

Sewage Treatment Plant for Houseboats at H block, Alappuzha

Field Inspection Report



Date of Inspection- 13-09-2023

By

**Technical Committee of Suchitwa Mission for LWM**

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# Background

Vembanad Lake is the biggest freshwater lake in Kerala and its serene beauty has led to a spectacular rise in backwater tourism in Alappuzha. The tremendous increase in Houseboats is deteriorating the water quality and causing serious environmental impact. The most important pollution is caused due to the direct discharge of untreated sewage from houseboats.

The Sewage Treatment Plant (STP) which was operated by the DTPC Alappuzha at H block lake was the only facility available for the treatment of liquid waste generated in the Houseboat. The common STP meant for treating fecal sludge from the houseboats has been reported to be non - functional and the District Collector vide letter No. DTPC/A4/18(2023) dated 14/08/2023 requested the Executive Director, SM to assess the status of the plant and suggest a solution for making the plant operational. Accordingly, a team consisting of the following members of the Technical Committee of SM visited the site on 13/09/2023. The report was prepared based on the site visit and the records made available to the team after the inspection.

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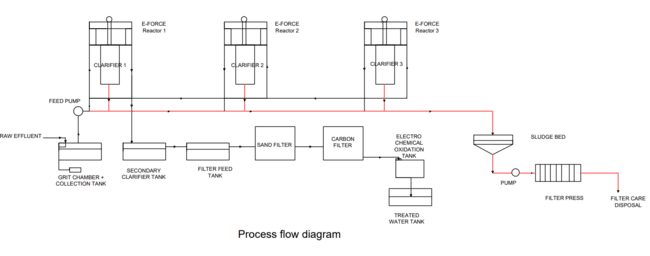
# Introduction

## Plant details

As per the details provided by DTPC, the Sewage Treatment Plant was initially established by M/s Wattreat Services, Perumbavoor, Kerala in 2014. The plant capacity was 180 KLD and the Project cost was Rs. 28,50,000/-.

## Treatment Process

A copy of the techno-commercial offer, submitted by Wattreat Services, Perumbavoor for setting up of a Sewage Treatment Plant of capacity 180 KLD was provided by the DTPC and the plant operation was based on electrocoagulation. As per the techno-commercial offer and the consent issued by KSPCB, it is seen that the plant consists of a collection tank with grit chamber, Electrolytic Cell, Clarifier, Sand filter, Activated Carbon filter, and Filter press. The process flow is as indicated below:



## Operational history

DTPC has provided a copy of the consent to operate issued by KSPCB on 15.11.2012. DTPC claims that the plant has been operational since 2012 but no record has been produced to prove the claim. However, a copy of Audit Enquiry No. 31 indicates that the common Sewage Treatment Plant started functioning from the year 2014. As per DTPC, the plant has been reported to be malfunctioning since 2019. It is understood that KSPCB has refused the renewal of consent to operate vide order no PCB/ALP/CRO/602/19 dated 02-04-2019 citing non-operation of the plant noticed during the seven visits conducted by them from 2016 to 2019.

# Maintenance done

The plant has not been functional for more than three years as per the operating staff of DTPC. It is seen that some modifications have been carried out in the plant but it is still not in working condition. It is noted that DTPC has entrusted the work of making the plant in working condition to M/s Ram Biologicals vide work order dated 26.02.2021, based on a proposal for the rectification work submitted by them. As per the records available, the agreement was signed on 27.02.2021 and the work has been started. It is understood that M/s Ram Biologicals being a consultant, the actual work was entrusted to M/s Panickers Trading Company which is claimed to have experience in the installation and operation of several other plants based on the same technology. However, the rectification work has not progressed fully to bring back the plant to operational condition due to several factors over which the firm and DTPC have made several communications alleging the non-compliance of obligations from each side as agreed. The Technical Committee has not analyzed it in detail on the above, as it is more of a contractual obligation related to the dispute and not based on any technical matter. The main aim of the committee was to assess the present condition of the plant and to find out whether the plant could be made operational by some means.

# Site visit observations

As the plant was non-functional during the site visit, the exact problems in successfully operating the plant could not be fully assessed and the functionality of the plant could not be ascertained. Hence the observations made are without conducting the trial run and only based on the visual inspection and records made available to the committee by the DTPC during the visit. Some general observations were also made by considering the seriousness of the pollution level in Vembanad Lake and the impact of discharging untreated sewage/fecal sludge from the houseboats.

