

A Study and Analysis of Waste Water in Sewage Treatment Plant at S.C.S.V.M.V Campus

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Abstract

A greater volume of fresh water will be saved if the reusing of waste water will comes into practice. This study aims to analyse the quality of waste water and find its suitability for the gardening purpose. The waste water should be collected before and after the treatment from sewage treatment plant in the campus. The raw waste water and the effluent were examined for physical, chemical and biological characteristics. The results showed that free ammonia, iron and the biological parameters exceeding their limits given by BIS. Thus, the treated wastewater in SCSVMV Campus was found to be a valuable resource for multiple purposes that can add value other than disposal.

Keywords: *Bacteriological parameters, Disposal, Effluent, Free ammonia, Sewage treatment, Waste water*

I. INTRODUCTION

Human waste or more technically referred to as 'excreta' is defined by Chamber's Concise 20th Century Dictionary as "useless matter discharged by animal alimentary", animals being humans in this context. Excreta are made up of a solid

matter, faeces, and a liquid matter, urine and are essentially an organic compound [1]. The constituents making up the compound are carbon, nitrogen, phosphorous, sulphur and hydrogen. Fats, carbohydrates, enzymes, proteins, trace elements, pathogens and many different

bacteria are also present. It is necessary to treat human waste or excreta for many reasons, but the most important reason is to preserve health. Untreated human excrement contains a variety of pathogenic organisms, which include protozoa, bacteria, viruses and eggs of helminthes that are disease-causing organisms[2]. The presence of these in the environment transmits various types of diseases. They could be, Water borne where pathogens are present in water supplies, Soil-based where the excreted organism is spread through the soil, Insect-vector borne where the pathogen is spread by insects that feed or breed water e.g. flies and mosquitoes. Faecal-oral transmission routes by which pathogens from faeces reach the mouth by either hand, clothes food etc. The term treatment means separation of solids and

stabilization of pollutants [3]. In turn stabilization means the degradation of organic matter until the point at which chemical or biological reactions stop. Treatment can also mean the removal of toxic or otherwise dangerous substances (for e.g. heavy metals or phosphorous) which are likely to distort sustainable biological cycles, even after stabilization of the organic matter [4]. This study aims to examine the quality of treated waste water and its suitability for irrigation purposes as shown in Table 1.

The quality of sewage can be checked and analyzed by studying and testing its

- physical characteristics
- chemical characteristics
- Bacteriological (biological) characteristics

Table 1 Quality Standards for Effluent Irrigation as per IS: 3307-1965 [13]

SL.NO	Parameters	Limit as per IS:3307 – 1965 (mg/l)
1.	BOD	500
2.	PH	5.5 - 9
3.	TDS	2100
4.	Oil And Grease	30
5.	Chlorides	600

6.	Boron	2
7.	Sulphates	1000
8.	% of Na with respect to Total Content of Na, Ca, Mg & K.	60%
9.	Arsenic	0.2
10.	Cyanide	0.2

STUDY AREA

Chandrasekharendra Saraswathi Viswa Mahavidyalaya (S.C.S.V.M.V), formed under the aegis of Sri Kanchi Kamakoti Peetam Charitable Trust in 1993, is located in a sprawling complex of 50 acre at Enathur, at a distance of about 4 Kilometres from Kanchipuram and 80 kilometres from Chennai as shown in Fig 1. More than 3000 students gets enlightened and it has its own unique infrastructure.



Figure1. SCSVMV Campus

MATERIALS AND METHODS

Estimation of quantity of water required by the University

In order to estimate the amount of sewage produced from the university, it is required to know the amount of water demanded by the university. It is done by knowing the population of the university and the per capita demand as presented in Table 2.

