RECYCLING OF SULLAGE FOR THE CAMPUS OF AN ENGINEERING COLLEGE

[1]Kishor S Wani, [2]Mujahid Husain, [3]Sanjay P Shekhawat
SSBT's College of Engineering and Technology, Bambhori, Jalgaon, MS (India)
spshekhawat@rediffmail.com

ABSTRACT

SSBT's College of Engineering and Technology (SSBT COET), Bambhori, Jalgaon is a residential campus, harboring over 1500 residential and 1500 floating population. It is located in an arid region with very less rainfall and highest rate of evaporation. The ground water level in the campus had been at 700 feet on upon a time. There is acute water scarcity in the region. It is hard to sustain greenery in this condition. However the campus of SSBT's COET is maintaining itself as lush green with lawns over 5 acre area. This has become possible only due to the recycling of sullage for irrigation purpose. The campus recycles over 100 m^3 water per day with indigenously developed technology. The technology has become a role model for the region and has got appreciation in the mass media and the administration of Kaviyitri Bahinabai Chaudhary North Maharashtra University has also taken the design from the SSBTCOET for its campus. It is a firm and impressive attempt towards sustainability. This paper inscribes and articulates the success story of SSBTSCOET to inspire other to adopt the technology under identical conditions. The paper gives the technological details also for the benefit of readers.

Key words: Sullage, recycling of wastewater, adsorption, sustainability.

INTRODUCTION

Water is the most precious resource for human civilization. All ancient civilizations were developed on banks of rivers only. When ISRO confirmed presence of water on moon, it was considered to be one of the greatest news in the space exploration history. The finding of fossil fuel on Mars or even the rains of diamond on Jupiter did not fetch that much attention. Reason is that finding of water in space can pave the path for sustaining extra terrestrial life. Whilst, fossil fuel and diamond can have substitutes, water cannot. In the twenty-first century, water scarcity has come up as a gigantic problem to mankind [5; 7]. Mr Koffi Annan has once said, if there is a third world war, it will be for water only. It is important to recognize that water is a non consumptive and renewable resource. In none of the activities, domestic, agricultural, industrial, power generation, navigation etc, it is consumed chemically. In fact it is subjected to a natural hydrological cycle. The drop of water which a modern man drinks is the one which was once upon a time drunk by dinosaur! [2] To recognize the renewability of water is the key to successful water management. Nature recycles the water through its cycle. As per needs, mankind can also recycle it using the help of technology [3].

The present work is also concerned with the recycling of water. It describes the sullage (bathroom wastewater) of the campus of SSBTCOET. It describes the origin and importance of this idea, its success in course of time, design and technological details and scope.

The SSBT's COET Campus:

In the north east region of Maharashtra State, the city of Jalgaon is located on ordinates 72.56 N and 21.003 E. It is 250 m above Mean Sea Level. It is an extremely arid region with rainfall in the range 650 mm/year and radiation 200 – 350 W/m^2[1]. With high radiation, less rain fall, heavy winds and less forest cover, it is a region with world's highest evaporation rate. In this region the SSBT;s College of engineering and technology Bambhori, Jalgaon is established in the year 1983, at the auspicious hands of Her Excellency Smt Pratibha Patil. Today it is a leading educational institute of not only the region, but the country. The institute is located in a

campus of 25 acres on high banks of river Girna. The plateau on which the college is located is basalt rock with least capacity to store water. The ground water table was below 700 feet. The location of the campus is shown in figure 1:

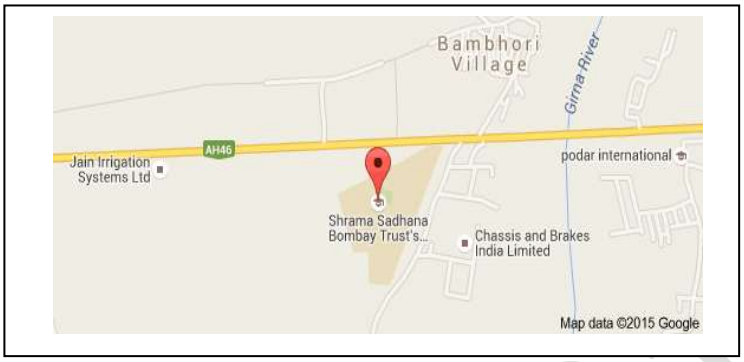

Fig -1 Location of the Campus of SSBT COET

An Ariel view of the campus is as follows:

Fig -2 Ariel view of SSBTCOET Campus.

