ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

A Case Study on Sewage Treatment Plant (STP), Delawas, Jaipur

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Abstract:
The basic needs of human survival, i.e. water, food & shelter are no more easily accessed resources. The ever-increasing demand of human being cannot be meet successfully through present conventional resources. The indiscriminate population explosion raises the demand of food and fodder for continue life on earth. Due to domestic waste, sewage and industrialization, our environment (rivers, ponds and other natural resources) is polluting. In Indiancontext, the situation is very drastically. The situations has only be handled by not throwing sewage directly to natural resources and reuse the treated water that ultimately reduces the overall demand of fresh water. However, India treats only 20% of its sewage and rest fall directly into rivers causing severe problems. The Problem faced by government and scientists in India is the mentality of people about the sewage treated water. This paper focuses on the mentality of people and coup it with the present situation and effectively reduces the overall demand in scientific healthy manner. The main aim of paper is to use the treated water in a way; whichdoes not harm human and environment along with consideration of mentality of society. The work area is STP Delawas, PratapNagar, Jaipur, which is setup in 2006, and operation &management is under the charge of M/S VatechWabag Ltd. The survey for knowing people's concern conducted in Sitapura area is the source of knowledge about people's views. The STP collects water from 25Km surrounding with gravity flow & no pumping is use for sewage upliftment for sending it to plant, which is a great achievement for itsengineers. The STP covers the area from Vidhyadhar nagar to Pratap Nagar, Sanganer. However, in study the authors also notice some illegal and careless practice of the plant and advice them to solve as soon as possible.

Keywords: sewerage, sewage, TSS, gravity flow, MLVSS, BOD, COD, MLD.

I. INTRODUCTION:

A STP can be express as the factory, which prevents the environment from waste produced by human beings. When the waste produced is beyond the limit of environment to decompose, STP is only the solution. The present STP reduces the waste produces manure& energy and helps us to keep our rivers, ponds clean. Various types of STP_s are introducing each day, according to the requirement and economic view.STP in Delawas is working on ASP (activated sludge process). It consists of two phase capacity of each is 62.5MLD. It is a best example of STP known for not using any chemicals in whole treatment process & not using any pump in sewerage system for bringing the sewage to STP from 25 Km. The farthest point of sewerage is 25Km and nearest is 1Km from the STP. This type of STP_s can also be termed as energy saver of a country. As it recharges the groundwater, flow freely and be used for irrigating purposes. The STP of Delawas consist inlet section, which is common for both phase of STP. The raw sewage first collects here.

Figure.1. Inlet section of STP
(Captured from the site)

After commencement of water in inlet section it is screened through automated screens. Screens are inclined at an angle of 45 degree.

Figure.2.Showing automated screening (captured from the site)

After removing the solid waste from water, it transfers to grit chamber for removing the grit; the grit obtained from this chamber is highly nutritious for crops. The chamber is trapezoidal in shape for easy collection of grit. The whole process is fully automatic.

Figure.3. Showing the inner view of grit removal (captured from the site)

Figure.4. View of mechanism of grit separator.

After grit separation, the water is send to primary clarifier for further processing through Parshall Flume for regulating the flow velocity. This is generally made at an angle varies from 1 - 12degree in STPs. By this mechanism, we are capable to increase the retention period in primary clarifier.

Figure.5. view of Parashall Flume

In primary clarifier, the sludgeremovethrough gravity separation method. Then it transfers to secondary clarifier passing via aeration tank for activated sludge process.

Figure.6.Primary clarifier (captured from STP site)

In aeration tank, oxygen is providing with the help of blower for survival of bacteria. A small quantity of sludge returned from secondary clarifier to aeration tank for activated sludge process. Air blowers are being operated with variable frequency drive (VFD). Man Machine Interface(MMI) is provided through programmable logic control system (PLC) for handling anaerobic sludge digester.

Figure.7. Aeration tank

From aeration tank, the wastewater goes to secondary clarifier. This is the final treatment process for water in this plant. The water from here opens to Amanisah runnel finally.