**General observations**

1. The location of any such treatment plant intended for treating wastewater from houseboats should be in such a way that it is accessible within a reasonable time by the houseboats and has to be located conveniently in between their daily trip routes. As the present treatment facility is located at a very remote location beyond the daily trip route, the houseboat crew may tend to bypass the mandatory desludging process stipulated by the authorities. Even though the desludging is obligatory for them to get the license renewed, they tend to resort to other shortcuts in obtaining the license without getting the desludging done. Such actions on the part of the crew can lead to wanton discharge of untreated wastewater into the water body and pose a serious threat to the water body. In case the location is far away from the normal route they undertake or the destination, they may tend to undertake only the minimum mandatory trips that are required for renewal of license and there is a chance for untreated wastewater to be discharged into the lake. It shall also be ensured that all plants established for treating wastewater from houseboats are provided with an uninterruptible power supply to avoid situations arising out of the plant not working due to power failure when the houseboat arrives for desludging and treatment.
2. As per the report prepared by KSPCB titled “*Survey of Pollution from Houseboats*”, the recommended size of bio tank prescribed for houseboats varies from 150 litres to 2400 litres depending on the number of bedrooms and person occupancy. As per the guidelines published by KSPCB dated 15.02.2023, the daily water requirement for cooking and hygiene in houseboats is estimated as 50 litre per person per day. It also prescribed that the tanks for the collection of entire wastewater generated in the houseboat shall be provided in the hull and the discharge from the bio-toilet is directed permanently using a rigid pipeline. However, there is no mechanism to ensure that untreated wastewater is discharged into the water body. Even if a fecal sludge treatment plant is set up, for treating the sludge from the bio tanks of houseboats, the remaining wastewater has to be treated. An ideal option would be to ensure that all the wastewater including the overflow from the bio tank is collected in a tank and is taken to a treatment plant for the treatment as and when the tank is full. However, this may not be practical as it necessitates either the installation of larger capacity tanks in the houseboats or warrants frequent emptying and treatment at a plant that is located on a land parcel. Hence a better and feasible option would be to install onsite systems capable of treating the entire wastewater generated and only the fecal sludge is retained for treatment in a common treatment.
3. Any treatment system designed shall be based on the actual analysis of the wastewater or sludge to be treated and shall not be based on assumptions as any variation in the process may cause partial treatment or non-compliance with the discharge norms prescribed.
4. To enhance the efficiency and accountability of septage/fecal sludge collection, transportation, and treatment systems, it is strongly advised to implement an IoT-based tracking system. This system will enable the monitoring of sewage disposal onto barges or at sewage treatment plants (STPs) in a secure manner. A sensor placed within the onsite sanitation tank of houseboats will activate once the tank reaches its capacity, automatically notifying the Barge tank or the control station at DTPC. Additionally, it is highly recommended to employ a software system similar to the septage management system successfully implemented by Thiruvananthapuram Corporation. Such a system would effectively deter any unauthorized discharge of sewage into the lake. Furthermore, it would facilitate houseboats in accessing the septage collection service through a user-friendly mobile application. This system can also facilitate the transparent collection of tipping fees, ensuring a fair and accountable process.
5. It is better to install this type of plant in DBOT mode with 10 years of O&M so that the original contractor who is designing the plant is responsible for successful operation and maintenance. Any issue related to the working of the plant beyond the committed period also shall be referred to the original contractor and a third party is to be consulted only if the original contractor is reluctant to take up the work. Also the DPR for any project has to be prepared in full with all drawings, specifications, and estimates and has to be kept in safe custody for future reference in the event of non-working of the plant. Since DTPC has no specialist in the sector, it is better to vet the process design/DPR through KWA or Suchitwa Mission.

