Characterization of Sewage Water in Tasgaon City

Arti A. Kokane[1], Amarsinh B. Landage[2]
[1]PG student, Construction Management, Department of Civil Engineering,
Government College of Engineering, Karad, Maharashtra, India
[2]Assistant Professor, Department of Civil Engineering,
Government College of Engineering, Karad, Maharashtra, India

Abstract: The characterization of sewage water is a main indicator of water pollution. The goal of this study is to understand the parameters of the sewage water in Tasgaon City. This includes Sample collection and study of wastewater parameters like PH, BOD, TDS, etc. Parameters are compared with the standards of the MPCB, it is discovered that values of BOD, PH, and TDS exceed those standards. All samples have significantly high BOD levels, which indicates high organic loading. According to these tests, the city's sewage water is heterogeneous and different sample locations have readings that are above the allowable limits. Therefore, the primary and secondary treatment of the sewage is needed. Some recommendations are provided which are useful for the treatment of sewage.

Keywords: sewage water, characterization, organic load, pollution, composite sample.

I.Introduction:

Discharge of wastewater from cities and towns is the main reason for contamination and degradation of water resources. The wastewater in Tasgaon city is disposed of in the Kapurwada nallah which is the main reason for the pollution of water. Many farmers use this water from nallah for their farms. This also causes the degradation of soil i.e., soil pollution. In cities and towns, increasing industrialization and population are to blame for rising water demand and subsequent wastewater output. The minimization of water and land pollution is controlled with the help of treatment plant installation. Proper treatment stage design depends on the quality and quantity of wastewater. The treatment design type and capacity are largely based on wastewater quality, amount of organic load and flow rate. The rapid population increase and respective water use is the most factor for pollution. In 2011 the population of Tasgaon city was 37945 persons and it increases rapidly. Therefore, the characterization gives the way to analyse wastewater's physical, chemical and biological quality. Characteristics like temperature, colour, odour, total solids, organic matter, Ph, Chlorides, BOD, etc have been tested in the laboratory and corresponding results are mentioned in the result section. The results give the actual state of water and help to consider the sub-units in STP plants like method, filters, chambers, capacity etc. The Tasgaon city is in district Sangli and the co-ordinates are 17.0295^0 N, 74.6078^0 E. This occupies an area of around 819.74 sq. km with a population density of 307 per sq. km. In Tasgaon city, sewage is disposed of at Kapurwada nallah.

This fact came to light that the water after secondary treatment left open in Nallah which ultimately pollute it. Local farmers for irrigation purposes 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 nallah. Sewage is generated by residential, institutional, commercial and industrial establishments. It includes household waste liquid from toilets, baths, showers, sinks and so forth is that disposed of via sewers. Sewage is the mix of water and whatever wastes from domestic and industrial life are flushed into the sewer. Water plays an important role in the development of any activity. Due to the growth of the population, the consumption of water resources is more and availability is less. Sewage is a type of wastewater that is produced by a community of people. It is characterized by volume or rate of flow, physical condition, chemical and toxic constituents, and its bacteriological status (which organisms it contains and what quantities) it consists mostly of grey water (from sinks, tubs, showers, dishwaters, and clothes washers), black water (the water is used to flush toilets, combined with the human waste that is flushed away), soap and detergents. So, the demand for water is increasing. Sewage treatment is the process of removing contaminants from wastewater, primarily from domestic sewage. Physical, chemical and biological processes are used to remove impurities, and contaminants and produce treated wastewater/sewage water that is safer for the environment.

II.Methodology:

The minimization of pollution due to wastewater is achieved by the installation of sewage treatment plants. This requires the study of characteristics and parameters included in the water i.e., type or quality of wastewater.

1. Types of stages/subunits to be designed in STP plant: It depends on the parameters or contents in the sewage water to be eliminated after treatment. Therefore, the identification of the characteristics is the most useful thing to analyse the wastewater.

2. Capacity of plant: Depends on the amount of total sewage water collected at the stages and is to be treated accordingly.

The aim of this study is to determine the contents and parameters of sewage water by characterization. It gives the actual state of water and helps to consider the sub-units in STP plants like filters, chambers, etc. The characterization of sewage water is carried out as follows

1. Physical characterization
2. Chemical characterization
3. Biological characterization

Physical as the name suggests is mainly solid with a strong odour, temperature, colour, etc. Chemical characterization describes the compounds present in different types of sewage. Identification of biological parameters gives the idea about the presence of bacteria and other organic contents.

For characterization sample collection methods are,

1. Composite sample collection: Continue sampling or the blending of discrete samples are both methods for collecting composite samples throughout time. An average wastewater characteristic during the composing time is represented by a composite sample.

2. Grab sample collection: A grab sample, often named a catch sample, is one sample collected at a certain time. Grab samples are either a single discrete sample or a collection of individual samples. The grab sample ought to be an accurate representation of the wastewater situation at the time it was taken. The type and number of analyses that will be carried out determine the sample volume.

