AQUATRON®- BASED AEROBIC BIO-DIGESTION SEWAGE TREATMENT SYSTEM

Case Study of Konark Hospitals, Jeedimetla, Hyderabad

PANGAEA TRADETEAM PVT LTD, HYDERABAD

EXECUTIVE SUMMARY

Konark Hospitals in Jeedimetla, Hyderabad produces a daily wastewater volume of 13,000 liters which was being released untreated into the municipal drain. In order to stop the release of untreated sewage and achieve PCB compliance, an Aquatron® solid-liquid separator along with a simple water treatment plant and ozonator were installed at the hospital on September 3rd 2019. The Aquatron® unit completely removes faecal solids from wastewater and thereby enables straight-forward treatment of separated flushing water and other grey water. The total project cost was about Rs 6.2 lakhs and the monthly operating cost works out to about Rs 5,000. This includes all media refills for the filters as well as all power consumption for the ozonator and one pump. There are no separate operator charges. The test results for outlet water from Konark's Aquatron®-based STP are within the PCB parameter limits.

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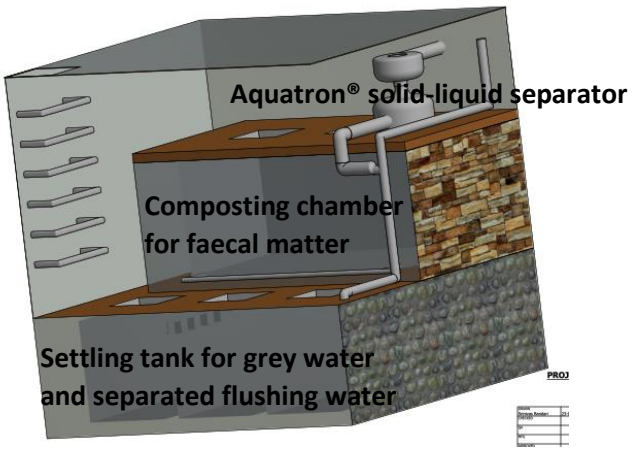
1.0 THE STARTING POINT

Konark Hospitals is a 100-bedded multi-specialty hospital in Jeedimetla, Hyderabad.

All sewage from the hospital was being released into the municipal drain but in line with new regulations, the Pollution Control Board asked the hospital to set up a sewage treatment plant. As the hospital is in the city and there is very limited space around it, installing an STP was a challenge since traditional STP technology needs a lot of space for tanks and other equipment. To overcome this challenge, the hospital decided to go for an STP based on Aquatron®, which minimizes the tank space requirement and any smell issues. The purpose of the Aquatron®-based system is to treat the wastewater with minimal power consumption and maintenance up to PCB standards.

The building has some 19 toilets which were connected to one Aquatron® unit (placed in a newly constructed underground space) by redirecting existing pipes. Aquatron® removes faecal solids from the wastewater flow and thereby makes it straightforward and odor-free to treat the daily 13,000 liters of wastewater from flushing, showers and handwash. An ozonator, activated media filter, carbon filter, micron cartridge filter and bag filter are sufficient to treat and polish the water.

Konark Hospitals. Blue shed on the right houses the STP filters.



Underground setup next to the blue shed.

2.0 PROJECT DETAILS

2.1 Specifications

The hospital building along with all plumbing were at least 10 years old so Aquatron® had to be retrofitted and an underground space had to be created to house the required tanks.

As the first step, toilet locations and the existing pipe layout were analyzed and the optimal way to connect the toilets to Aquatron® was decided. Dimensions of the composting chamber and settling tank were determined according to daily usage data received from the hospital.

All 19 toilets in the property are now connected to a single Aquatron® unit which separates faecal solids for natural decomposition in a 2400-liter bio-chamber. The bio-chamber was dimensioned for up to 100 residential users.

Under the bio-chamber, there is an 8700-liter settling tank (see diagram on previous page), consisting of three compartments separated by baffle walls. The settling tank is used to collect all grey water as well as separated water from Aquatron®. Ozonation takes place in the last compartment of the settling tank. After ozonation, the water is further polished with an AMF, ACF, MCF and bag filter.

2.2 Overview of the system

Sewage Treatment Plant:

Underground:

