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Comparative Study between Two Sewage Treatment Plants and Their Conclusions (Delawas Jaipur and Delhi STP)

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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 met 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 Indian context, 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; which does not harm human and environment along with consideration of mentality of society. The work area is STP Delawas, Pratap Nagar, 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 up lift ment for sending it to plant, which is a great achievement for its engineers. The STP covers the area from Vidhyadharnagar to Pratap Nagar, Sanganer. However, in study the authors also notice some illegal and careless practice of the plant and advice then 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.



Figure.1. Inlet section of STP

This type of STP, 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. 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 Figure.3. Showing the inner view of grit Removal

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. 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 - 12 degree in STPs. By this mechanism, we are capable to increase the retention period in primary clarifie.



Figure.4. View of mechanism of grit separator



Figure.5 view in Parashall Flume



Figure.6. Primary Clarifier



Figure.7. Aeration Tank

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

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, which gives them cost price of 6.50 RSPNm³. 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 equipment's for testing water is available here. In this laboratory, the water is testing at every stage for ensuring the health of the STP.



Figure.8. Secondary clarifier



Figure.9. View of sludge digester



Figure.10. STP model

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.

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 an

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 goggle form. The data collected from STP office is useful to analyze rather the treated water fit for any other use or not and relate this result to the result obtained from the online survey through goggle form in the area to solve out the problem without harming environment and even not breaking sentiments of locals.



Figure.11. Satellite image of the plant

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 ViddhutVitrان Nigam limited).

II. RELATED WORK

Prachi N. Wakode, Sameer U. Sayyad (2014) study and evaluate the performance of 25MLD STP at Kalia (Raj.). Dharmraj Jangid, Akhilendra B. Gupta (2014) study the waste to energy concept of STP, Delawas. N. Muthukumar and N.K. Ambujan (2003) compare the treated water of Tiruchirappalli 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. Sunita Lakhiwal, Dr. Surendra Singh Chauhan (2015) study the seasonal variation in physico-chemical parameters of secondary treated water from STP, Delawas.

2.1 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 Amanisha Nallah 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 bad 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.



2.2 Survey Questions:

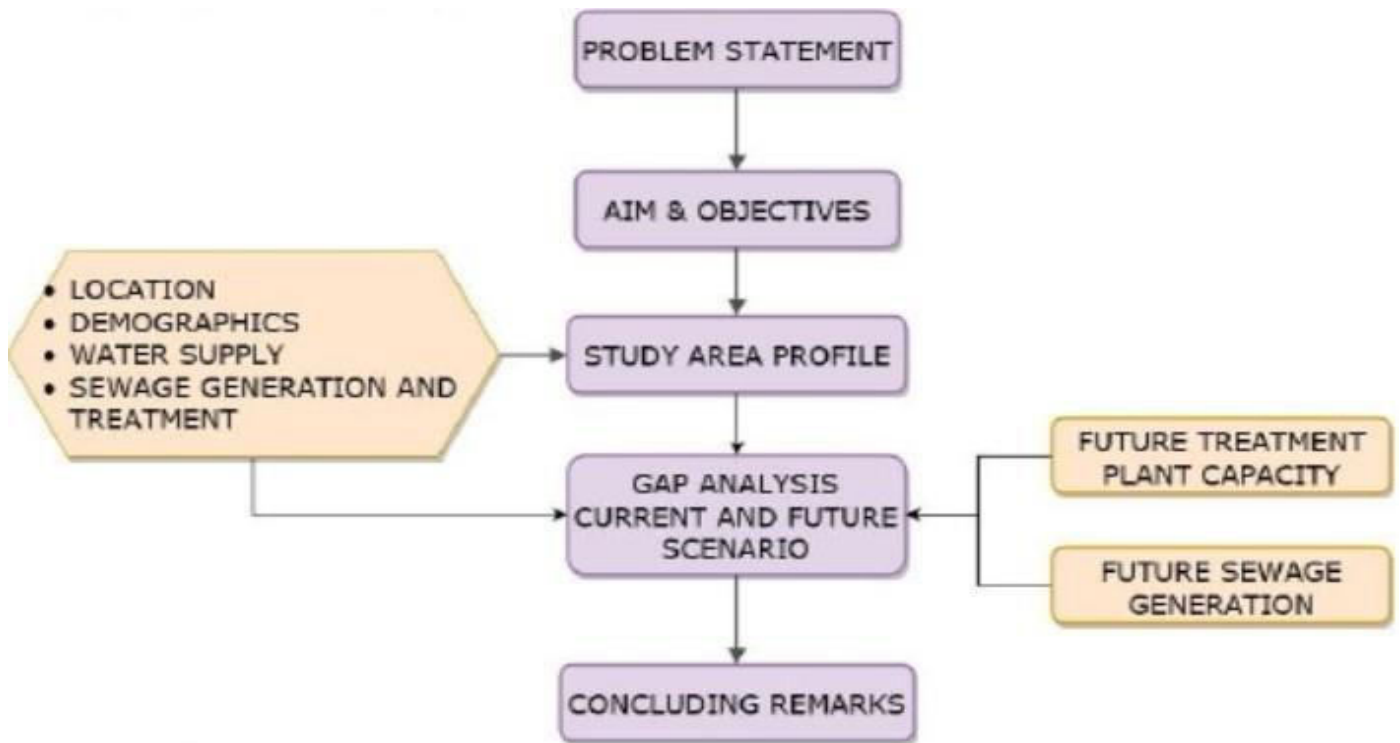
The mass survey is based on the some basic questions including nine multiple-choice questions, which shows the thinking of people on the issue. Out of nine, seven questions comprise yes or no answer based questions & two questions are of more choice. The questions of yes or no type are:

