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Field Testing of Mobile Treatment Unit (MTU) solid liquid separator of Faecal sludge from Septic tanks

Background:

In most of the urban cities and towns, truck operators are involved in desludging on-site containment systems and disposing the faecal sludge & septage in drains, water bodies and open areas, causing high level of environmental pollution and health risks. Due to which, many cities are already suffering the consequences, in the form of health ailments and serious pollution of water and soil resources. Most of the operators do not decant the septage in treatment plants due to non-availability of the same. In some cases, treatment plants are so distant that deters the operators to decant there due to high fuel/operational costs.

Keeping this in view, Water, Sanitation and Hygiene Institute (WASH Institute) has developed a treatment option to mitigate this problem by devising a system called Mobile Treatment Unit (MTU). MTU is an onsite Faecal sludge treatment technology.

MTU works with the concept of solid-liquid separation, sludge thickening and effluent treatment process. While the liquid is separated from the solid, the effluent passes through the membrane treatment process before the treated water is disposed. The treated water meets the established pollution control norms for wastewater disposal. This mobile unit is easy to operate and has low operational & maintenance cost.

The Mobile Treatment Unit has undergone detailed field-testing/study and evaluation by renowned

international institutions namely Duke University, USA and RTI International. The study reports by these two organizations have shown positive results, meeting the disposal standards of CPCB.

Objective of this Work:

As part of commercialization protocol of this technology, WASH Institute has decided to field test/study as per the protocol and acquire certification from Prof Srikanth Mutnuri at BITS Pilani K K Birla Goa campus.

The goals of this project are: (1) Field testing the MTU solid liquid separator of faecal sludge from septic tanks (2) to characterize the effluent post MTU operation for safe disposal and (3) to quantify the sludge separated post MTU operation.

Scope of this Work:

Field testing of MTU solid liquid separator:

One MTU solid liquid separator will be moved to Goa. This solid liquid separator will be used to separate solids and liquid at 60 different septic tanks over a period of 4 months. The liquid will be treated by the MTU onsite and the solids that will be separated will be taken and disposed at sites in either Bainā or Sada, Goa. The driver and the workers to operate the MTU is under the scope of WASH INSTITUTE including their accommodation and local expenditure. SERVICE PROVIDER will have one research student associated with this project who will travel to the sites for overseeing MTU operation as well as to test the quality of water released post separation. Prototype MTU transportation, installation and operation is under the scope of WASH INSTITUTE.

Details of the system

The details of the system were the same as described by Forbis-Stokes et al., 2021.

(Forbis-stokes, A.A., Kalimuthu, A., Ravindran, J., Deshusses, M.A., 2021. Technical evaluation and optimization of a mobile septage treatment unit 277).

“A 0.5 HP mono-block centrifugal pump (Texon Engineering, Coimbatore, India) drew waste from the septic tank using a 5 cm internal diameter (ID) hose pipe inserted through one of the septic tank’s risers. This liquid was sent into a 500 L holding tank located on the truck. The middle of the holding tank contained a 25 cm ID PVC pipe, 90 cm in height, with 10 mm diameter (dia.) holes drilled into the top

75 cm of the pipe to allow septic tank supernatant to fill the pipe. The holes covered this upper section with 10 mm spacing between each. The outside wall of that pipe was wrapped with a #250 mesh (58 μm) fabric to pre-filter the septic waste before pumping. The purpose of this fabric was to remove the larger particles and thereby extend the life of the succeeding filters by using a low-cost and easy to clean material. The holding tank was modified to have a conical-bottom to improve solids settling, and a baffle was installed around the feed pipe to better restrict the flow of solid particles towards the feed pipe. From the center of this pipe, liquid was pumped using a 1 HP mono-block, double capacitor centrifugal pump (CRI Pumps, Coimbatore, India), inducing an outside-in filtration of septage from holding tank into the fabric-covered pipe. The next filter was a dual-media (D-M) filter housed in a 190 L (166 cm height, 41.2 cm dia.) fiber-reinforced plastic (FRP) container. Flow entered the FRP container at the bottom and exited from the top. The D-M filter media distribution (bottom to top): 30 cm large pebbles (30–60 mm dia.), 30 cm small pebbles (4–30 mm dia.), 30 cm coarse sand (0.5–1.0 mm dia.), 15 cm fine sand (0.125–0.250 mm dia.), and 15 cm anthracite (1–2 mm dia.). The remaining volume was left empty. The D-M filtrate then entered a granular activated carbon (GAC) (Krishna Industrial, Chennai, India) filter housed in a FRP container with the same dimensions as the D-M filter, containing approximately 85 kg of GAC of #4 \times 8 mesh size (2.4–4.8 mm) with 1200–1800 m^2/g surface area. GAC filtrate entered two microfilter (MF) polypropylene-wound filter cartridges (Placon Filters, Chennai, India) in series, with 10 μm and 5 μm of 5 in each housing unit respectively of 76.2 cm in length. MF effluent was treated with an ultrafiltration (UF) membrane (ZeeWeed 1500 UF with 55.7 m^2 surface area, 192 cm length, 18 cm dia., and 0.02 μm nominal pore size (Reeves Enviro systems, Chennai). The hollow fiber membranes had an outer dia. of 0.1 mm and nominal pore size of 0.02 μm with an outside-in flow direction. All filtrations except the UF were conducted as dead-end filtration. The bottom of the holding tank was connected to a centrifuge (1 HP, 2800 RPM, 30 L volume). The centrifuge concentrated solids that settled in the holding tank. Centrate (i.e., clarified liquid leaving the centrifuge) was returned to holding tank using a submersible pump. The Chlorination system is connected to one of the UF outlet and, with the use of a dosing pump, the bleach is added at the rate of 110 ml/min. The supersaturated chlorine solution is made by mixing 2 L of industrial bleach solution to 20 L of fresh water.

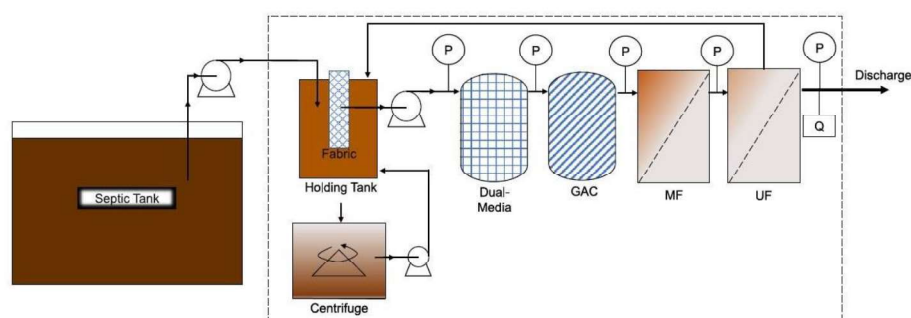


Figure: Mobile Treatment Unit (MTU) process flow diagram as presented in Forbis-Stokes et al., 2021.

Analysis of wastewater post treatment:

Post separation of the solid and liquid and the post treatment of the water separated, the discharge water was collected and tested for all the parameters as per CPCB standards. Our team monitored and collected the samples.