Figure.8.condary clarifier

The sludge collected at different steps of process sent to the sump and then to the digester dome. The sludge is dewatered by using centrifugal pumps and the thickened sludge is sent to dome for anaerobic digestion. This process gives biogas and digested sludge, which use as manure by local farmers. The gas produce is using for revenue collection. The gas sent to CNG bottling plant, whichgives them cost price of 6.50 RSPNm$^{3.}$

Figure.9.View of sludge digester.

For smooth running of plant and follow the BIS standards for treated water, lab is setup on the STP site. The laboratory is fully furnished and all necessary equipments for testing water is available here. In this laboratory, the water is testing at every stage for ensuring the health of the STP.

Figure.10. showing disposal process of sludge (captured from site)

Figure.11. Innerview of laboratory setup (captured from site)

A model of the whole plant is also available at the site for point of study or knowing the whole process of STP. The authors when rush to the site are welcomed and introduced first by model before actual prototype. The model situation is in office building.

Figure.12.STP model (available at Plant office).

Objective of the study:

The chief objective of this case study is to check sustainable development with using treated water without any harmful cause to environment with the satisfaction of common residents of the area. By a keen study on STP Delawas, we try to understand its waste to energy generation, waste reduction & treated water consumption in a economical way. The study also includes a wide survey, which helps the Nagar Nigam, Jaipur to develop the process in people's acceptable way.

Study Area:

The study area is confined to STP Delawas, Pratap Nagar,sector 28, Jaipur and nearby area for mass survey through google form. The data collected from STP office is useful to analyze rather the treated water fit for any other use

Figure.13. Satellite image of the plant (captured from google earth)

or not and relate this result to the result obtained from the online survey through google form in the area to solve out the problem without harming environment and even not breaking sentiments of locals.

Historical Background:

One of the most ancient systems of wastewater management was constructed in Mohenjo-Daro near Indus river (Pakistan) at about 1500B.C. some traces of sewerage development and advancement also seen in Rome. After this, this process is widely accepted all over the world. For treating sewage of Jaipur, RUIDP constructed STP based on activated sludge process in Delawas and handed over it to JMC (Jaipur Municipal Corporation).Unit-I commissioned on 15-2-2006 and unit II in March 2011. From 2009 onwards, the STP starts production of biogas, which further reduces the power consumption cost and dependability on power supply by JVVNL (Jaipur ViddhutVitran Nigam limited).

II. RELATED WORK:

PrachiN. Wakode, Sameer U. Sayyad(2014) study and evaluate the performance of 25MLD STP at kalian(Raj.). DharmrajJangid, Akhilendra B. Gupta(2014) study the waste to energy concept of STP, Delawas. N. Muthukumaran&N.K. Ambujan (2003) compare the treated water of Tiruchirappali city with FAO irrigation standards and find it fit for irrigation. They also conduct a survey for knowing people's view on using this water. SunitaLakhiwal, Dr. Surendra Singh Chauhan(2015)

study the seasonal variation in physic-chemical parameters of secondary treated water from STP, Delawas.

Identification of Problems Associated: Authors travelled along the confined area and try to understand the disposal method for treated water by STP Delawas. This fact came into light that the water after secondary treatment left open in AmanishaNallah which ultimately meet to Dhund river and pollute it. Local farmers for irrigation purpose use the water illegally and without any noticeable information to local bodies. There are no measures taken to remove phosphorus and nitrogen from treated water, which ultimately can cause eutrophication in Dhund River. On the governmental level, there is no plan for reusing or proper disposal of treated water. The treated water even not disinfected before drain it into runnel (nallah) and in open run smells bed to passersby. This would prove a fatal mistake in case of any road accident or if animal drink this. Local farmers for utilizing as manure for their fields take the sludge produce from the plant away. However, on official level, there is no record of this sludge and even no proper method of disposal of sludge. Due to RIICO industrial area nearby and cloth dying, the STP receive toxic waste from industries but no testing of heavy metals concentration at inlet and outlet of plant is done on regular basis. The treated water is not using by STP to make its surrounding area green, no plantation on large scale with treated water seen except in front of office and generator room. No holding tank is there for wastewater reuse in an organized manner.