Table 2 Determination of Water Quantities

S. No	Description	Population	Per Capita Demand (Lit)	Water Required(Lpcd)
1	Hostel	2000	135	2.7×10^4
2	Civil Block	150	45	6750
3	ECE/B.Ed	1110	45	49950
4	EEE/Admin	420	45	18900
5	S&H	750	45	33750
6	E&I/Sanskrit/MCA	200	45	9000
7	Library	50	45	2250
8	Canteen	50	70	3500
9	Mech/MBA	750	45	33750

Thus water demand or required by our university is calculated to be 1, 84,850 L/ day

Estimation of Quantity of Sewage

Average Qty of Water supplied = 1,84,850 l/day

Assuming 80% of this is produced as sewage = 80% of 1,84,850

Quantity of sewage = 1,47,880 l/day

= 147.88 m³/day

Considering Peak factor to be = $\frac{148 \text{ KLD}}{3}$

Maximum quantity = 3 X 1,47,880

47, 880

= 4, 43, 640 l/day

= 443.64 m³/day

In this study, SCSVMV campus wastewater treatment plant received the waste water from Hostels of both boys and girls, Guest houses for faculties, various departments, and laboratories and from hostel kitchens are very toxic and harmful. Generally campus wastewaters have different properties than domestic wastewaters considering amount and features of them, since population of campus have various regional differences.

Two numbers of samples were collected before and after the treatment process. Waste water samples were taken from effluent of equalization tank in SCSVMV campus wastewater treatment plants and other sample before it reaches to the treatment plant as shown in Fig 2.

Samples collected were brought to the laboratory and standard methods were followed for its analysis [15-20].



Figure 2 STP in SCSVMV Campus

RESULT & DISCUSSIONS

The quality of wastewater was examined and their values are given in Table 3.

Table 3 Analytical results of waste water samples

Parameter	Permissible Limits (BIS10500:2012)	Sewage Water	Treated Water
Colour	-	Blackish	Colourless
Odour	Agreeable	Foul Smell	-
Turbidity(NTU)	5	18.3	0.8
pH	6.5-8.5	6.70	7.76
Free Ammonia(mg/l)	0.5	28.38	3.10
Nitrite(mg/l)	-	0	0.02
Nitrate(mg/l)	45	39	25
Chloride(mg/l)	1000	320	305
C.O.D(mg/l)	-	628	30
B.O.D(mg/l)	-	210	16
Total Hardness(mg/l)	600	250	220
Calcium(mg/l)	200	64	56
Magnesium(mg/l)	100	22	19
Sodium(mg/l)	-	282	280
Potassium(mg/l)	-	21	20
Iron(mg/l)	0.3	0.80	0.63
Fluoride (mg/l)	1.5	1.12	0.84
Sulphate(mg/l)	400	33	28
Phosphate(mg/l)	-	2.35	0.25
Standard Plate Count / ml	500\ Organisms/ml	1,400,000	1200
Total Coliform / 100 ml	Nil/100ml	1,600,000	900
Faecal Streptococcus/100 ml	Nil/100ml	90,000	220
Faecal Coliforms /100 ml	Nil/100ml	5000	110

Colour

The colour of the sewage water obtained from the university is blackish but after the treatment process the colour is changed to colourless. Thus further treatment is not needed to neutralize its colour [5,7,8].

Odour

The odour of the sewage water is foul smell and it is neutralized after the treatment so further treatment is not needed.

Turbidity

The turbidity of the sewage water is 18.3 NT Units. But after the treatment process it has come down to 0.8 NT units which is less than the permissible limits (BIS 10500:2012) 5 NT units (Fig 3.). Hence further treatment process may not be required.

pH

The pH of waste water before treatment is 6.70 and after treatment is 7.76 and they are within the Permissible Limits (BIS 10500:2012) 6.5 - 8.5. (Fig 4.). Hence further treatment process may not be required to bring pH value in the required limits.

Free Ammonia

The permissible limit of free ammonia is

0.5 mg/l. but the sewage before and after treatment has greater value than the permissible limit. Hence the current treatment procedure should be altered (Fig 5.).

Nitrate

The permissible limit of nitrate is 45 mg/l. and the value of nitrate after the treatment is 25 mg /l .Hence it lies within the permissible limits (Fig 5.).

Chloride

The chloride content of sewage water before treatment is 320 mg/l and the content after the treatment process is 305 mg/l and are within the permissible limits .Hence further treatment process may not be required (Fig 5.).