Methodology:

The WASH-mobile treatment system was operated in Goa, India. This unit was taken to different households, where the complete liquid volume of septic tank wastewater was treated by the system (Table A2). The initial septic tank wastewater and the final treated effluent was collected by the operators in 1L sampling bottles. The samples were then submitted to the concerned person for analyzing it for various wastewater-defining parameters. The wastewater was analyzed as per the standard protocols mentioned in APHA. Detailed methodology is given in the Annexure at the end of the document. Briefly, the methods are as follows - The **pH** of the samples was checked using Oakton pH meter. The **Chemical oxygen demand (COD)** of the samples was measured using closed reflux spectrophotometer method where dichromate reagent along with acid and catalysts was used for the detection. The phosphorus was calculated in the form of **orthophosphates (OP)** and the method employed was based on ammonium vanadate and molybdate method. The **Total ammoniacal nitrogen (TAN)** was calculated using Merck kit. However, as suggested in one of the meetings, the TAN estimation was crosschecked with Kjeldahl

method. The **Nitrates (NO₃⁻)** were also measured using Merck kit. The kit method was used to estimate the nitrates in the KNO₃ standards as well to validate its efficacy. The **Biological oxygen demand (BOD)** was measured using 5-day incubation method, maintaining the samples in cold environment. The **Total dissolved solids (TDS)** in the samples was measured by filtering the samples. The filtrate collected dried and used to calculate TDS. The **Total suspended solids (TSS)** present in the sample was measured by filtering the wastewater samples through 1.2um filter. The last parameter was the **Coliform count** that was determined by plating the samples (with/without dilution) on MacConkey agar plates.

Results:

The mobile treatment unit designed by WASH institute was driven to Goa in order to test its treatment efficiency at different geographical locations (60 tanks, Treated 4,53,701 L in total with a total operational time of 180hrs). This unit was a combination of different filters, which are connected in series, thus making a systematic treatment process. The filters used were media filters, activated carbon based filters and membrane filters. Each filter has specific role in the treatment process. The main objective of the designed treatment unit was to achieve the treatment efficiency in accordance to the CPCB standards. 60 different sites/households were selected in Goa and their septic tank wastewater was treated whose data is presented in the **Table** presented below. The influent and effluent data for COD (dissolved) and OP show significant removal efficiency by the system. However, the nitrogen component of the wastewater (TAN, NO₃) showed inconsistent reduction. Regarding the solids present in wastewater, although there was significant removal of TDS and TSS, the TSS component was still a little high. This could be because of using the chlorination in the treated effluent as a final polishing step. With respect to coliforms, the MTU shows promising results as the treated wastewater shows no or very few colonies on agar plates.

Table: Average influent and effluent concentrations for different wastewater defining parameters

| Sample No. | OP (mg/L) | | TAN (mg/L) | | NO ₃ ⁻ (mg/L) | | Coliforms (CFU/100ml) | |
|------------|-----------|--------|------------|--------|-------------------------------------|--------|-----------------------|--------|
| | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet |
| S1 | 6 | 1 | 48 | 22 | 23 | 12 | 12X10 ⁴ | N.D. |

| | | | | | | | | |
|------------|----|----|-----|-----|----|----|--------------------|------|
| S2 | 3 | 1 | 29 | 22 | 48 | 39 | 3X10 ³ | 40 |
| S3 | 8 | 3 | 35 | 27 | 22 | 14 | 15X10 ³ | 60 |
| S4 | 6 | 4 | 74 | 72 | 36 | 34 | 34X10 ² | N.D. |
| S5 | 13 | 9 | 97 | 89 | 37 | 35 | 31X10 ⁴ | N.D. |
| S6 | 20 | 6 | 76 | 79 | 46 | 47 | 37X10 ⁵ | N.D. |
| S7 | 13 | 5 | 62 | 60 | 75 | 66 | 24X10 ⁵ | 12 |
| S8 | 13 | 5 | 78 | 64 | 54 | 59 | 12X10 ⁶ | 10 |
| S9 | 20 | 10 | 154 | 152 | 68 | 54 | 27X10 ⁴ | 2 |
| S10 | 20 | 14 | 96 | 98 | 25 | 27 | 34X10 ⁴ | 34 |
| S11 | 16 | 10 | 120 | 124 | 34 | 37 | 24X10 ² | N.D. |
| S12 | 17 | 9 | 70 | 77 | 43 | 33 | 46X10 ⁴ | 22 |
| S13 | 11 | 4 | 54 | 61 | 36 | 37 | 33X10 ³ | N.D. |
| S14 | 23 | 15 | 152 | 154 | 41 | 39 | 28X10 ³ | 12 |
| S15 | 26 | 9 | 118 | 106 | 21 | 15 | 32X10 ⁴ | N.D. |
| S16 | 12 | 4 | 64 | 56 | 35 | 34 | 12X10 ⁴ | N.D. |
| S17 | 32 | 9 | 74 | 68 | 31 | 28 | 24X10 ⁴ | 12 |
| S18 | 12 | 10 | 78 | 75 | 32 | 37 | 32X10 ⁵ | 4 |
| S19 | 15 | 8 | 44 | 46 | 33 | 36 | 24X10 ⁴ | N.D. |
| S20 | 30 | 11 | 94 | 91 | 25 | 28 | 35X10 ⁴ | 2 |
| S21 | 27 | 13 | 90 | 85 | 18 | 21 | 24X10 ² | N.D. |
| S22 | 19 | 14 | 112 | 119 | 23 | 19 | 18X10 ⁴ | N.D. |
| S23 | 14 | 11 | 104 | 93 | 21 | 18 | 24X10 ⁴ | 10 |
| S24 | 36 | 21 | 127 | 121 | 14 | 18 | 34X10 ⁶ | 8 |
| S25 | 24 | 16 | 154 | 114 | 28 | 26 | 24X10 ⁶ | N.D. |
| S26 | 25 | 11 | 145 | 132 | 19 | 16 | 12X10 ⁴ | N.D. |
| S27 | 20 | 11 | 74 | 53 | 22 | 18 | 20X10 ⁴ | 4 |
| S28 | 14 | 6 | 46 | 41 | 34 | 22 | 5X10 ⁴ | 6 |
| S29 | 47 | 12 | 48 | 37 | 28 | 29 | 24X10 ⁴ | 12 |
| S30 | 39 | 7 | 123 | 113 | 26 | 24 | 28X10 ⁴ | N.D. |
| S31 | 49 | 8 | 76 | 71 | 22 | 23 | 17X10 ⁴ | 8 |