Survey Questions:

The mass survey is based on the some basic questions including nine multiple-choicequestions, which shows the thinking of people on the issue. Out of nine, seven questionscomprise yes or no answer based questions & two questions are of more choice. The questions of yes or no type are:

- Are you aware about the fact that in Delawas, Pratap Nagar sewage treatment Plant exists?
- Are you aware about the fact that this treated water is using in nearby farms to produce crops?
- Are you comfortable in using these products, which are producing by this treated water?
- Are you comfortable in using biogas fuel in your kitchen?
- Are you comfortable in using the manure produced in this plant in your own garden?
- In your opinion, treatment plants should be setup on large scale.
- Have you participated as an active member in any survey based on STP before this?
- Questions comprise more than two choices:
- In your opinion, which treatment should be suitable for disposal of sewage?

- (•) STP
- ( ) Pit Method
- ( ) BOTH

- If given a chance to use the treated water, where would you like to use it?

- ( ) IN agriculture
- ( ) In industries
- ( ) Flow in the river
- ( ) If any other decision (Please mail on 2015pcecivpritesh @poornima.org and tick on this option)

These questions and their answers given by the subjects are the key resource for the author for generating this case study. Some subjects suggest reusing this water recharging the arid lands but authors consider it in option of "flow in the river" because both optionsgive a way to coup the water naturally.

Graphs based on answers of survey:

Result and Analysis Based on data available:

Notation Used

RSI - Raw Sewage Inlet

AT - Aeration Tank

FO - Final Outlet

POF- Primary overflow

Based on data available at plant office, we analyses the variation in pH, TSS, COD, BOD of the various parts of the STP.

pH of the different sections of STP:

Parameters	Mar-16	May-16	Oct-16
RSI	7.47	7.45	7.38
POF	7.51	7.49	7.53
AT	7.50	7.50	7.54
RAS	7.33	8.18	7.32
FO	7.68	39.83	7.69
Digester	7.07	6.95	9.85

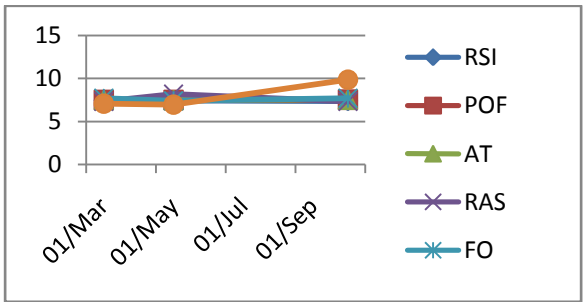

Figure.14. ()showing variation in pH

TSS of different sections of STP:

	Mar-16	May-16	Oct-16
RSI	587	470	578
POF	228	206	225
FO	40.10	40	139.87

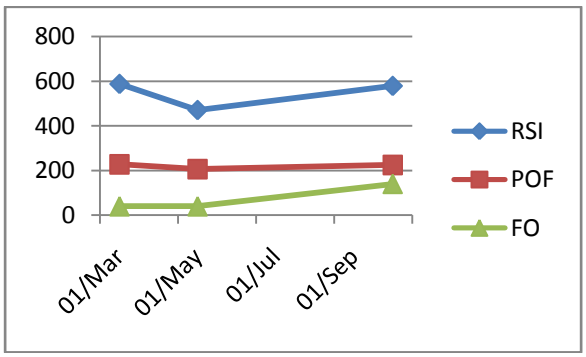

Figure.15. ()Showing variation in TSS

COD of different sections of STP:

