pipe line or at the biogas appliances (stove, lamp etc.).

Why should this task be done?

- To avoid blockage or slowing down of biogas flow to the biogas appliance (stove, lamp etc) due to collection of condensed water[1] in the biogas pipe line
- Condensed water formation in biogas pipeline is normal, but it needs to be removed.

How should this task be done?

STEP 1

1. Locate water trap(s) with its condensed water release valve (normally lowest point of your biogas pipe line)
2. Open manhole top cover if the water trap is provided inside the chamber.

STEP 2

1. Ensure that there is no fire or any other sparking device nearby. (No smoking!)
2. Open condensed water release valve for 5 seconds and close it again
3. Repeat the above step once again.

STEP 3

1. If the water bubbling sound persists and / or less biogas pressure or unusual flame quality from the biogas stove was observed continuously for 2 days, report it to CDD Society or to its certified service provider.

NOTES

1. **Condensed water formation**: The biogas coming from the digester is saturated with water vapour. This water vapour will condense and collect on the walls of the pipe line.

Task 6. **Cleaning biogas stove burner**

Cleaning of burner ring holes

Cleaning of Jet holes

Where should this task be done?

- At the biogas stove burner(s) or other biogas appliances (eg. lamps).

When should cleaning be done?

- Once in 30 days
- In the following cases
  - —There is inconsistent flame
  - —There is corrosions found on the stove burner
  - —There are signs of corrosion.

Why should cleaning be done?

- To keep the stove in efficient usage condition by eliminating depositions
- To use the biogas efficiently.

How should this task be done?

STEP 1

1. Close the biogas supply valve near the biogas stove
2. Make sure water from water trap(s) are released (Refer Task 5 "Check for release of condensed water").

STEP 2

1. Dismantle the burner(s) of the stove or other biogas appliances as per appliance manual
2. Clean the burner(s) ring and its holes using a brush and if required a needle
3. Clean the jet hole with a needle
4. Some times you may also have to dismantle and clean the gas flame regulator valve if it does not turn easily
5. If corrosion is not are found, remove them with brush
6. After completion of all the above steps, make sure that every part is properly put together again
7. Open the biogas supply valve near the biogas stove and check for the flame.

STEP 3

1. If you are not satisfied with the performance of the stove, then contact the stove provider or CDD Society or to its certified service provider.

Task 7. **Check for biogas leakage at biogas supply pipeline**

Material required for preparation of soap solution

Application of soap solution

Where should this task be done?

- At the biogas pipe lines, from the biogas plant to the appliances.

When should this task be done?

- Once in 4 months as a routine
- Or, in the following cases
  - —There is no steady pressure and flame in the biogas appliances
  - —There is little or no biogas supply
  - —There is biogas odour near the biogas pipe line.

Why should this task be done?

- To ensure optimum use of biogas
- To avoid leakage of biogas
- To avoid odour of biogas
- To avoid outburst of fire.

How should this task be done?

STEP 1

1. Prepare a soap solution by mixing water and liquid soap (3 : 1 mixture) or water and detergent powder (1 cup water : 1 tea spoon detergent powder)
2. Check
   a. for availability of gas by lighting the appliance (stove etc.)
   b. whether the main valve at biogas unit is open
   c. for the gas pressure in the gas pipe
3. Apply this solution on exposed pipes and pipe joints using a paint brush at the place where the gas leakage[1] is suspected.

STEP 2

1. Check for the bubbles or foam formation during the application of the soap, which indicates the location of gas leakage.

STEP 3

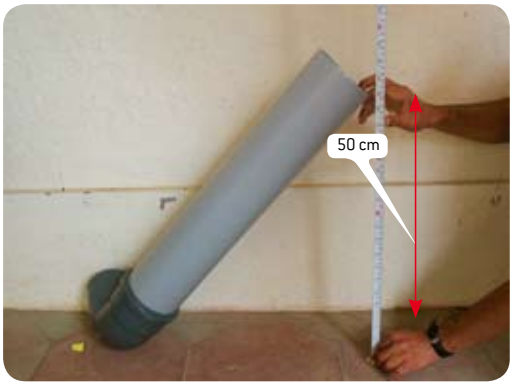
1. If bubbles or foam formation is observed, contact a plumber for rectification work immediately
2. If biogas leakage continues after rectification, report it to CDD Society or its certified service provider.

NOTES

1. **Gas Leakage**: The potential leakage points in a biogas supply pipe line are the joints such as T joints, normal joints, bends, near the valves etc.

Task 8. **Check for swivel pipe level in the planted gravel filter**

Swivel pipe chamber/ Outlet chamber



Measuring the level of swivel pipe top

Where should this task be done?

