

Study and Implementation of Zero Liquid Discharge System in Shivaji University Campus

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Abstract— The water is most significant piece of our daily routine on the grounds that each experiencing things needs water to endure. Water is limited source and consequently we confronting the huge influx of water issues everywhere on the world. To diminish the pressure of water deficiency just as water contamination issues and to strengthen a natural supportability, it is generally essential to make moves towards sparing water and lessening the pace of water age. Zero liquid delivery structures are executed all through the world as a critical wastewater the heads framework and allude to treatment measures in which therein no arrival of wastewater into surface water. In Shivaji University, we actualize this ZLD strategy to reuse the water into grounds just and not to release into waterway.

Keywords—Zero Fluid Discharge, Constructed Wetlands, WTP, WWTP, CETP, STP, ETP

I. INTRODUCTION

In a global economy under which freshwater is an ever more precious asset, industrial processes, if the water is recycled, threaten its accessibility on various reasons. Many production activities consume water, then lessen the water distribution to the atmosphere or other mechanisms, or consequently contaminate and release water damaging the local environment. It is a course of action of treatment that help to crash all waste water from a structure. ZLD implies a treatment strategy wherein the plant delivers no liquid exuding into surface waters, thus absolutely clearing out the biological pollution related with treatment. Aside from this advantage, a ZLD procedure likewise utilizes wastewater treatment, reusing, and reuse, thus adding to water protection through diminished admission of new water. Zero Liquid Delivery is a key wastewater system that guarantees that the present wastewater doesn't show up in nature. Compensation of wastewater through re-use and a short time later recovery and re-use is practiced for present-day reasons. In this way, the ZLD is an illustration of a shutdown without a discharge. In relation to the extreme strategy of ZLD, it prepares for monetary favorable circumstances by recovering salts and other engineered blends. ZLD main emphasis is on economically decreasing wastewater and generating recyclable, clean water, thus further making profit and going to benefit the environment. ZLD frameworks use advanced treatment procedures to clean and reuse essentially the entirety of the delivered wastewater.

II. OBJECTIVE

1. To study the quantity of the wastewater generated in Shivaji University Campus.

2. To analyze the physical, chemical and biological parameters of wastewater in the SUK.
3. To find the remedial measures to improve the efficiency of the existing wastewater treatment plants.
4. To study and propose 4R technology for the implementation of the zero liquid discharge system.

III. METHODOLOGY

A. Study Area

Shivaji University, founded in 1962 in Kolhapur, Maharashtra, India. College grounds are 853 sections of land (34519 km²) and are labelled after Chhatrapati Shivaji Maharaj, the leader of the Maratha Kingdom. It was launched on 18 November 1962 by none other than leader of India, Sarvepalli Radhakrishnan. Yashwantrao Chavan with Balasaheb Desai started to lead the pack in setting up this college. Kolhapur, Sangli, and Satara go under its locale with 279 associated schools and perceived organizations. In 1962 the University began working with 34 partnered schools and around 14,000 understudies with 5 Post-graduate Departments on the grounds. Today, the number of subsidiary schools has increased to 293 and the undergraduate body has increased to 2.50,000 with 34 postgraduate departments nearby. This campus provides education in four significant resources of Humanities, Science and Technology, Commerce and Management and Faculty of Interdisciplinary Studies.



Fig. 1 Main Building Of Shivaji University

B. Water Sources in SUK

Shivaji University is the solitary college from the territory of Maharashtra which is independent in water. There are three tanks on the grounds which supply water for normal use where also on the grounds supplies drinking water. There is additionally water filtration plant for filtration of water which supplies water for all offices. For drinking reason college has set up a Reverse Osmosis Plant (RO Plant) for clean drinking water for everyone on the grounds. During flood circumstance in the period of August, 2019, college has provided RO water

to destitute individuals from city liberated from cost. Rooftop top downpour water gathering is additionally been polished and water gathered been shipped off water tanks nearby.

Sr.No	Sources	Capacity in Liters.
1	Bhasha Bhavan Lake	22.15 cr
2	Music Department Lake	5.20 cr
3	Sutar well	4.00 lakh
4	Well near Sports department	4.87 lakh
5	Well near Chemistry department	3.00 lakh
6	Well near Synthetic track	5.00 lakh
7	Shinde well	3.00 lakh
8	Three farm ponds	40.00 lakh

Fig. 2 Total Capacity Of Water Reservoirs On Campus In Liter.