| | | | | | | | | |
|------------|----|----|-----|-----|----|----|--------------------|------|
| S32 | 51 | 12 | 98 | 67 | 27 | 23 | 46X10 ⁶ | 22 |
| S33 | 23 | 15 | 122 | 116 | 26 | 21 | 34X10 ⁵ | 10 |
| S34 | 46 | 13 | 69 | 62 | 13 | 15 | 16x10 ⁴ | N.D. |
| S35 | 34 | 9 | 89 | 45 | 18 | 14 | 22x10 ² | N.D. |
| S36 | 38 | 11 | 103 | 97 | 24 | 19 | 36x10 ⁶ | 12 |
| S37 | 24 | 8 | 131 | 124 | 19 | 10 | 18x10 ³ | N.D. |
| S38 | 31 | 7 | 74 | 65 | 15 | 12 | 27x10 ⁶ | 14 |
| S39 | 29 | 6 | 102 | 98 | 22 | 16 | 26x10 ² | 4 |
| S40 | 42 | 10 | 83 | 86 | 28 | 25 | 32x10 ⁴ | 6 |
| S41 | 57 | 14 | 78 | 72 | 33 | 35 | 28x10 ⁶ | N.D. |
| S42 | 14 | 11 | 42 | 41 | 13 | 11 | 16x10 ⁸ | 460 |
| S43 | 9 | 6 | 56 | 42 | 13 | 15 | 13x10 ⁴ | 200 |
| S44 | 15 | 11 | 89 | 64 | 17 | 12 | 22x10 ⁵ | N.D. |
| S45 | 15 | 13 | 60 | 61 | 18 | 11 | 18x10 ⁴ | N.D. |
| S46 | 7 | 6 | 29 | 35 | 11 | 12 | 22x10 ⁴ | N.D. |
| S47 | 13 | 1 | 20 | 14 | 47 | 34 | 14x10 ³ | N.D. |
| S48 | 66 | 2 | 63 | 45 | 29 | 21 | 4x10 ⁴ | N.D. |
| S49 | 23 | 10 | 58 | 76 | 32 | 36 | 23X10 ⁴ | 32 |
| S50 | 5 | 1 | 16 | 17 | 38 | 25 | 56X10 ⁵ | 130 |
| S51 | 15 | 9 | 86 | 78 | 30 | 37 | 4X10 ⁵ | 56 |
| S52 | 31 | 12 | 114 | 78 | 39 | 41 | 1X10 ⁵ | 120 |
| S53 | 41 | 15 | 69 | 65 | 34 | 38 | 24X10 ⁴ | 134 |
| S54 | 20 | 11 | 106 | 93 | 32 | 37 | 3X10 ⁵ | 400 |
| S55 | 17 | 5 | 62 | 46 | 21 | 29 | 2X10 ⁵ | 340 |
| S56 | 17 | 8 | 108 | 92 | 38 | 39 | 27X10 ³ | 60 |
| S57 | 15 | 8 | 70 | 76 | 47 | 56 | 18X10 ³ | 4 |
| S58 | 22 | 13 | 156 | 148 | 46 | 57 | 10X10 ⁴ | 6 |
| S59 | 18 | 3 | 66 | 50 | 45 | 32 | 6X10 ⁴ | 10 |
| S60 | 33 | 13 | 196 | 112 | 54 | 46 | 20X10 ⁴ | 200 |

| Sample No. | COD (mg/L) | | BOD (mg/L) | | TDS (mg/L) | | TSS (mg/L) | | pH | |
|------------|------------|--------|------------|--------|------------|--------|------------|--------|-------|--------|
| | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet |
| S1 | 620 | 68 | 234 | 50 | 275 | 74 | 108 | 27 | 6.9 | 6.42 |
| S2 | 740 | 20 | 231 | 18 | 156 | 69 | 236 | 38 | 7.82 | 7.26 |
| S3 | 147 | 48 | 67 | 12 | 269 | 89 | 103 | 24 | 7.11 | 7.08 |
| S4 | 97 | 52 | 96 | 8 | 161 | 45 | 115 | 18 | 7.19 | 7.23 |
| S5 | 147 | 60 | 182 | 11 | 402 | 91 | 102 | 26 | 7.95 | 7.75 |
| S6 | 480 | 90 | 179 | 14 | 356 | 65 | 175 | 45 | 7.43 | 7.46 |
| S7 | 613 | 92 | 145 | 11 | 242 | 68 | 102 | 27 | 7.4 | 7.41 |
| S8 | 333 | 77 | 132 | 7 | 342 | 55 | 235 | 60 | 7.56 | 7.44 |
| S9 | 340 | 122 | 134 | 13 | 268 | 59 | 126 | 18 | 8.04 | 7.98 |
| S10 | 270 | 108 | 154 | 7 | 345 | 108 | 167 | 48 | 7.19 | 7.21 |
| S11 | 280 | 57 | 114 | 9 | 289 | 61 | 112 | 26 | 7.75 | 7.7 |
| S12 | 227 | 88 | 156 | 12 | 321 | 95 | 213 | 62 | 7.53 | 7.54 |
| S13 | 277 | 108 | 121 | 15 | 237 | 46 | 165 | 47 | 7.51 | 7.46 |
| S14 | 237 | 102 | 167 | 20 | 435 | 125 | 136 | 33 | 7.8 | 7.7 |
| S15 | 330 | 63 | 103 | 8 | 412 | 58 | 214 | 56 | 7.73 | 7.68 |
| S16 | 307 | 50 | 175 | 11 | 293 | 36 | 79 | 18 | 7.43 | 7.41 |
| S17 | 673 | 68 | 89 | 9 | 212 | 38 | 113 | 23 | 7.12 | 7.14 |
| S18 | 227 | 200 | 231 | 18 | 232 | 41 | 87 | 17 | 7.09 | 7.11 |
| S19 | 233 | 103 | 78 | 10 | 234 | 38 | 89 | 9 | 7.11 | 7.02 |
| S20 | 500 | 100 | 110 | 13 | 214 | 31 | 124 | 32 | 7.25 | 7.22 |
| S21 | 273 | 78 | 93 | 11 | 293 | 59 | 146 | 38 | 7.34 | 7.36 |
| S22 | 247 | 75 | 141 | 10 | 269 | 50 | 87 | 18 | 7.04 | 7.12 |
| S23 | 107 | 85 | 92 | 5 | 288 | 49 | 98 | 23 | 7.02 | 7.1 |
| S24 | 460 | 185 | 234 | 15 | 412 | 85 | 187 | 51 | 7.19 | 7.11 |
| S25 | 440 | 65 | 212 | 9 | 327 | 61 | 143 | 35 | 7.46 | 7.24 |
| S26 | 500 | 153 | 256 | 11 | 303 | 28 | 112 | 21 | 8.02 | 7.45 |
| S27 | 213 | 160 | 103 | 12 | 204 | 54 | 134 | 27 | 7.23 | 7.12 |
| S28 | 133 | 75 | 89 | 7 | 210 | 69 | 108 | 33 | 7.26 | 7.1 |