Total Hardness

The total hardness of waste water before treatment is 250 mg/l and after treatment is 220 mg/l and they are within the Permissible Limits (BIS 10500:2012) 600 mg/l. Hence further treatment process may not be required to bring total hardness value in the required limits (Fig 5.).

Calcium

The calcium content of waste water before treatment is 64 mg/l and after treatment is 56 mg/l and they are within the

Permissible Limits (BIS 10500:2012) 200 mg/l. Hence further treatment process may not be required to bring calcium value in the required limits (Fig 5.) [10,11].

Magnesium

The magnesium content of waste water before treatment is 22 mg/l and after treatment is 19 mg/l and they are within the Permissible Limits (BIS 10500:2012) 100 mg/l. Hence further treatment process may not be required to bring magnesium value in the required limits (Fig 5.).

Iron

The permissible limit of iron is 0.3 mg/l. but the sewage before and after treatment has greater value than the permissible limit. (Fig 4.). Hence the current treatment procedure should be altered [6,9].

Fluoride

The fluoride content of waste water before treatment is 1.12 mg/l and after treatment is 0.84 mg/l and they are within the permissible limits (BIS 10500:2012) 1.5 mg/l. (Fig 4.). Hence further treatment process may not be required to bring fluoride value in the required limits.

Sulphate

The sulphate content of waste water before treatment is 33 mg/l and after treatment is

28 mg/l and they are within the Permissible Limits (BIS 10500:2012) 400 mg/l. Hence further treatment process may not be required to bring sulphate value in the required limits (Fig 5.).

Standard Plate Count

The standard plate count per ml in sewage water is 1,400,000 and in treated water it counts 1200. But the max limits as per BIS 10500:2012 is 500 organisms /ml. Therefore further treatment process or the change in the present treatment process is essential (Fig 6.).

Total Coliform

The total coliform per 100 ml in sewage water is 1,600,000 and in treated water it is 900 which is much greater than the maximum limits (nil / 100 ml). Hence the current treatment procedure should be altered [12,13] (Fig 6.).

Faecal Streptococcus

In sewage water Faecal Streptococcus per 100 ml is 90,000 and in treated water it counts 220 which are greater than the max limit (nil/100ml). Therefore further treatment process or the change in the present treatment process is essential [14](Fig 6.).

Faecal Coliforms

Faecal coliforms per 100 ml in untreated and treated water is 5000 and 110 respectively. And the max limit as per BIS 10500:2012 is nil/ 100 ml. Hence the

current treatment procedure should be altered (Fig 6.).

Thus this analysis report justifies the important of better treatment process in the existing treatment plant.