The approximate total floating population in university campus is around 20000 to 30000 peoples per day. Water utilization can be characterized as water utilized for all exercises which are completed on grounds from various water sources. This remembers utilization for every private corridor, scholastic structures, nearby and on grounds. Wastewater is alluded as the water which is moved off the grounds. The wastewater incorporates sewerage, home, lobby water utilized in cooking, showering, garments washing just as wastewater from synthetic and natural labs which eventually going down in sink or seepage framework. The total water demand of university campus and all departments per day as per population is 740,000 liters/day.

C. Methodologies Used For Wastewater Treatments in SUK

In the SUK grounds, we utilized the two strategies for treatments of wastewater are PHYTORID innovation and Activated Carbon technique. By utilizing this strategies we can treats the wastewater created in the grounds and reuse the filtered water in grounds territory just and cannot released into the waterway. Wastewater reusing was considered as best ideal choice of water use. Underlining this reality, Shivaji University has set up two reusing plants in 2008-09 and 2013-14. First plant was set up close to ladies' hostel where 50 thousand liter water is reused every day. Another plant is set up close to student's inn at Department of Technology, where 50 thousand liter water is reused.

D. About PHYTORID System

In the Shivaji University grounds, there are 3 PHYTORID frameworks plants are accessible. One is working and other two are under development. The PHYTORID framework plant in Shivaji University grounds, having limit of 50000Litre every day. This plant is situated at the inn regions in the grounds of college to treat the wastewater/sewage produced. The beneath picture demonstrated the PHYTORID effluent disposal facility of DOT, Shivaji University, Kolhapur. This is regular water cleaning measure which doesn't utilize power/power, synthetic dosing, and hefty upkeep to

decontaminate water. It utilizes common assets like plants, stones, rocks, and so on for cleansing of water.

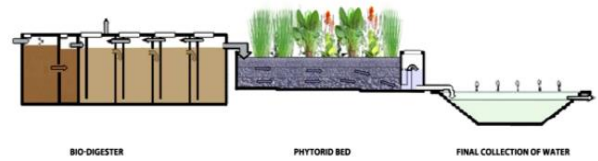


Fig. 3 A Typical Phytorid System



Fig. 4 Phytorid Treatment Plant

- 1) The process involves following steps:
 - a) *Constructed wetland beds*- The plants were relocated into the bio filter tanks which are filled by the layers of permeable stone and laterite stone. The water is authorized to enjoy the bio channel tank and encountered the response. The water after phytoremediation measure includes in coagulation measure utilizing alum and sludge digestion process is finished by vetiver powder.
 - b) *Biodigesters*- It comprises of rocks/stones of various sizes organized as layer through which waste water is permitted to pass. In this manner it acts like normal channel. It contains of various puzzles that allow the section of water via the chamber.



Fig.5 Bio Digester Tanks Attached To the Constructed Wetland Beds



Fig. 6 Treated Water Collection Tank

E. Activated Carbon Column Method

The initiated carbon measure followed by sand filtration and carbon adsorption is a compelling strategy for eliminating oxygen requesting mixes just as the shading conferred to homegrown sewage by natural materials. The motive of sewage remedy is the removal of those undesired contaminations and the healing of customary water fine. The pollutions are normally pre-wiped clean with different treatment cycles, as an example, flocculation, sedimentation and additionally natural treatment. The enacted carbon is typically utilized in a last handling step to eliminate the most troublesome contaminations like drug miniature toxins. Adsorption is the cycle by which Activated Carbon wipes out substances from water. The activated carbon utilized for cleaning (granular or powder) needs to satisfy a wide range of errands:

1. Removal of natural synthetic substances and colorants
2. Reduction of follow substances like synthetic compounds or drugs
3. Enormous decline of lingering COD.



Fig. 7 Typical Activated Carbon Plant

In the Shivaji University campus, there is one Activated Carbon Column Plant with the 50000L every day limit which set at rear of the University Girls lodging in the grounds. This plant is utilized to treat wastewater produced in the inn and close by some different structures. This plant is utilized to eliminate all pollutants from the wastewater and get the treated water to use for additional reusing or reuse reason.



Fig. 8 Activated Carbon Column Method Treatment Plant in Shivaji University



Fig. 9 Activated Carbon Filter House

a) *Filter House*- In this filter house the contaminated wastewater is treated and removes the all harmful

compounds with help of activated carbon. This is the primary filtration process which is economical in nature. This filter house used to treat water and the activated carbon is used in the treatment to remove or control unpleasant taste and odor, also to remove organic compounds.