- Swivel pipes (L-pipe) inside the outlet chamber.

When should this task be done?

- Once in 30 days
- Or, in the following cases
  - —The water level is observed above the upper surface of the filter material (coarse aggregates)
  - —There is dampness on the filter material
  - —There is no plant growth
  - —There is excess mosquito growth.

Why should this task be done?

- To ensure efficient usage of filter media for wastewater treatment
- To avoid flooding
- To avoid death of plants
- To avoid mosquito growth due to flooding.

How should this task be done?

STEP 1

1. Open the cover slab of the outlet chamber.

STEP 2

1. Check if the swivel pipe top is at 50cm from the bottom of the outlet chamber.

STEP 3

1. If the swivel pipe top is not at the desired level, lower or raise it until the top of the swivel pipe is 50cm from the bottom of the outlet chamber
2. If there is no water flow from top of the swivel pipe[1], check for leakage at the swivel pipe joint at the bottom. If any leakage is found, inform the contractor to rectify the same immediately. If the condition prevails even after rectification, report it to CDD Society or its certified service provider.

NOTES

1. **Swivel pipe**: This is a device which can be used to regulate the water level in the planted gravel filter.

Task 9. **Weeding, removal of dead leaf litter and other litter**

Pond with algae growth

Weeding and cleaning of litter

Where should this task be done?

- In side the planted gravel filter
- On the surface of polishing pond
- Around all the treatment modules.

When should this task be done?

- Once in 30 days
- or, in the following case
  —There is excess weed or/and litter.

Why should this task be done?

- To avoid rotting of dead leaf litter in the planted gravel filter and polishing pond
- To avoid clogging of filter material in the planted gravel filter
- To avoid algae bloom[1] in the polishing pond
- To expose treated water in the polishing pond to the atmosphere and to the sun
- To maintain the cleanliness and to increase aesthetics near the treatment modules.

How should this task be done?

STEP 1

1. Check for presence of dead leaf litter or/and weed inside the planted gravel filter and polishing pond
2. Check for weed and other litter around all the treatment modules
3. Check for excess (more than 60% coverage of water surface) algae inside the polishing pond.

STEP 2

1. If the dead leaf litter or other litter is present, remove it manually or using an appropriate tool (garden rake, fish net and sieve)
2. Weed should be removed by extracting the roots also
3. Remove excess algae in the polishing pond using a fish net.

NOTES

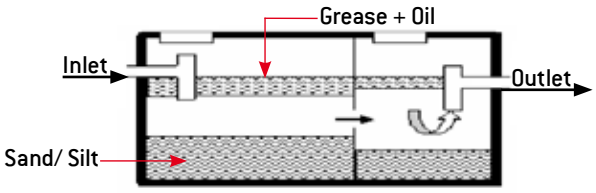
1. **Algae bloom**: Excessive growth of algae in a water body due to high nutrient content.