1. Aquatron® for solid-liquid separation

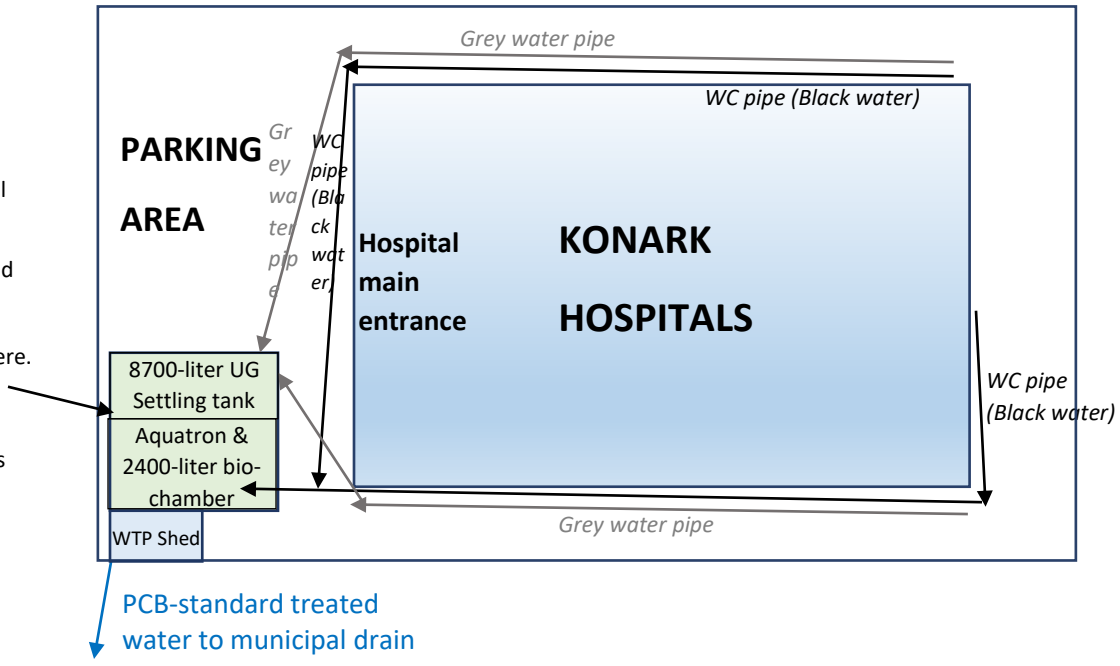
2. 2400-liter bio-chamber for faecal matter decomposition

3. 8700-liter tank for grey water and separated flushing water. Any remaining suspended solids settle here. Ozonation also takes place here.

Aboveground:

4. Water from the 8700-liter tank is pumped up for polishing in AMF, ACF, MCF & bag filter. After treatment, water is released into the drain.

5. The ozonator unit is placed in the same aboveground shed.



2.3 Execution

The execution had three phases: Underground space and tank construction, plumbing work and water treatment plant installation (together with the protective shed).

2.3.1 Underground space and tanks

The 3m x 3m x 3m underground room together with all tanks, plastering, waterproofing and slabs took about 15 working days to complete for one mason and two helpers. This is excluding the curing time for the top slab. The below series of images should illustrate the construction process.

Day 1
Breaking of existing tiles and 250 mm PCC bed

Day 2
JCB work: digging 3 m x 3 m x 3 m pit

Day 3
Pit dressing

Day 4
Settling tank brickwork started

Day 5
Settling tank brickwork completed with dividers

Day 6
Plastering and waterproofing on the outside and inside

Day 7
Settling tank plastering and bed completed

Day 8
Settling tank slab and manholes

Day 9
Curing

Day 10
Bio-chamber walls constructed

Day 11
Plastering of bio-chamber and other internal walls

Day 12
Bio-chamber slab

Day 12

Top slab centering

Day 13

Top slab

Day 15

Finishing touches and setting of manhole lids.

2.3.2 Plumbing

Modifications to existing plumbing and new plumbing took totally 30 working days to complete. This mainly involved diversion of the existing WC downtakes to Aquatron®, creating new grey water lines, connections from the settling tank to the water treatment plant and pipework within the water treatment plant. There was an existing underground pipe with manholes leading out to the municipal drain so instead of letting the downtakes enter that, the relevant pipes were cut and a new pipe without manholes was drawn along the wall. Any bends (horizontal and vertical) were done using 45 degree and Y bends.

2.2.3 Installation of Water Treatment Plant and Ozonator

To complement the removal of faecal matter by Aquatron® and provide a sufficient treated water for latest NGT standard, a water treatment plant with an activated media filter, activated carbon filter, bag filter, micron cartridge filter, ultrafiltration plant and UV was installed at first. However, the UF plant was unable to cope with the heavy chemical and biological demand of the hospital. As a measure to provide a permanent, problem-free solution, a 5mg ozonator was installed and the UF setup was removed.

Original WTP setup with AMF, ACF, bag filter and UF.

Current WTP setup with ozonator, bag filter, AMF, ACF and MCF.

3.0 COSTS

3.2 Project costs

The total cost for the client came up to approximately Rs 6 lakhs, out of which Rs 2 lakhs was civil work and Rs 4 lakhs was for equipment, plumbing etc. miscellaneous costs**.**

The CAPEX cost for the entire project is about 70% of the cost of conventional MBBR STP equipment for a similar site. MBBR technology requires larger tanks for aeration as well as for collection of sludge and treated water, which imply a higher cost of civil work. Apart from this, conventional systems need frequent equipment maintenance and repairs and often a specialist operator too.

In regard to the operating costs, the monthly power bill for the Aquatron®-based system is about Rs 3000 which covers both the ozone generator and the pump. Other operating expenses consist of ACF media replacement at an annual cost of Rs 12,000, 12 MCF filter replacements at an annual cost of Rs 5000 and bag filter refills at an annual cost of Rs 2000. Taking into account occasional cleaning of the underground space, the total monthly maintenance cost works out to Rs 3000 or so.