Fig. 10 Treated Water Collection Tank

b) *Treated Water Collection Tank*: In this tank the treated water is collected and distributed to the hostel building for reusing purpose. This treated water is used in the toilet flushing in the hostel bathrooms as well as it is also distributed towards the gardening area with the help of drip irrigation pipelines. About 46% water is used in the toilet flushings daily, so there is a need for reuse the treated wastewater for toilet flushing.



Fig. 11 Pipes Connected To the Treated Water Collection Tank

F. TESTINGS AND RESULTS

1) PHYTORID System Plant

Table1: The Standard Permissible Values Given By Environmental Protection Rules,

Parameters	Inlet wastewater	Outlet (Treated water) after PHYTORID Bed
pH	5.5 to 9	5.5 to 9
Color	Black/ Dark	Colorless
BOD (mg/L)	80 to 300	<30
COD (mg/L)	200 to 600	<100

From the experimental analysis, following parameters are tested and values are obtained. These values were compared with standard permissible values given by Environmental protection rules, 1986 and the results are as follows:

Table 2: Average values of results after testing some samples

Parameters	Results in range between	
	UT	T
pH	7.9 to 8.4	7.6 to 7.9
COD(mg/L)	215 to 230	180 to 200
BOD (mg/L)	70 to 90	60 to 70

1) *Activated Carbon Column Method*

Table 3: CPCB Standards for Delivery of Effluent after Treatment in STP are:

Parameters	Value
pH	5.5 to 9.0
Colour	Dark gray to colorless
BOD (3Days 27 ⁰ C) mg/L	100
COD (mg/L)	250

Table 4: Average Values of results after testing of inlet and treated wastewater are as follow:

Parameters	Results in range between	
	UT	T
pH	7.95 to 8.4	6.95 to 7
Colour	Dark gray to colorless	
COD(mg/L)	410 to 450	250 to 300
BOD (mg/L)	240 to 270	80 to 100

The all values taking after treatment are getting into the standard limit given by CPCB standards. The color of wastewater is also changed after treatment as dark gray to quite colorless. So here the Activated carbon plant is working well, but there is need to work on the proper maintenance of plant in at least after 6months.

G) 4R CONCEPT OF WASTEWATER MANAGEMENT FOR IMPLEMENT ZLD

Various wastewater decrease measures are accessible in which 4R idea is best as ecological contemplations. 4R methods Reduce, Reuse, Recycle and Recovery of wastewater. This concept can be utilized to improve end result around zero fluid launch framework in Shivaji university grounds, Kolhapur. We should spread awareness and conservation of water needs in order to decrease the rate of waste water produced. We will campaign in all divisions to increase awareness of the benefits of the 4R concept. Campus has tremendous green grounds of around 853 sections of land. Drip water framework and sprinkler water framework structure have been presented at 15 school gardens which helps with saving water and enhancements by allowing water to stream steadily to the basic establishments of plants. The objective is to put water direct into the root zone and limit dispersal to save water.



Fig.12 Water supply in the Garden area

The treated water is utilized for the nursery and grounds beautification through trickle lines across nurseries. The nursery of Old and New library, garden neighboring sculpture of Karmaveer Annabhau Patil, nursery of Humanities building and north circle garden is flooded with the reused water from the reusing treatment plant close to Ladies Hostel. The nurseries in the region of Department of Technology are

inundated with the reused water from their hostel. The treated water can be further used in toilet flush also to reduce the high water demand for it. Also this purified water will used in the different washing operations in the campus or educational buildings such as for washing floor tiles, Campus roads etc. Recovery implies the supplements are recuperated from wastewater. There is a wastewater produced at the University PHYTORID plant from lodgings, instructive offices and the wastewater bottle. That wastewater likewise has an amount of muck. This sewage can be settled by giving maintenance time-frame in the essential assortment tank. This setttable muck can be physically or precisely hauled out of the tank and this slop can be treated as the manure utilized for the grounds plants. By utilizing this idea of 4R we can decrease/reuse the wastewater, consequently there is no requirement for removal of wastewater in the waterway.

IV. CONCLUSION AND SUGGESTIONS

In Shivaji University Campus, there is two treatment plants are accessible. With the assistance of this treatment plants we can take the usage of ZLD framework. The treated water is used for the garden and campus beautification through drip lines across the gardens. The wastewater treatment plants can be restarted by doing upkeep and tasks just as new built wetland plant can be planned according to the prerequisite of wastewater age rate every day. Installation of CETP to treat laboratory waste from all departments can be done. In future there might be a work on the restarting plant or the new plant configuration like even stream developed wetland (HFCW) or vertical stream built wetland plant (VFCW) frameworks.

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