Appendix

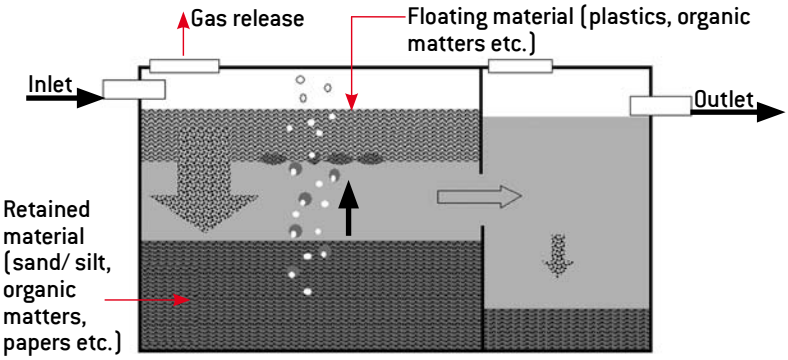
1.0 DEWATS modules description

1.1 Primary Treatment (Pre treatment)

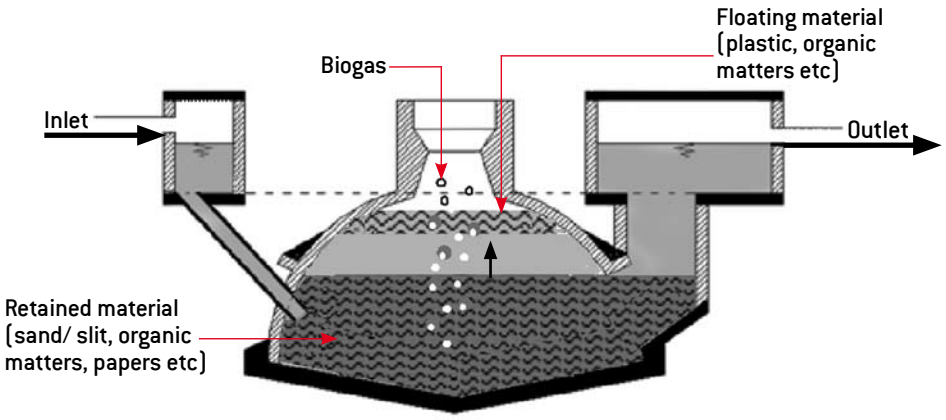
1. Grease traps are used as pretreatment steps to retain oil and grease by flotation, while clearer water underneath is discharged in to the following treatment module. The wastewater is retained in this unit for 2 to 4 minutes.



2. Settlers are sedimentation tanks for retaining all that sinks in a given time. Settled (sunk) organic matter is retained in the tank , while all the rest (dissolved and suspended matter) passes untreated to the following treatment module. The wastewater is retained in this unit for 1.5 to 2 hours.

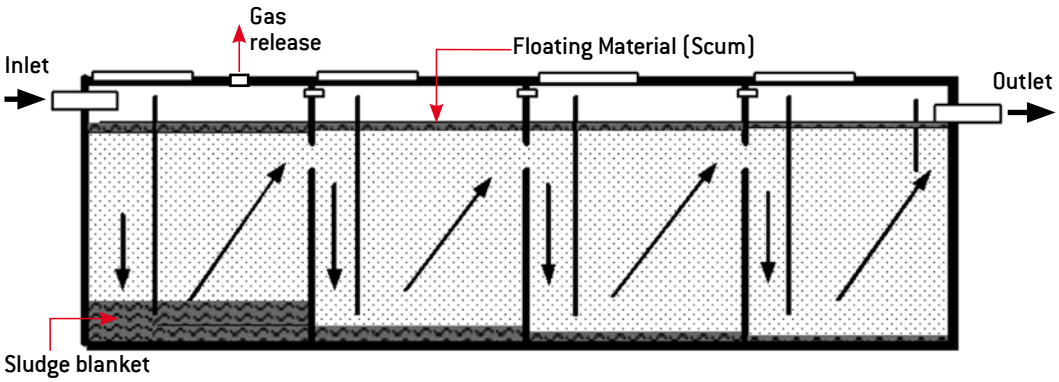


3. Biogas settlers are sedimentation tanks for retaining all that sinks (settles) in a given time. Biogas is formed due to the decomposition (digestion) of settled organic particles; called anaerobic digestion. All the rest (dissolved and suspended particles) pass untreated to the following treatment module. The wastewater is retained in this unit for 12 to 24 hours.

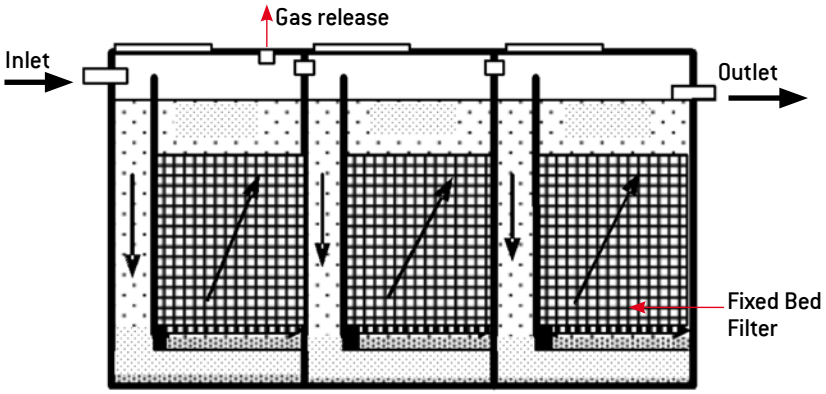


1.2 Secondary treatment

1. Baffle reactors ensure anaerobic degradation of suspended and dissolved solids by mixing wastewater with active sludge blanket – these are naturally occurring bacteria that accumulate in the bottom of each chamber. The baffle reactor is suitable for all kinds of organic wastewater and its efficiency increases with more organics in the water (the dirtier the better). The wastewater is retained in this unit for 1 to 2 days.