| | | | | | | | | | | |
|------------|------|-----|-----|-----|-----|-----|------|----|------|------|
| S29 | 133 | 75 | 113 | 11 | 197 | 48 | 89 | 17 | 7.04 | 7.02 |
| S30 | 20 | 32 | 137 | 14 | 260 | 58 | 121 | 36 | 7.24 | 7.18 |
| S31 | 433 | 83 | 152 | 12 | 313 | 98 | 186 | 53 | 7.21 | 7.22 |
| S32 | 620 | 67 | 114 | 15 | 376 | 71 | 215 | 56 | 7.45 | 7.04 |
| S33 | 633 | 42 | 67 | 12 | 349 | 62 | 167 | 77 | 7.19 | 7.06 |
| S34 | 367 | 128 | 123 | 17 | 402 | 48 | 156 | 48 | 7.11 | 7.08 |
| S35 | 327 | 37 | 103 | 11 | 219 | 41 | 89 | 11 | 7.48 | 7.36 |
| S36 | 580 | 92 | 89 | 8 | 214 | 99 | 256 | 69 | 7.18 | 7.18 |
| S37 | 107 | 35 | 78 | 9 | 146 | 25 | 102 | 17 | 7.24 | 7.21 |
| S38 | 693 | 108 | 102 | 18 | 256 | 94 | 178 | 63 | 7.34 | 7.28 |
| S39 | 413 | 53 | 115 | 14 | 223 | 27 | 123 | 33 | 7.26 | 7.31 |
| S40 | 1087 | 73 | 98 | 8 | 289 | 41 | 245 | 33 | 7.25 | 7.26 |
| S41 | 613 | 98 | 82 | 9 | 274 | 47 | 221 | 28 | 7.29 | 7.24 |
| S42 | 507 | 158 | 253 | 35 | 250 | 67 | 1273 | 11 | 7.5 | 6.8 |
| S43 | 235 | 56 | 119 | 25 | 234 | 59 | 94 | 15 | 7.04 | 6.87 |
| S44 | 237 | 78 | 120 | 32 | 242 | 63 | 232 | 22 | 7.87 | 7.46 |
| S45 | 127 | 28 | 65 | 11 | 231 | 58 | 617 | 28 | 6.95 | 7.06 |
| S46 | 93 | 33 | 48 | 14 | 217 | 51 | 119 | 8 | 7.75 | 7.48 |
| S47 | 133 | 37 | 87 | 25 | 312 | 79 | 315 | 78 | 6.57 | 7.01 |
| S48 | 1880 | 198 | 678 | 56 | 115 | 47 | 156 | 42 | 6.97 | 6.21 |
| S49 | 200 | 115 | 105 | 18 | 378 | 112 | 168 | 44 | 7.55 | 7.74 |
| S50 | 67 | 20 | 48 | 6 | 316 | 98 | 223 | 56 | 7.19 | 7.47 |
| S51 | 113 | 68 | 105 | 11 | 345 | 108 | 198 | 47 | 7.05 | 7.25 |
| S52 | 807 | 233 | 360 | 23 | 378 | 125 | 221 | 55 | 7.35 | 7.31 |
| S53 | 747 | 123 | 200 | 112 | 399 | 161 | 269 | 42 | 8.09 | 7.99 |
| S54 | 647 | 68 | 280 | 17 | 169 | 65 | 167 | 48 | 6.77 | 7.38 |
| S55 | 367 | 187 | 300 | 70 | 255 | 94 | 211 | 54 | 7.44 | 7.55 |
| S56 | 213 | 52 | 105 | 18 | 369 | 97 | 241 | 71 | 7.76 | 7.64 |
| S57 | 550 | 278 | 201 | 25 | 392 | 86 | 114 | 26 | 7.19 | 7.32 |
| S58 | 430 | 112 | 198 | 19 | 422 | 134 | 119 | 32 | 7.74 | 7.61 |

| | | | | | | | | | | |
|------------|-----|-----|-----|----|-----|-----|-----|----|------|------|
| S59 | 267 | 113 | 156 | 16 | 158 | 80 | 136 | 32 | 7.43 | 7.57 |
| S60 | 533 | 5 | 212 | 21 | 234 | 123 | 206 | 56 | 7.51 | 7.53 |

Conclusion:

“Mobile septage Treatment Unit (MTU)”, an innovation aimed at collection and treatment of septage from septic tanks, is able to treat septage satisfactorily and discharges treated effluent meeting the current CPCB standards

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Annexure

A1. METHODS

Test 1- pH: Oakton pH meter

Test 2-TDS: Properly mixed sample was pipetted out and added to glass fiber filter (1.45µm) with applied vacuum. Wash with three successive 10ml volumes of reagent grade water, allowing complete drainage between washings, and continue suction till the filtration is complete. Transfer total filtrate to a weighed evaporating dish. Dry evaporate the sample in an oven for 1 h at 180 degrees. Once dried, cool down the sample to room temperature.

$$\text{TDS (mg/L)} = ((A-B) \times 100) / \text{sample volume, ml}$$

Where:

A= weight of dried residue + dish, mg

B= weight of dish, mg

Test 3-Total suspended solids (TSS):

Known volume of sample filtered (1.2µm) using vacuum filter assembly. Carefully transfer the filter to a weighing dish, and place filter on a butter paper sheet. Place filters on sheet into an oven set to $104 \pm 1^\circ\text{C}$ and dry for a minimum of one hour. Remove filters from oven and cool them down at room temperature. Weigh the sample filter.

$$\text{TSS (mg/L)} = (A - B) / V$$

Where: A = mass of filter + dried residue (mg),

B = mass of filter (tare weight) (mg), and

V = volume of sample filtered (L)

Test 4- Chemical Oxygen Demand

REAGENTS:

- Standard Potassium dichromate ($K_2Cr_2O_7$) digestion solution(1L):
Add to about 500 mL distilled water 10.216 g $K_2Cr_2O_7$, primary standard grade, previously dried at $150^\circ C$ for 2 h, 167 mL conc. H_2SO_4 , and 33.3 g $HgSO_4$. Dissolve, cool to room temperature, and dilute to 1000 ml.
- Sulfuric acid reagent: Add 1% Ag_2SO_4 to the respective volume of H_2SO_4 . Let stand 1 to 2 d to dissolve and mix. This accelerates the oxidation of straight chain aliphatic and aromatic compounds.

Procedure:

1. Wash COD tubes and caps with 20% H_2SO_4 before using to prevent contamination.
2. Place sample (2 mL) in COD tube and add $K_2Cr_2O_7$ digestion solution (1.2 mL).
3. Carefully run sulphuric acid reagent (2.8 mL) down inside of vessel so an acid layer is formed under the sample-digestion solution layer and tightly cap tubes or seal ampules, and invert each several times to mix completely.
4. Place tubes in block digester preheated to $150^\circ C$ and reflux for 2 h behind a protective shield.
5. Cool to room temperature and place vessels in test tube rack. Some mercuric sulfate may precipitate out but this will not affect the analysis.
6. Measure the absorbance at 600nm and calculate the COD concentration by standard graph.

Test 5- Biological Oxygen Demand

Step1:- Calculate COD

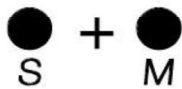
Step 2:- Estimate the BOD_5 value to be expected for the wastewater sample:

Expected BOD_5 value _ 80 % of the COD value

Look for corresponding measuring range in the following chart and gather correct values for sample volume and factor.

| Sample volume (ml) | Measuring range (mg/l) | Factor |
|--------------------|------------------------|--------|
| 432 | 0 - 40 | 1 |
| 365 | 0 - 80 | 2 |
| 250 | 0 - 200 | 5 |
| 164 | 0 - 400 | 10 |
| 97 | 0 - 800 | 20 |
| 43.5 | 0 - 2000 | 50 |
| 22.7 | 0 - 4000 | 100 |

- **Rinse** measuring bottle with **sample**. Empty thoroughly.
- **Exactly measure** the required oxygen-saturated (thoroughly homogenized) **quantity of the sample** according to information.
- Put the **magnetic stirring rod** into the bottle.
- Insert a **rubber quiver** in the neck of the bottle.
- Put **2 sodium hydroxide tablets** into the rubber quiver with a tweezers. (Caution: The tablets must never come into the sample!)
- Screw OxiTop® directly on sample bottle (tightly close).



Start measurement:

Press S and M simultaneously. (2 seconds) until the display shows 00.



2 sec



Display: Stored values are deleted.