- 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?
- Have you participated as an active member in any survey based on STP before this?
- In your opinion, which treatment should be suitable for disposal of sewage?

Some subjects suggest reusing this water recharging the arid lands but authors consider it in option of “flow in the river” because both options give a way to coup the water naturally.

III. METHODOLOGY

Study was started with identification of general infrastructure problems in Jaipur and Delhi. Turns out that the treatment of waste water generation is major problem in both the cities. After identification of the problem, the aim, objectives and the methodology were framed. Firstly, the study is carried out for geographical conditions and existing sewage conditions of cities. Primary and secondary data is collected from several sources.



1. Pumping the water is pumped up with the help of pipes of various diameter varying from 32mm to 75mm.
2. Fine Screening is the step which involves the removal of fine impurities from the sludge. This step is important because removing the fine impurities like jute bags, scrap of plastic, hairs, threads etc. will reduce the cost of treatment.
3. The sewage water from screen chamber flows to grit chamber, where coarse particles of sand, ash and clinkers, egg shells, bone clips and inert materials are removed by method of Grit Separation.
4. The sewage water from grit chamber flows to primary clarifier where sedimentation of settleable solids takes place. Primary clarifier also reduces the organics load on secondary treatment units.



5. The sewage water from primary clarifier flows to aeration tank, where the sewage containing waste organic matter is aerated and micro-organisms metabolize the soluble and suspended organic matter.
6. The waste water from aeration tank flows to secondary settling tank, where separation of biological sludge takes place. The efficient separation of the biological sludge is necessary for ensuring final effluent quality and also for return of adequate sludge to maintain the MLSS level in the aeration tank.
7. The Primary sludge Digestion is the step in which anaerobic sludge digestion takes place. Inlet is the place where all the sewage of the city is collected for the further treatment of turning this waste water in a usable form.
8. Initially the water is sent for coarse screening to separate out the waste of big size example plastic bags, etc.