**Site-specific observations**

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1. The technology selected for the plant is the Electrocoagulation (EC) process which is based on the coagulation of the contaminants from the aqueous medium by the cation produced from the electrolytic oxidation of iron/aluminum anode. With optimized conditions, EC provides significant removal efficiency, and reduced retention time, and it eliminates additional coagulant loading. Hence, the selection of EC as technology for the plant is not an issue as the sludge is to be processed in batches and not in a continuous manner as in other sewage/septage plants. However, it is not clear whether the plant operation has been optimized and whether the plant was working efficiently during the time when it was reported to be working.
2. The plant consists of three aluminum anodes and three stainless steel cathodes in the electrocoagulation reactor. In the electrocoagulation system, anodes are sacrificial. Hence these have to be replenished from time to time, say four times a year. Considering that the water used for the dilution of sludge may have higher conductivity due to the presence of salinity, the replacement period can vary but the plant cannot run for a long period without replacement of electrodes. However, it was known from the DTPC authorities that no such electrode replacements have taken place so far. Hence it is to be presumed that the plant might not have been working properly.
3. In the drawing, it is noted that alum dosage is indicated in the process flow. This is confusing as the EC process does not require alum dosing. Hence whether the plant was working on manual dosing of alum and subsequent coagulation and settling during its operation is not clear.
4. There seems to be a difference of opinion regarding the functionality of the plant after its commissioning as claimed by DTPC. As already mentioned in the report, the available records indicate that the plant started functioning only in 2014, but during the seven visits made by KSPCB during the period from 2016 to 2019, the plant was not working. Though DTPC claims that the non-availability of power is the reason for the not working of the plant during all these visits, it is pertinent to note that the KSPCB has also observed that the KSEB meter readings were constant and did not vary appreciably during all these visits which indicates nil energy consumption during these periods. Upon verification of the DTPC Logbook, payments received from the houseboat are entered for the period of 2016-2018. The committee during their visit has requested DTPC to provide any evidence such as KSEB bills or any other inspection reports supporting the claim of earlier operation of the plant. This is crucial because if the plant has been operational since its commissioning, there is a possibility of bringing it back to functioning. However, if there are inherent flaws, rectification may be more challenging. DTPC has only provided a copy of the manual register which they have maintained in the office indicating acceptance of payments from houseboats during the period from 2016 to 2018 for availing the facility.
5. As per the copy of the techno commercial proposal submitted by M/s WATTREAT (original contractor), it is seen that the capacity of the plant is indicated as 180 KLD, but the design parameters are based on 20 KLD since this is a batch operation, this invariably means nine independent batch operations; but the dimensions of the electrocell and clarifiers are inadequate for such an operation. Each of the three electrocell tanks and clarifiers has a holding capacity of 0.5 KL which totals up to a capacity of 1.5 KL for a single batch operation. Assuming a reaction time of 15 minutes, and no interval between the reactions, the maximum treatment capacity for even a 24-hour operation would be 144 KLD. Hence it is to be presumed that the plant is actually designed for a smaller capacity than claimed.
6. Also as per the above-referred document, the design Biochemical of Oxygen Demand (BOD) is based on sewage (200-400 mg/l) whereas the sludge from the houseboats will have characteristics of septage/fecal sludge which is higher than that of sewage. Data on the incoming BOD of sludge treated in the plant is not made available. Hence it is assumed that while the plant was working, the incoming sludge would have been diluted with the water so that the BOD matches with the design value. This might have been possible as plenty of water is available in the vicinity itself for diluting. However, whether the dilution has been carried out based on the actual parameters of the sludge is not known. This might have resulted in the non-compliance of standards or not working of the plant resulting in the closing down.
7. The plant is seen not in working condition. It is seen that the electrodes are replaced with new sets of electrodes as part of the rectification works. In an EC process, the removal rate depends on specific operational parameters such as the initial concentration, current density, pH, material, number, and arrangement of the electrodes and the distance between them, the conductivity of the water to be treated, as well as the treatment time. Since the original design parameters were not made available to the committee, it could not be ascertained whether the replaced electrodes could produce the same performance as the old one.
8. It is noted that there are two new components that are not indicated in the original process flow and are added to the system during the repair period. One of the components which is an ionizer is found to be redundant here. Also, the necessity for an ultrafiltration unit is also not justified. It is not known whether the system has been added as a replacement for sand filters and carbon filters, the efficiency of which is doubted by the consultant who has prepared the proposal for the rectification work.
9. It is seen that there is no presence of residual settled sludge in the collection tank though the plant is reported to be not working for a long time. The DTPC operator has reported that no desludging of the collection tank was done. This indicates a possibility of cracks or fissures in the collection tank through which the water from the surroundings might have entered the tank and the sludge got washed out. A detailed examination by competent experts is needed to ascertain whether the collection sludge holding tank is leakproof.
10. There is no method of proper sludge handling existing in the plant. This necessitates a comprehensive reassessment and enhancement of the plant's sludge management provisions.
11. The electrical installations and wirings within the plant are currently posing significant safety concerns. Specifically, there is a glaring issue with the insulation of cables, which is a critical component for ensuring the safety of both operating personnel and the overall operation of the plant. Given that the process relies on electrocoagulation, where the current is supplied directly to electrodes in contact with the sludge, this situation demands immediate attention.