- Keep the measuring bottle with the OxiTop put on **for 5 days at 20°C** (e.g. in a incubator). After the meas. temperature has been reached (after 1 hour at the earliest, after 3 hours at the latest; **AutoTemp function**), the OxiTop automatically starts the measurement of the oxygen consumption .
- During the 5 days the sample is continuously stirred. The OxiTop **automatical stores one value every 24 hours** for 5 days. To have the current value show press the M key.



Display current measured value:

Press M until measured value is displayed (1 second).



e.g.

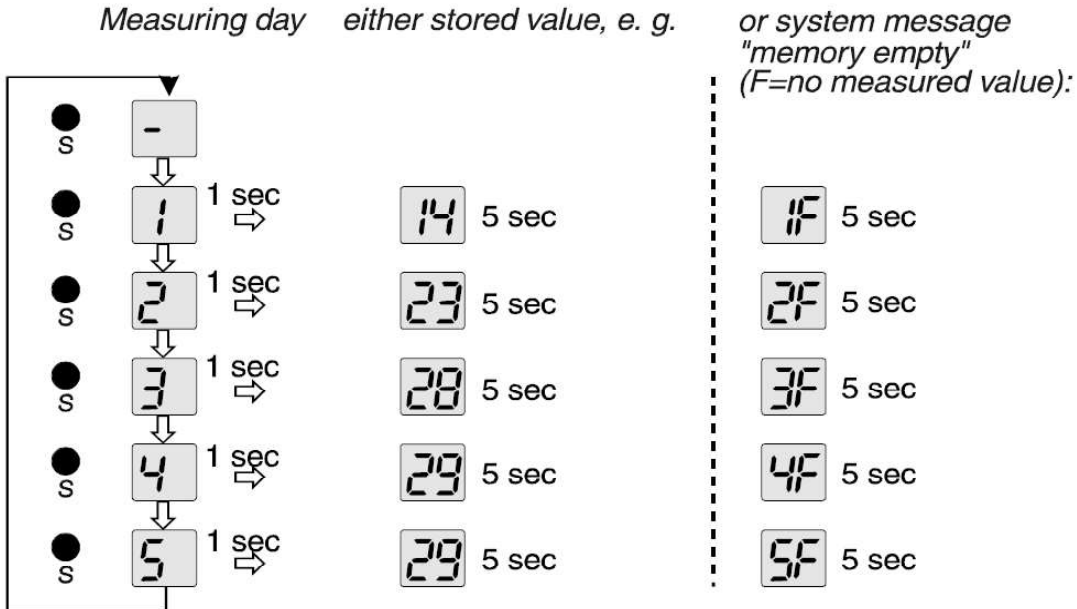
- **Readout of the stored values** after the 5 days have passed.



Recall stored values:

Press S until measured value is displayed (1 second).

Scroll to next day by repressing the S key while the measured value is displayed (5 sec). Fast scrolling by repeatedly pressing the S key.



- Convert the displayed measured value (digits) into the BOD value with the following table (Digits x Factor = BOD5 in mg/l):

| Sample volume (ml) | Measuring range (mg/l) | Factor |
|--------------------|------------------------|--------|
| 432 | 0 - 40 | 1 |
| 365 | 0 - 80 | 2 |
| 250 | 0 - 200 | 5 |
| 164 | 0 - 400 | 10 |
| 97 | 0 - 800 | 20 |
| 43.5 | 0 - 2000 | 50 |
| 22.7 | 0 - 4000 | 100 |

Test 6- Phosphorus

Preparation of reagents:

1. Reagent A: Ammonium molybdate solution

Dissolve 25 gm of Ammonium molybdate in 400 ml distilled water.

2. Reagent B: Ammonium vanadate

Dissolve 1.25 gm of Ammonium vanadate in 300 ml distilled water.

3. Mixed reagent: should be prepared freshly.

To prepare 50 ml of mixed reagent, take 20 ml of reagent A, 15 ml of reagent B, 12.5 ml of concentrated HNO₃ and 2.5 ml distilled water.

Procedure:

Take 3.5 ml sample, add 1 ml of mixed reagent and dilute to make final volume of 5.0 ml by adding 0.5 ml of water. Mix the sample well or vortex for 10-20 sec. Measure the absorbance at 450nm.

The concentration can be found out by using the standard curve made for KH₂PO₄.

Test 7- Total ammoniacal nitrogen (TAN): Merck Kit

Photometric method (contains sodium nitroprusside).

Procedure: 5ml of reagent-1 mixed with 100ul or 200ul of the sample. 1 spoon of reagent 2 added. Vortexed to mix it completely and left for 15min. Using the barcode reader (different for 100/200ul sample volume) provided in the kit (that only worked with the Merck spectrophotometer that we have), the concentration was measured.

Spectrophotometer: Spectroquant Prove 100

This kit analysis for TAN was cross-checked with the standard method mentioned in APHA (titration method) and the results that we achieved was mostly similar. The standard deviation was found to be ±2.

Test 8- Nitrates: Merck kit

Nitrates test: Photometric method (contains boric acid, cadmium powder (pyrophoric), sulfanilic

acid). Procedure: 10ml sample mixed with 1 spoon of powder provided in the kit. Vortexed for 1 minute and left for 5 min. Using the barcode reader provided in the kit(that only worked with the Merck spectrophotometer that we have), the concentration was measured.

The samples were sent to external lab for nitrates estimation where they analysed the samples by using standard APHA method and the results they send were in accordanceto our kit method.

Test 9- Bacterial Tests

Media used: MacConkey agar

- Autoclave your media and prepare agar plates.
- Dilute your sample in 0.8% NaCl (serial dilution). For this, add 0.1ml of sample in 0.9ml of saline. Mix it well and do the serial dilutions.
- Then take 0.1ml of sample from each dilution and pour it on MacConkey agar plate. With the help of glass spreader (L-shape), spread the sample on whole plate. Allow the sample to dry and incubate the plates at 37 degrees in incubator.
- After 24-48 hours, check the plates for the presence/absence of colonies.
- Different bacteria gave different colored colonies.
- E.coli shows pink colonies on agar plate.
- Count the number of colonies on plate and multiply with dilution number you have used.
- This will give colony forming unit per 0.1ml (CFU/0.1ml).
- Calculate further CFU/ml (standard unit).