	Mar-15	May-16	Oct-16
RSI	802	800	800
POF	360	360	357
FO	140.90	136	24.97

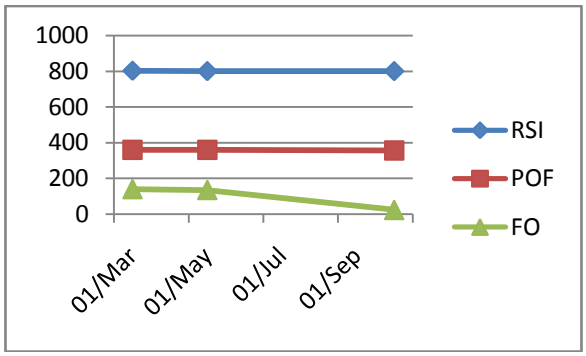

Figure.16. () Showing variation of COD

BOD of different sections of STP:

RAS	`	Digester
	25.39	
	6.95	
	25.00	

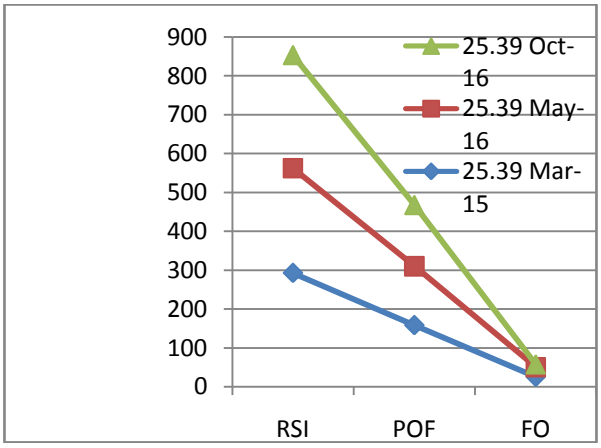

Figure.17. () Showing variation of BOD

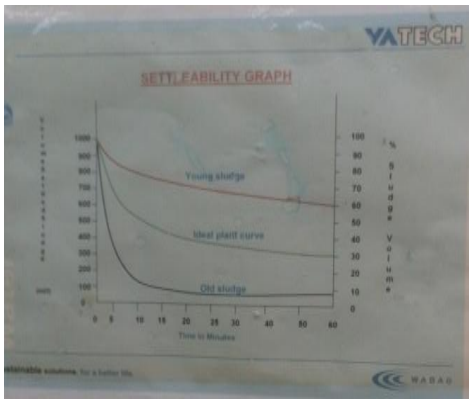

Figure.18. () Graph captured from the lab of STP.

III. RECOMMENDATION:

The authors view the whole STP and its confined region and collect local views for analyzing the problem and try to give best solution. The STP Delawas recommended to establishing a storage tank for proper utilization of treated water. The authors also advices them to use chlorination and tertiary treatment of water to reduce its smell and to avoid problem of eutrophication. In authors view, the water should be used in agriculture, horticulture but a legalize pattern should be followed. For proper security of STP, boundary should be fenced with throne wiring.

IV. FUTURE PLAN OF STP:

On visiting the plant and meeting with M. Vankatesh(currently chief engineerof Plant), we come to know that future plan is for establishing tertiary treatment units with coordination of TATA in future if required.

V.CONCLUSION:

The STP is currently working well and farmers can use this water, as it cannot harm the crops, even increase the yield of crop. However, the irrigated crops should be of commercial purpose as people strongly opposed to use this water for farming food. The STP produced biogas, which can helps in meeting about its 75%-80% energy requirement for operation and maintenance. The concept of waste to energy of the designer is a subject of appreciation. The treated water can also be used for recharging groundwater or for horticulture and planting trees on both sides of road of the area. This practice will definitely again help in reducing power consumption as no need for pumping water from ground for planting trees and for commercial crops irrigation. This type of STP should setup on large scale so they will help India in improving health and sanitation with sustainable development. The survey report shows the open mind of majority of the subjects who take part in this survey enthusiastically.

VI. ACKNOWLEDGEMENT:

The author acknowledge with sincere gratitude towards the help provided by Mr. Raju Mahawar (lab technician of STP Delawas, Jaipur) as an employee of M/s vatechwabag Ltd, and shows sincere gratitude towards Mrs. Asha Kumawat who stimulate us to this work. We also feel thankful toour guide Mr. Rahul Sharmawho shows timely guidance helps us a lot during the whole case study.

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