The campus is like an educational hub. It has colleges like SSBT's College of Engineering & Technology, SSBT's College of Pharmacy, SSBT's College of arts Commerce and Science etc. It is a residential campus with three hostel and quarters for teaching and non-teaching staff. There are around 1500 residents. The day scholar students and teachers are also around 1500.

The campus has two pipe system for wastewater management. That is, the wastewater coming from latrine and bathroom plus kitchen, are taken in separate pipes. This feature has helped a lot in the design of sullage recycling scheme for the campus.

Generation of Sullage

Sullage is the grey water coming out from bathrooms and kitchen. It is relatively cleaned and can be used for gardening purpose with little treatment. There are two sullage recycling plants designed in the campus near to girls' hostel and boys' hostel respectively. The generation rate of sullage is assessed for SSBTCOET as follows:

Population of staff quarters (Block A & B) = 240.

Population of Professors' quarter, including girls hostel annex =120.

Population of Girls Hostel (main) = 225.

Total population= 585.

Total Quantity of wastewater from bathrooms considering 115L/day=115* 585= 67275 L/day.

Population of boys' hostel: 700

Total quantity of sullage from boys' hostel: 700*115 = 80500L/day.

Conceptual Design scheme for bathroom waste wastewater:

The treatment consists of Skimming followed by adsorption by coconut husk [4; 6].

Note: RL difference of 30 cm between subsequent units is provided to compensate head losses and maintain the gravity flow.

Technical design:

Design of skimming tank:

Flow =67275 L/day. Assume DT = 10 min

Volume = 67275*10/(60*24) = 467L ~ 500 L

Assume depth = 1 m, Area = 0.5 m^2, Assume length = 1 m., Width = 0.5 m, provide 0.75 m

The detailed drawing:

Design of adsorption unit:

It will be a tank of depth 1 m, and lateral dimensions 60 cm x 60 cm. The coconut husk will be filled in a mesh container as described in the figure 5.

Volume of coconut husk required:

60 x 60 x 100 = 360000 cm^3 = 360 L =0.36 m^3. Considering the bulk density to be 0.6, the weight ~ 216 kg.

The husk should be replaced weekly and disposed off as solid waste.

The sample design given here is for girls' hostel. Same can be done for boys' hostel also for econsidering the appropriate flow.

Snapshots of the plant:

CONCLUSIONS

The sullage recycling plant is working in the campus since year 2012. It has maintained the campus lush green in the hot and arid climate. It is a role model of success for similar campuses. It is hoped that it will inspire others to follow the similar model in their premises also. in fact the campus of SSBTCOET is a green campus in many aspects with solar power generation, water harvesting, solid waste composting etc. It is committed to sustainability.

REFERENCES

1. Anna Mani and S Rangrajan (1982) Solar Radiation Over India, Allied Publishers Pvt Ltd, Bombay.
2. Brahma Chellaney (2015) Water, Peace and War, Rowman and Little field Publishing Group, London.
3. Julie Trotier (2008) Water crises: Political construction or physical reality? Contemporary Politics, 14 (2).
4. Metcal and Eddy Inc (2003) Wastewater Engineering: Treatment, Disposal and Reuse, Tata McGraw Hills Publication, New Delhi.
5. Priscoli J D and Wolf A T (2010) Managing and Transforming Water Conflicts, Cambridge University Press, Cambridge.
6. Punmia B C and Ashok Jain (2002) Wastewater Engineering, Laxmi Publications New Delhi.

7. Taylor P L and Sonnenfeld D N (2017) Water Crises and Institutions: Inventing and Reinventing Governance in an Era of Uncertainty, Society and Natural Resources, 30 (4).