A2. Site details and data about sludge generation

| Site Assessment # | Site | Dimensions | No. of Chambers Desludged | Level Remaining Info | Volume desludged (L) | Treatment Time (hr) | No. of Backwashes for UF |
|-------------------|--------------------------|--|---------------------------|----------------------|----------------------|---------------------|--------------------------|
| 1 | Syed-MES College | 5ft liquid level + 0.5 ft sludge + 1.5 ft free board | 1 | 2 to 4 " of sludge | 4400 | 0:45 | 1 |
| 2 | Dourlo-MES college | 6ft liquid level +1ft sludge | 1 | 0.5 ft sludge | 5700 | 1.25 | 2 |
| 3 | Usman Ali-MES college | 5.75ft liquid level+0.75ft of sludge | 1 | 2 to 4 " of sludge | 8499 | 2:45 | 4 |
| 4 | Rafik-MES college | 7ft depth + 2 feet free board + 1 ft sludge | 1 | 0.5 ft sludge | 5864 | 1:30 | 3 |
| 5 | Abdul Karim- MES college | 6 ft = 5 ft liquid level + 1 ft slurry | 1 | 2 to 4 " of sludge | 4166 | 1.58 | 3 |
| 6 | Varian -MES college | depth 8 ft = 6 ft liquid level + 2 ft slurry | 1 | 1 ft sludge | 3875 | 1:30 | 3 |
| 7 | Bhasir Ahmed-MES College | 6 ft liquid level (with floatable solids) +2 ft sludge | 1 | 0.5 ft sludge | 4760 | 1:00 | 2 |

| | | | | | | | |
|----|------------------------------|---|---|--------------------|-------|------|---|
| 8 | Vaman Naik-MES College | | 1 | | 3500 | 0:45 | 1 |
| 9 | Rafir-MES college | depth 5 ft+ 2.5 ft sludge | 1 | 1.5 ft sludge | 4300 | 0.34 | 1 |
| 10 | Gawade-MES college | 7 ft depth = 6 ft liquid portion+1 ft sludge) | 1 | 2 to 4 " of sludge | 9700 | 3:50 | 7 |
| 11 | Naik-Zuarinagar | 8ft, liquid depth - 7ft + 1 ft sludge | 1 | 2 to 4 " of sludge | 10100 | 4:00 | 8 |
| 12 | Shaik salim-Near MES college | | 1 | | 6400 | 2:15 | 4 |
| 13 | Naik-Zuarinagar | 8 ft, liquid depth - 7ft + 1ft sludge | 1 | 2 to 4 " of sludge | 11365 | 3:50 | 7 |
| 14 | Shaiksalim-Siddarth colony | 4ft liquid portion+1.5ft sludge | 1 | 2 to 4 " of sludge | 6263 | 3.65 | 7 |
| 15 | Ismail-siddarth colony | Total depth 6ft - 4ft liquid + 1 ft sludge + 1 ft freeboard | 1 | 0.5 ft sludge | 8700 | 3:20 | 6 |
| 16 | Zareena Khader- | | 1 | | 5308 | 2:00 | 4 |

| | | | | | | | |
|----|-------------------------|--|---|--------------------|-------|------|----|
| | Siddharth colony | | | | | | |
| 17 | Princy johnson | 7 ft liquid + 1.5 ft sludge + 1.5 ft freeboard | 1 | 0.5 ft sludge | 14175 | 5:00 | 10 |
| 18 | Nadeem-Zuari nagar | 9 ft. (5ft liquid + 2.5 ft sludge + 1.5 ft free board). | 1 | 0.5ft sludge | 13017 | 4:30 | 9 |
| 19 | Desai-Zuarai nagar | 8 ft depth (6ft liquid portion + 1 ft sludge +1 ft freeboard) | 1 | 2 to 4 " of sludge | 8674 | 2.51 | 5 |
| 20 | Vijaya-Siddharth colony | 10 ft, in-depth = 7 ft of liquid level + 1.5 ft sludge depth+1.5 freeboard). | 1 | 0.5 ft sludge | 11600 | 4:00 | 8 |
| 21 | Mohan-MES college | Depth 6 ft = 2.25 ft liquid depth + 2.75 ft sludge depth + 1 ft free board. | 1 | 1.75 ft sludge | 3670 | 0:30 | 1 |

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|----|-----------------------------|---|---|--------------------|-------|---------|---|
| 22 | Vinodha-Siddharth colony | 6ft liquid level +1ft sludge | 1 | 2 to 4 " of sludge | 12300 | 4:30 | 9 |
| 23 | Rahima-Siddharth colony | depth 10 ft = 6 ft liquid level + 1.5 ft sludge + 2.5 ft free board | 1 | 2 to 4 " of sludge | 10865 | 4:15:00 | 8 |
| 24 | D.G.Mukthi-Zuari nagar | 7 ft, 6 ft liquid level + 1 ft sludge | 1 | 2 to 4 " of sludge | 8700 | 3:00 | 6 |
| 25 | Subhash-MES college | 6 ft, 5 ft liquid level + 1 ft sludge depth | 1 | 3 " of sludge | 6890 | 2:30 | 5 |
| 26 | Suresh Nayak-Zurari Nagar | 8 ft, 7 ft liquid level + 1 ft free board | 1 | 3 " of sludge | 13050 | 4:30 | 9 |
| 27 | Louis-Siddharth colony | 8 ft, 6.5 ft - liquid level, 1.5 ft - sludge | 1 | 2 to 4 " of sludge | 9,565 | 3:30 | 7 |
| 28 | KB Naik-Zuari Nagar | 7ft , 1 ft sludge depth + 5 ft liquid level+1 ft free board | 1 | 3" of sludge | 5608 | 2:00 | 4 |
| 29 | Dayanand - Siddharth colony | | 1 | | 7896 | 3:00 | 6 |

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|----|--------------------------|--|---|--------------------|-------|------|---|
| 30 | Balachandra | 6 ft, 5.5 ft liquid level + 0.5 ft sludge depth | 1 | 2 to 4 " of sludge | 7415 | 2:30 | 5 |
| 31 | Nazima-Siddarth Colony | 8ft, 7 ft liquid level + 1 ft sludge depth | 1 | 3 " of sludge | 11584 | 4:00 | 8 |
| 32 | Ahmed-Park street colony | 7ft, 5.5 ft liquid level + 1.5 ft sludge depth | 1 | 3 " of sludge | 10132 | 3:30 | 7 |
| 33 | Sheikh Gulab | 10 ft, 6.5 ft - liquid level, 1.5 ft - sludge depth, 2 ft free board | 1 | 0.5 ft sludge | 7100 | 2:30 | 5 |
| 34 | Anil-Siddarth college | 4 ft , 1 ft sludge depth + 3 ft liquid level | 1 | 2 to 4 " of sludge | 4300 | 0.34 | 1 |
| 35 | Kamal-MES college | depth 5 ft = 3 ft liquid level + 2.5 ft sludge + 0.5 ft free board | 1 | 1 ft sludge | 5375 | 1:10 | 2 |
| 36 | Pablo-MES College | 5ft, 3.5 ft liquid level + 1 ft sludge | 1 | 2 to 4 " of sludge | 5664 | 1:24 | 2 |

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|----|---|--|---|-----------------------|-------|------|---|
| | | depth+0.5 free board | | | | | |
| 37 | Sheikh Muhammed- Ashhraf nagar | 8 ft, 6 ft liquid level + 1 ft sludge depth+1 free board | 1 | 3 " of sludge | 8598 | 2:40 | 5 |
| 38 | Shabina- Zuari Nagar | 8 ft, 6 ft liquid level + 2 ft sludge depth | 1 | 0.75 ft of sludge | 10511 | 3:35 | 7 |
| 39 | Fidele-MES College | 9 ft, 7.5 ft - liquid level, 1.5 ft - sludge depth | 1 | 0.5 ft sludge | 8700 | 3:00 | 6 |
| 40 | Ramesh- MES college | 6ft , 1 ft sludge depth + 5 ft liquid level | 1 | 0.5 ft sludge | 9800 | 3:30 | 7 |
| 41 | Sreenivash - upper orchard | 10ft,8 ft liquid portion+1 ft sludge+1ft free board | 1 | 2 to 4 " of sludge | 10500 | 3:30 | 7 |
| 42 | Lalsab-MES college | | 1 | | 5464 | 2:00 | 4 |
| 43 | Ram-Zuari nagar | | 1 | | 4425 | 0:45 | 2 |