# Recommendations.

1. Before proceeding with any repair work to restore the existing plant to a functional state, it is crucial to first assess its structural stability. This assessment, particularly focusing on ensuring that the collection tank is free from any cracks, should be conducted by either the Public Works Department (PWD) or certified structural engineers from a reputed engineering college. Only after confirming the structural integrity, the DTPC shall proceed with subsequent repair works. In case the collection tank only is having an issue, the possibility of providing alternate pre-fabricated tanks or synthetic tanks is an option. The capacity of the collection tank shall be optimized based on the actual design parameters.
2. If the structure is found to be in good condition, it's advisable to move forward with the necessary repairs to restore the plant to working condition. Though the plant's actual capacity with the current setup may not meet the initial claims and even if it operates satisfactorily to handle wastewater at a reduced capacity, the provision of such a treatment facility to treat the fecal sludge from houseboats ensuring better performance would be a positive development as the lake is already under serious threat of pollution.
3. The treatment facility is designed for sewage and the BOD considered for design is 200-400 mg/l. In order to ensure that the plant is operating efficiently, the BOD of the incoming sludge is to be made to the design range by suitable dilution. This needs strict monitoring of incoming BOD and the dilution. This has to be ensured during further rectification works.
4. The current facilities available for managing sludge are deficient in both effectiveness and efficiency, which could result in negative impacts on both the environment and plant operations. Hence there should be improved sludge management so as to ensure that the treated sludge is not dumped in the surroundings or let out to the water body. The possibility of using the dried treated sludge as soil conditioner may be explored.
5. A comprehensive evaluation of the electrical infrastructure is essential, followed by the implementation of necessary measures such as cable replacement or the reinforcement of insulation. These steps are vital to mitigate the associated risks and establish a safe working environment. A facility for uninterrupted power supply shall be made available.
6. The rationale behind involving a third-party agency (M/s Ram Biologicals), while the initial firm responsible for the plant's design and construction (M/s WATTREAT) remains operational, is unclear. This becomes particularly crucial in the absence of any documentary evidence detailing the complete design and drawings. Also, another agency (M/s ABSOPURE) which has no experience in the technology has been called for to evaluate the rectification work based on which the rectification works have been assessed as unsatisfactory. It would have been better to let the original company help with the repairs after checking the structural stability. However, most of the tasks outlined in the latest work order for repairs have already been undertaken by a different agency, it is advisable to convene a meeting between them so as to figure out the best way to finish the repairs. This will help to solve the problem and move forward.

In order to avoid the inconvenience caused to houseboats due to the non-functioning of the STP, the following recommendations are also made:

1. A sucker barge of ample capacity can be engaged for collecting sewage from the houseboats. The capacity of the barge shall be ascertained only after ascertaining the number of houseboats, their wastewater tank holding capacity, and the usage pattern. The treatment of the collected sludge in the existing treatment facility at Kumarakom can also be considered.
2. Exploring the potential use of the mobile treatment unit developed by the WASH Institute offers a forward-thinking approach to addressing sanitation needs. This specialized unit provides a flexible and efficient solution, particularly in areas where a fixed treatment facility may not be feasible. However, there should be a comprehensive plan for handling and safe disposal of the sludge generated from the treatment.
3. Once the Cherthala FSTP becomes operational, DTPC may explore the option of getting the fecal sludge from houseboats treated in surplus capacity available with the same. The feasibility of having such an arrangement may be worked out with the municipality prior to proceeding with the above proposal. Additionally, DTPC will be responsible for organizing the logistics of transferring sludge from the houseboats to honey sucker trucks for treatment.

| **Sl. No.** | **Name & Designation** | | **Signature** |
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