Annual O & M costs for Aquatron®-based STP at Konark Hospitals

Item	Action	Frequency	Approx. cost/year
Underground room	Cleaning and disinfection	Annual	
Aquatron	Cleaning from inside and outside	Annual	
Bio-chamber	Emptying compost	Annual	
Bio-filter mat	Pressure wash	Annual	₹ 12,000.00
Barrel & filter	Pressure wash	Monthly	₹ 6,000.00
Pump	Repairs	Occasionally	
AMF	NA	NA	
ACF	Media refill	Annual	₹ 12,000.00
MCF	Filter refill	Monthly	₹ 5,040.00
Bag filter	Filter refill	Monthly	₹ 2,000.00
Ozonator electricity			₹ 6,000.00
Pump electricity			₹ 30,000.00
Total			**₹ 73,040.00**

The annual total cost being about Rs 73,000, the monthly total O&M cost works out to about Rs 6000.

4.0 WATER TEST RESULTS

The treated outlet water was tested for all the PCB parameters as follows:

TEST REPORT

Issued to

Konark Multi-Specialty & Fertility Center
Plot Nos:13 & 14,
Pipeline Road,
Behind Deevan Dhaba,
Petbasheerabad,
Jeedimetla, Hyderabad,
Telangana 500055
Ph. 9849661515

Date of Receipt	11th December, 2019	**Date of Test Performed**	11th - 16th December,2019
Date of Reporting	17th December,2019	**Report No.**	PLCPL/19-20/Konark/12/01
Sample particulars	STP Outlet, No. of sample 1 (One), packed in two containers (1 PVC+1 Bsbg) of one liter		
Test required	pH, TSS, COD, BOD, Turbidity, Odour, Total Nitrogen, Ammonical Nitrogen as N, Phosphorous as P.		
Sample collected by	Client		

Discipline: Chemical Testing
Group: Water

EFFLUENT SAMPLE ANALYSIS

No.	Parameters	Units	Method	Results	GSR 422 E Limits
1	pH value	--	IS 3025 (Part 11)	7.5	5.5 – 9.0
2	Turbidity		IS 3025 (Part 10)	10	NS
3	Odour	-	IS 3025 (Part 5)	Agreeable	NS
4	Total Suspended Solids	mg/L	IS 3025 (Part 17)	53	100
5	Chemical Oxygen Demand	mg/L	IS 3025 (Part 58)	28	250
6	BOD, 3 days at 27°C	mg/L	IS 3025 (Part 44)	6	30
7	Ammonical Nitrogen as N	mg/L	IS 3025 (Part 34)	6.1	50
8	Total Nitrogen	mg/L	IS 3025 (Part 34)	56	100
9	Phosphorous as P	mg/L	IS 3025 (Part 31)	5.5	NS
10	Oil and Grease	mg/L	IS 3025 (Part 39)	9	10

NS: Not specified in GSR 422 E.

P. Saritha
Analyst Signatory
(P. Saritha)

Authorized Signatory
(M. Ravi Kiran)

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Date of Reporting	17th December,2019	**Report No.**	PLCPL/19-20/Konark/12/02
Sample particulars	STP Outlet, No. of sample 1 (One), packed in 500ml of Microbiological bottle		
Test required	Total, Fecal Coliform& E-Coli		
Sample collected by	Client	**Page No.**	2 of 2

Discipline: Biological Testing
Group: Water

Results

S. No.	Parameters	Units	Test Method	Results
1	*Total Coliform*	MPN/100ml	APHA 23rdEdition, 2017	700
2	*Fecal Coliform*	MPN/100ml		58
3	*E. Coli*	MPN/100ml		94

P. Saritha
Analyst Signatory
(P. Saritha)

Authorized Signatory
(M. Ravi Kiran)

5.0 SUMMARY

The Aquatron®-based sewage treatment system at Konark Hospitals was commissioned on September 3rd 2019 in order to achieve PCB compliance and put an end to releasing 13 KL of untreated wastewater into the public drain every day. The Aquatron® separator eliminates the need to treat faecal solids by separating them from wastewater for direct, natural decomposition. Hence, the entire wastewater (separated flushing water and grey water) can be treated by using only an ozonator, AMF and ACF instead of a much heavier conventional STP setup. By the date of this report, about 4 months from commissioning, the decomposition of faecal matter has been as expected and the filtration process has yielded the required water quality as evidenced by the lab test certificates.

The project took a total of 15 days of civil work, 30 days of plumbing work and 5 days of WTP installation work to complete.

Both the capital expenditure as well as operational expenditure were lower than for a conventional STP of a similar capacity: the system cost Rs 6 lakhs including all civil, labour and materials whereas the cost of a conventional STP would be in excess of Rs 10 lakhs. The total monthly operating cost for the Aquatron®-based system is about Rs 6000 which is less than half of what it would cost to operate a regular STP.