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|----|--|---|---|-----------------------|-------|------|---|
| 44 | Muzafarshah-MES college | 6ft,5 ft liquid,1ft freeboard | 1 | | 8400 | 3:00 | 6 |
| 45 | Krishna - Zuari nagar | 5ft liquid,2.5ft sludge | 1 | 1 ft sludge | 7332 | 2:20 | 5 |
| 46 | Parushuram- Mother teresa colony | 5 ft depth +1 ft sludge +1ft free board | 1 | 2 to 4 " of sludge | 10150 | 3:30 | 7 |
| 47 | Yusuf-MES College | 7ft depth .6 ft liquid+1ft freeboard | 1 | | 5732 | 1:45 | 3 |
| 48 | Amam- Ameer colony | 10ft,8 ft liquid portion+1 ft sludge+1ft free board | 1 | 2 to 4 " of sludge | 7900 | 2:50 | 5 |
| 49 | Acharia- Bharath colony | 8ft, 7 ft liquid level + 1 ft sludge depth | 1 | 3 " of sludge | 8745 | 3:00 | 6 |
| 50 | Samuel-Zuari nagar | 7ft depth,6ft liquid portion+1 ft sludge | 1 | 3 " of sludge | 6250 | 1:45 | 3 |
| 51 | Airway- Jalvayu vilas | 8ft, 7 ft liquid level + 1 ft sludge depth | 1 | 2 to 4 " of sludge | 4850 | 0:45 | 2 |

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|----|---------------------------|--|---|--------------------|-------|------|---|
| 52 | Meghna dileep-Zuari nagar | 6ft depth,3 ft liquid +1 ft sludge +1ft freeboard | 1 | | 3949 | 0:30 | 1 |
| 53 | Babu-Zuari nagar | 6ft depth,4 ft liquid +1 ft sludge +1ft free board | 1 | 2 to 4 " of sludge | 5466 | 1:35 | 3 |
| 54 | Amit factory | 3 ft liquid +3ft sludge | 1 | 1.5 ft sludge | 4350 | 0:45 | 2 |
| 55 | Sadanand-Surya colony | 12ft,9 ft liquid portion+2 ft sludge +1 ft freeboard | 1 | 0.5 ft sludge | 10932 | 4:00 | 8 |
| 56 | John-Dabolim | 6ft.5ft liquid+1 ft free board | 1 | | 4000 | 0:35 | 1 |
| 57 | Naik -MES college | 8 ft depth (6ft liquid portion +1ft sludge +1 ft free board) | 1 | 2 to 4 " of sludge | 8196 | 3:00 | 6 |
| 58 | Brandon-MES college | 7ft depth.(6ft liquid+1 ft free board) | 1 | | 5666 | 1:20 | 3 |
| 59 | Swetha Naik-Sriram nagar | 8ft depth,6 ft liquid portion+2 ft sludge +1 ft freeboard | 1 | 0.5 ft sludge | 5889 | 1:35 | 3 |

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|----|---------------------|---|---|------------------|------|------|---|
| 60 | Suresh-MES nagar | 6 ft depth,4.5 ft liquid+1.5 ft sludge +0.5 ft free board | 1 | 0.5 ft sludge | 7416 | 2:15 | 5 |
|----|---------------------|---|---|------------------|------|------|---|

Table continued.....

| Site Assessment # | Site | Total Operational Time (hr) | Effective Flowrate (L/hr) | Notes/Reason for Stopping MTU operation | Chlorination |
|-------------------|-------------------------|-----------------------------|---------------------------|---|--------------|
| 1 | Syed-MES College | 1:15 | 2350 | Processed all 5 ft of liquid level and 0.5 ft of sludge portion (mostly sand mixed with slurry). | Y |
| 2 | Dourlo-MES college | 2:05 | 2850 | Processed the liquid portion completely .40 kg of sludge was collected .The raw liquid colour was blackish.35 kgs collected | Y |
| 3 | Usman Ali-MES college | 3:10 | 2833 | Processed liquid volume, 0.75 ft slurry processing time 30 minutes included in operation time. | Y |
| 4 | Rafik-MES college | 2:00 | 2932 | 25 kgs of sludge collected the raw liquid was blackish in colour /7 members usage /last desludging was 4 years ago. | Y |
| 5 | Abdul Karim-MES college | 2:20 | 2058 | Processed all liquid portion 7 members usage /Last desludging was 3 yrs ago .Raw liquid was in muddy colour.Treated effluent was very clear.48 kgs was desluded | Y |
| 6 | Varian -MES college | 2:00 | 1947 | Processed liquid volume and 1 ft sludge is left over because it was thick and unable to pump it by sludge pump and processed 1 ft sludge portion was kind of slurry. 6 members usage .Last desluded by 2014.35 kgs desluded | Y |

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|----|-------------------------------------|------|------|---|---|
| 7 | Bhasir Ahmed- MES College | 1:30 | 2360 | Processed the liquid portion completely .20 kg of sludge was collected .5 centrifuge bags were changed .6 members usage .Not sure when it was lst deslugged . | Y |
| 8 | Vaman Naik- MES College | 1:20 | 2100 | There was power shortage in the area.4 members usage .No idea when it was deslugged last .The pastings of the septic tank was not done throughly . | Y |
| 9 | Rafir-MES college | 1:00 | 2000 | The septage had a lot of floating particles in it .During the processing of the sludge the centifudge bag got clogged very frequently ,so we had to stop the operation .4 members usage | Y |
| 10 | Gawade- MES college | 4:15 | 2700 | 6 members usage .Tha tank was not properly plastered .It was deslugged before 5 yrs .The septage was in the colour of brick. | Y |
| 11 | Naik- Zuarinagar | 4:30 | 2600 | 6 members usage .70 kgs deslugged | Y |
| 12 | Shaik salim- Near MES college | 3.03 | 2141 | Processed liquid portion and 0.8 ft of sludge is processed and 0.7 is left over.Voltage drop | Y |
| 13 | Naik- Zuarinagar | 4:20 | 2841 | The sepatage was in light yellowish colour /6 members usage /last desludges before 5 years | Y |
| 14 | Shaiksalim- Siddarth colony | 4.65 | 2101 | Processed 4 ft liquid portion and 1.5 ft of sludge depth, collected 25 kgs of sludge in total of 7 nos of mesh bags. | Y |

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|----|---------------------------------|------|------|--|---|
| 15 | Ismail-siddarth colony | 4:10 | 2733 | Completely de-sludged 4 ft of liquid level and 0.5 ft sludge depth is left over.Blackish yellow raw liquid .6 members usage.Plastering was not done properly there were much stones and sand particles | Y |
| 16 | Zareena Khader-Siddharth colony | 2:30 | 2654 | Completely de-sludged liquid level. | Y |
| 17 | Princy johnson | 5:30 | 2835 | Completely de-sludged liquid level and 0.5 ft sludge depth is left over.4 houses with 12 members .No details of last desludging . | N |
| 18 | Nadeem-Zuari nagar | 5:00 | 2892 | Last desludged before 6 months .Usage 5 members .Indication of seepage in the tank . | N |
| 19 | Desai-Zuarai nagar | 3.2 | 2879 | We desludged all 6ft of liquid level and processed 1 ft of sludge, collected 25 kgs of sludge used in 1 no of mesh bags deployed in each conical tank and centrifugation system during the treatment. | Y |
| 20 | Vijaya-Siddharth colony | 4:30 | 2900 | Desludged before 5 yrs.8 members usage . | Y |