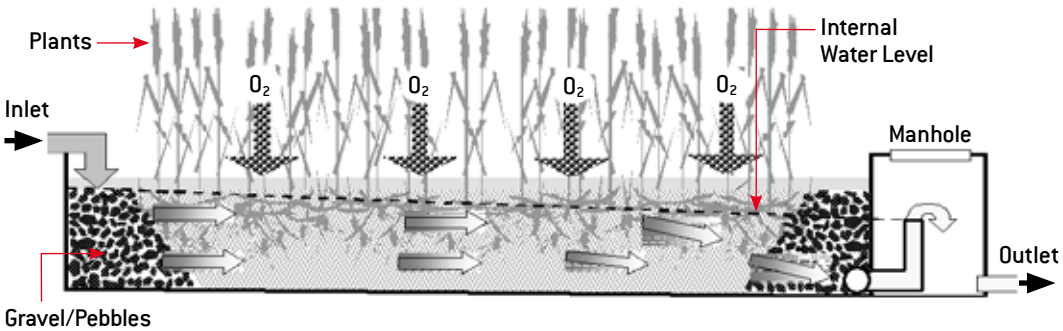


2. Anaerobic fixed bed filters make use of anaerobic digestion process with fixed bed filter—these are stones or other material in chambers. Active bacterial mass grows on the filter material (carrier). These units treat whatever is dissolved in the wastewater by bringing it in close contact with active bacteria mass. The filter media can be cinder, rock aggregates, slag, or specially designed plastic material etc. These units are ideal for wastewater with low content of suspended solids. The wastewater is retained in this unit for 1.5 to 2 days.

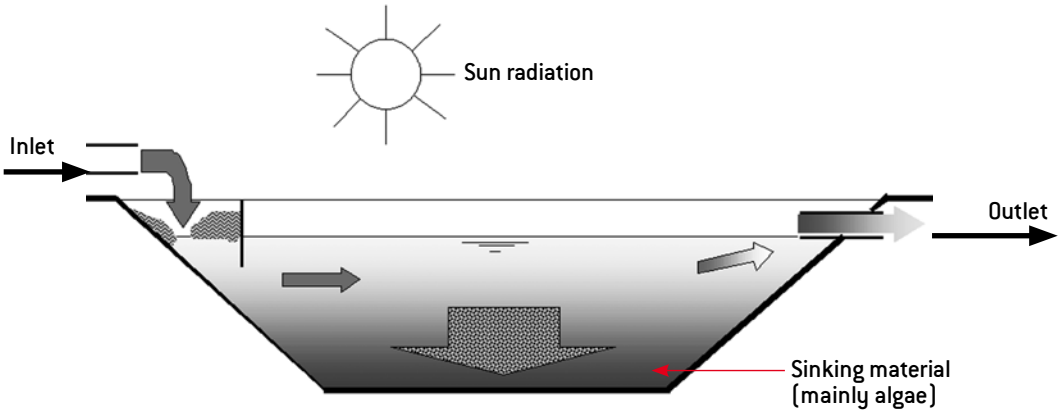


1.3 Tertiary treatment

1. Horizontal Planted Gravel Filter: The horizontal gravel filter is a shallow tank filled with



graded gravel or pebbles, and special plants are planted in this gravel filter. The normal depth is 60cm. The main removal mechanisms are biological conversion, physical filtration and chemical adsorption. Plants commonly used are canas indica, reed juncas, phragmites etc. The filters clean the wastewater by retaining particles and digesting them with the help of bacteria growing naturally on the gravel/ pebbles. Important is the intake of air (oxygen) into the filter body. The plants help with transporting oxygen through their roots. Wastewater is retained in this unit between 5 to 10 days.



1.4 Post Treatment

1. Polishing Pond: The polishing pond is a shallow pond where pathogen removal takes place. The main purpose of ponds is oxygen enrichment and elimination of pathogen germs through sun's radiation. Floating aquatic plants can help control algal growth and make it a pleasant landscape feature if desired. Wastewater is retained in this unit for 1 day.

2.0 Check List

Sl. No	Task	Frequency	Date of performance of operational task	Signature of the operator	Remarks
1	**Check for free wastewater flow**	Once in 30 days			
2	**Check for grease formation**	Once in 7 days			
3	**Check for water seal level in the biogas settler**	Once in 15 days			
4	**Check for gas leakages at the water seal in biogas settler**	Once in 60 days			
5	**Check for release of condensed water in the biogas supply pipeline**	Once in 7-15 days			
6	**Cleaning biogas stove burner**	Once in 30 days			
7	**Check for biogas leakage at biogas supply pipe**	Once in 120 days			
8	**Check for swivel pipe level in the planted gravel filter**	Once in 30 days			
9	**Weeding, removal of dead leaf litter and other litter**	Once in 30 days			

Note Make photo copies of this checklist and hand over to the DEWATS Plant operator

BORDA

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and Development

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