3.1 MATERIALS AND METHODS:

A total of 14 samples were collected for the study in the year 2007–2008. These 14 samples were representing seven inlets and seven outlets of the same STP. The pH and conductivity were measured from unfiltered water samples. The pH was measured by Rachho (model no. 123) pH Meter. Systronics conductivity meter was used for the measurement of conductivity and TDS. The bicarbonate content was determined following the potentiometric titration method (American Public Health Association (APHA) 1995). Nitrate was estimated by brucine method. Nitrate and brucine react to produce a yellow color, the intensity of which can be measured at 410 nm. The method is suitable for the samples with a very wide range of salinity. Sulphate was analyzed by turbidimetric method. Suspended matter and original color of the sample may interfere with the sulphate determination. Suspended matter can be removed by filtration. Presence of silica in excess of 500 mg/l and large quantity of organic matter may affect the satisfactory precipitation of barium sulphate. The ascorbic acid method (APHA 1995) determined phosphate. Optical density was measured at 650 nm using Cecil Spectrophotometer (model no. 594). Chloride was determined by spectrophotometer. Cations such as Na, K, Ca and Mg were analyzed using atomic absorption spectrophotometer, Shimadzu-AA-6800. Excessive sodium content in water renders it unsuitable for soils containing exchangeable calcium and magnesium ions. The exchange capacity of water is expressed in sodium absorption ratio (SAR) by sodium percentage was calculated by using equations.

3.2 TREATMENT OF SEWAGE IN JAIPUR:

Sewage treatment is the way of expelling contaminants from wastewater, essentially from domestic areas sewage. Physical, synthetic and natural procedures are utilized to expel contaminants and create treated wastewater that is more secure for the earth. A by-product of sewage treatment is generally a semi-strong waste or slurry, called sewage sludge. The sludge needs to experience assist treatment before being appropriate for disposal on land or water. Jaipur Jal Board is in charge of treatment and transfer of waste water through a proficient system of around 7000 Km of Sewage lines crosswise over Jaipur. There are 5 Sewage treatment plants in Jaipur, out of which 3 were found to be operational and 4 were non-operational. Table shows the break-up of STPs in Jaipur.

Table: Break-up of STPs in Jaipur

Sl No.	Status	No. Of STP	Installed Capacity (MLD)	Actual Treatment (MLD)
1.	Operational	11	2799.82	2202.56
2.	Non-operational	3	140.84	0
3.	Total	14	2940.66	2202.56

3.3 VERMIFILTRATION TECHNOLOGY

Vermifiltration was found as one of the new, creative and sustainable innovation. It comprises of a natural reactor containing media that filters organic material from sewage. It depends on the symbiotic connection amongst earthworms and microorganisms. Verm filters provide an aerobic environment and wet substrate that encourages small scale living beings development as a biofilm. Micro-organisms perform biochemical degradation of organic matter present in wastewater, while earthworms expel the unsafe pathogens in wastewater by eating them up. This



technology involves all the three primary, secondary and tertiary forms of treatment. In all Verm filtration removes nearly 90% of BOD, 80% of COD and pathogens. It also reduces ammonium content.

Advantages of this technology and why it is better than other conventional technologies are:-

- 1) It has high treatment efficiency given the low space requirement.
- 2) Odorless and cost efficient technology
- 3) Energy is not required for aeration, so these filters can be considered 'Passive Treatment' systems.
- 4) Resulting vermifiltered water is clean and disinfected enough to be reused for irrigation and in parks and gardens.

IV. CONCLUSION

The idea of STP is very promising step that each city should plant. It gives us the liberty to reuse the sewage water. By using the STP, water is available for variety of uses like it can be discharged easily to any water bodies, can be used for irrigation and cultivation purpose and what not. STP also develop biogas which is used to make different form of energy available for government, specifically mentioning, Jaipur STP produces electricity of 12-19 kWh. Moreover, production of methane also contributes to the unavoidable advantage of STP. The idea of waste to vitality is the prime concern that draws the attention. In Jaipur STP the water is discharged to the canal which is running all over the city and finally ends up in a water body. Further this water is used for irrigation purpose. The sludge generated from the secondary treatment process is used as manure besides this, the production of biogas is enough for running the plant and also available for the government uses. Jaipur STP lacks the tertiary treatment process which makes it suppressing in terms of efficiency than Delhi STP. But still Jaipur STP is a very effectively treating sewage of Jaipur.

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