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|----|---------------------------|------|------|---|---|
| 21 | Mohan-MES college | 1:00 | 2465 | In 2.75 ft sludge depth, collected 1 ft of sludge depth (did not process only collection, since the particles was colloidal and clogging the mesh bags) in 2 barrels which sums to 180 kgs + 15 kgs of sludge is stored in the centrifuge system, total of 195 kgs collected and disposed at STP. | Y |
| 22 | Vinodha-Siddharth colony | 5:00 | 2000 | Processed liquid and sludge portion completely. Even though the chlorine dosing was not invloved, the effluent was odorless.Voltage drop | Y |
| 23 | Rahima-Siddharth colony | 4:45 | 2875 | Processed liquid and sludge portion completely. Only 2 to 4 " of sludge depth is left over.Last desludged before 8 years.5 users.46 kgs desludged | Y |
| 24 | D.G.Mukthi-Zuari nagar | 3:30 | 2896 | Processed liquid and sludge portion completely. Only 2 to 4 " of sludge depth is left over.90 kgs desludged | Y |
| 25 | Subhash-MES college | 3:00 | 2756 | Processed liquid and sludge portion completely. Only 3" of sludge depth is left over.The tank was not plastered properely .last desludged before 7 yrs. Users 6 | Y |
| 26 | Suresh Nayak-Zurari Nagar | 5:00 | 2900 | Processed liquid and sludge portion completely. Only 3" of sludge depth is left over.The tank was not plastered properely .Last desludged before 5 yrs.users 5 | Y |

| | | | | | |
|----|-----------------------------|------|------|---|---|
| 27 | Louis-Siddharth colony | 4:00 | 2733 | The tank was emptied completely with liquid portion being processed.90 kgs of sludge was collected . | Y |
| 28 | KB Naik-Zuari Nagar | 2:30 | 2804 | it's the 1st desludging after 4 years .5 users.Was not properly plastered .The tank was emptied completely | Y |
| 29 | Dayanand - Siddharth Colony | 3:30 | 2632 | The tank was under a structure and was only able to access through a pipe.the tank was last desludged in 2013.users 4 ppl. | Y |
| 30 | Balachandra | 3:00 | 2966 | Processed liquid and sludge portion completely. Only 2 to 4 " of sludge depth is left over.Users 9 members.No detail on last desludging | Y |
| 31 | Nazima-Siddarth Colony | 4:30 | 2896 | Processed liquid and sludge portion completely. Only 3" of sludge depth is left over.Users 15 .Last desludges before 1 year. | Y |
| 32 | Ahmed-Park street colony | 4:00 | 2895 | Processed liquid and sludge portion completely. Only 3" of sludge depth is left over. | Y |
| 33 | Sheikh Gulab | 3:00 | 2840 | Processed the liquid portion.0.5ft of sludge was left over.collected 70 kg og sludge | Y |
| 34 | Anil-Siddarth college | 1:00 | 2896 | the tank was last desludged before a year only 2 users. | Y |
| 35 | Kamal-MES college | 1:36 | 2875 | Last desludged 3 yrs ago.Users 3.110 kgs sludge collected | Y |

| | | | | | |
|----|---|------|------|--|---|
| 36 | Pablo-MES College | 1:50 | 2832 | Processed liquid and sludge portion completely. Only 2 to 4 " of sludge depth is left over | Y |
| 37 | Sheikh Muhammed- Ashhraf nagar | 3:15 | 2866 | Processed liquid and sludge portion completely. Last desludged before 3 yrs.Users 24 | Y |
| 38 | Shabina- Zuari Nagar | 4:00 | 2899 | Last desludged before 7 yrs.3 users .Not plastered properly | Y |
| 39 | Fidele-MES | 3:30 | 2900 | Last desludged 2 yrs ago.Users 3 . | Y |
| 40 | Ramesh- MES college | 4:00 | 2800 | Last desludged 3 yrs.Usage 4 | Y |
| 41 | Sreenivash Upper orchard | 4:00 | 3000 | Users 8 members .Last desludged before 2.5 yrs | Y |
| 42 | Lalsab-MES college | 2:20 | 2732 | There was no access to the tank was desludged from a pipe .No inspection hole . | Y |
| 43 | Ram-Zuari nagar | 1:10 | 2950 | The pressure started building up after certain time and there was power cut on the particular day. | Y |
| 44 | Muzafarshah- MES college | 3:20 | 2442 | Voltage fluctuation.Last desludged - <1 yrs.Users 6 members | Y |
| 45 | krishna - Zuari nagar | 2:50 | 2933 | Last desludged 4 yrs.Users 6 .Collected 140 kgs of sludge | Y |

| | | | | | |
|----|--|------|------|--|---|
| 46 | Parushuram- Mother teresa colony | 3:50 | 2900 | Last desludged 6 yrs ago .Users 3 .75 kgs od sludge collected | Y |
| 47 | Yusuf-MES College | 2:10 | 2866 | Completely emptied.users 6 .No details on last desludged | Y |
| 48 | Amam- Ameer colony | 3:20 | 2633 | Last desludged befor 4 yrs.Users 8 members.85 kg of sludge collected | Y |
| 49 | Acharia- Bharath | 3:30 | 2900 | Users 8 members .Last desludged before 2.5 yrs | Y |
| 50 | Samuel-Zuari nagar | 2:10 | 2675 | Last desludged before 6 yrs.5 members usage | Y |
| 51 | Airway- Jalvayu vilas | 1:24 | 2966 | Users 5 .70 kg of sludge collected | N |
| 52 | Meghna dileep- Zuari nagar | 1:00 | 2633 | 1 user .last desludged before 5 yrs | N |
| 53 | Babu-Zuari nagar | 2:00 | 2783 | 2 users.the structure was damaged and there was so much sand and stones at the bottom.50 kgs of sludge was collected . | N |
| 54 | Amit factory | 1:15 | 2735 | Once tha tank was opened it was found that it was not plastered properely and the rainliquid intrusion was also evident in the tank .80 kgs of sludge was collected. | N |
| 55 | Sadanand- Surya colony | 4:20 | 2733 | Users 10.Last desludged before 1 year.No chlorination added. | N |

| | | | | | |
|----|--------------------------|------|------|--|---|
| 56 | John-Dabolim | 1:00 | 2666 | Completely emptied.4 users.Deslugged before 1 year.The pressure was building because of the lengthy hose connection. | N |
| 57 | Naik -MES college | 3:20 | 2732 | Users 6.Last deslugged before 2 yrs.110 kgs od sludge collected. | N |
| 58 | Brandon-MES | 1:45 | 2833 | Users 4.Last deslugged no data. No chlorination | N |
| 59 | Swetha Naik-Sriram nagar | 2:00 | 2900 | Last deslugged 4 yrs .Users 8 members .74 kgs of sludge extracted | Y |
| 60 | Suresh-MES nagar | 2:35 | 2966 | Last deslugged in 2017.Users 5.Voltagefluctuation. | Y |