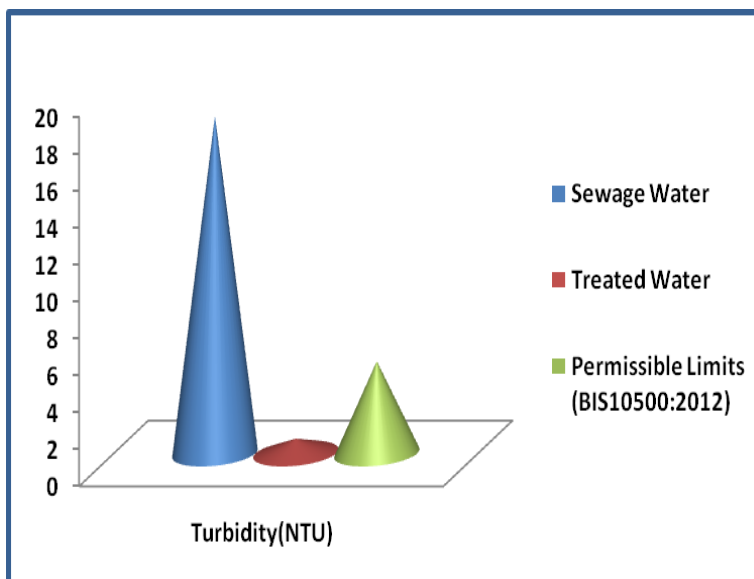


Figure 3 Turbidity Parameter

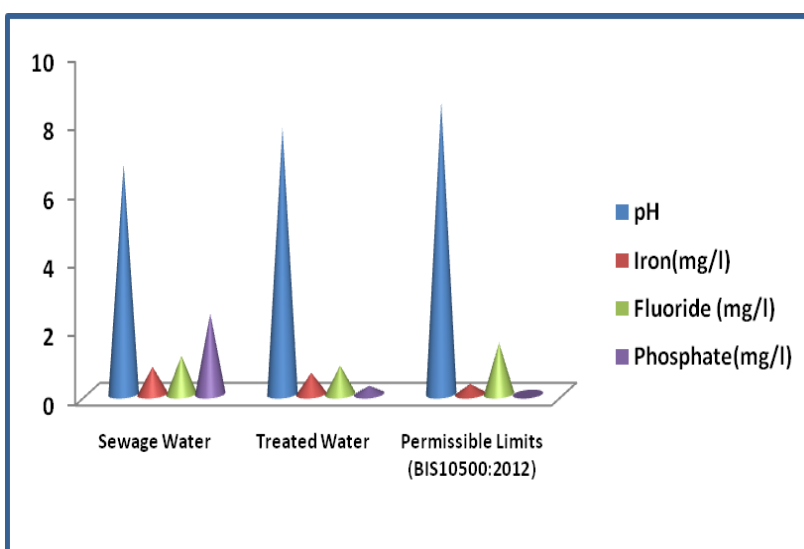


Figure 4 Chemical Parameters

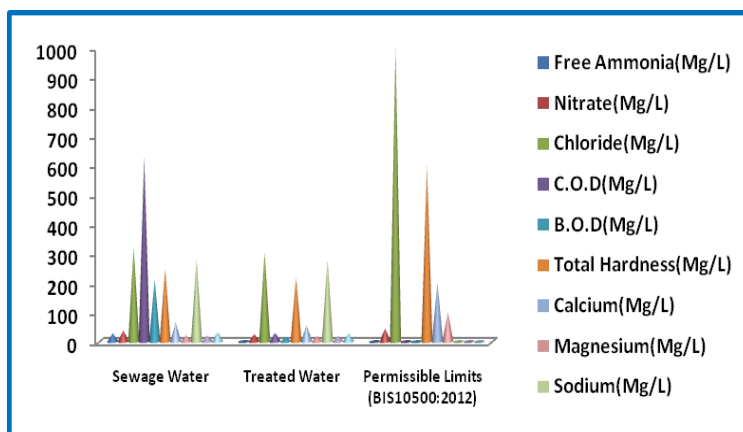


Figure 5 Chemical Parameters

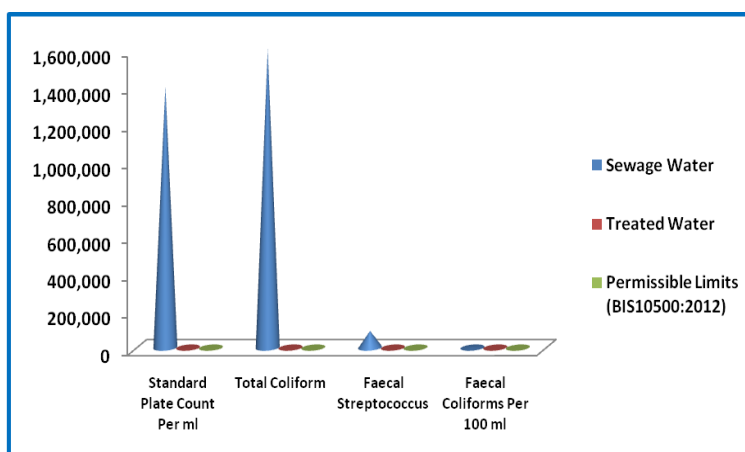


Figure 6 Biological Parameters

CONCLUSION

At SCSVMV campus the waste water collected after the treatment process by STP satisfied the standards given by the various organizations. Hence the effluent produced from the plant can be used for gardening and for the underground recharge. The dry sludge can be used as manure and also for manufacturing of bricks. The black water and the grey water produced within the campus was fully treated and make it has zero waste by

reusing it. The campus is in eco friendly manner.

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