The adopted sample collection method is the composite sample collection method. A composite sample, also known as an integrated sample, is a sample that consists of a mixture of several individual grab samples collected at regular and specified time periods, each sample taken in proportion to the amount of flow at that time. Composite samples give a more representative sample of the characteristics of water over a longer period of time. The samples were collected at different 05 locations at 05-time slots. Sample collection slots are divided into morning, afternoon and evening slots of time. The gap between the 2 samples was 1 hour. A total of 5 locations are selected from the city from different regions which dispose of the maximum mixed wastewater. 1st composite samples were collected on 06/12/22 and the test was conducted on 07/12/22 onwards as per standard procedures. Also, with the same procedure on 20/12/22 again sample collection is done i.e., after 15 days after the 1st sample to confirm the variety in the wastewater characteristics. The same process is followed for testing of this 2nd sample also done from 21/12/22 onwards. These results of testing are compared with the MPCB standards. Compatibility and advantages of composite sampling over grab sampling for sewage water testing: The benefit of composite sampling is that it allows you to estimate the typical state of a body of water over time in which the samples are collected at various intervals and combined or space i.e., samples taken at different locations within the water body.

Locations in Tasgaon city for sample collection:

A. Nimani, Vrindavan colony,
B. Guruwar peth, Bapu wadi,
C. Atpadi road, Bapu wadi,
D. Vasumbe phata (location 1),
E. Vasumbe phata (location 2)

Figure 1: Water Pollution at Kapurwada nallah

III.Results

After comparing and analyzing the collected samples in the laboratory, the following results are obtained. MPCB has recommended some standard parameters for sewage water. As per testing results, it shows more value than MPCB limits. Therefore, this sewage water may cause large pollution and must be treated with the proper system accordingly.

1. Result based on the sample collected on 06/12/22

Sr. No.	Parameters	MPCB standards	Unit	Value
1	B. O. D	<100	mg/l	210
2	pH	5.5-9.0	-	7.00
3	C. O. D	<250	mg/l	262.67
4	Chloride	<600	mg/l	160.17
5	Suspended solids	<100	mg/l	1893

6	T. D. S.	<2100	mg/l	8620
7	Sulphate	<1000	mg/l	98
8	Nitrate	<45	mg/l	2.3
9	Phosphate	-	mg/l	1.25
10	Oil and grease	<10	Mg/l	<5
11	Most probable number	-	/100ml	40
12	Escherichia coli	-	/100 ml	Detected

Table 1: Sewage water test results- Sample 1

2. Result based on the sample collected on 20/12/22:

Sr. No.	Parameters	MPCB standards	Unit	Value
1	B. O. D	<100	mg/l	198
2	pH	5.5-9.0	-	6.40
3	C. O. D	<250	mg/l	257.23
4	Chloride	<600	mg/l	165.18
5	Suspended solids	<100	mg/l	1496
6	T. D. S.	<2100	mg/l	2954
7	Sulphate	<1000	mg/l	109
8	Nitrate	<45	mg/l	5.8
9	Phosphate	-	mg/l	1.58
10	Oil and grease	<10	Mg/l	<5
11	Most probable number	-	/100ml	30
12	Escherichia coli	-	/100 ml	Detected

Table 2: Sewage water test results- Sample 2

3. Physical Characterisation: In general, the physical parameters to observe the wastewater are temperature, colour and odour of the sample at the time of sample collection.

Temperature: The average temperature of the water with multiple samples collected in a single vessel is 26^0 C in the morning and after the second half it increased to almost 42^0 C, so, took an average of 34^0 C. It was observed in range with the standards (< 45^0 C).

Odour: The odour or smell of the freshly collected composite sample was observed unpleasant, mixed of detergent and drainage smell.

Colour: The colour of the composite sample seems grey and has some brownish shade.

4. Biological and chemical Characterisation:

B. O. D. & C. O. D.: The B. O. D. and C. O. D. of the wastewater were observed slightly above the limit. It shows the presence of organic matter which demands oxygen.

pH: The pH Values are Between standard values at stations A, B and C. At stations D and E, pH values were observed below the limit so wastewater consists of some acids. As the sample is composite the value shows approximately 6.7.

Chloride: The chloride contents are observed under limits which indicates the optimum presence of industrial waste.

Suspended solids and T. D. S.: The suspended and dissolved solid values are greater than permissible limits. The T. D. S. contents in the sample is much greater than MPCB standards.

Oil and grease: Oil and grease content/values are under the standard range. But this water is not suitable for farming because of the oil and grease presence.

IV. Conclusion

After analyzing the collected samples from different locations around the city, it is observed that some parameters show more value than MPCB permissible limits. The values of BOD are high for both samples which show a higher amount of organic matter. Also, oil and grease & chloride content for both samples are found below MPCB limits whereas suspended & T. D. S. are above MPCB standards. With these results, it is concluded that the sewage water from Tasgaon city has more heterogeneous characteristics and also shows above MPCB standards. Therefore, it is necessary to provide primary & secondary treatments on sewage water before releasing it into Kapurwada nallah which ultimately reduces the pollution of nallah.

V. Future Scope

According to the results, sewage water treatments are suggested. At the primary treatment bar screen, the grit chamber and Oil & grease trap are useful for large-size matter, suspended solids and other contents. Also, SBR technology for sludge treatment is effective and economical. Therefore, an SBR tank is suggested for secondary treatment. Filtration units at tertiary treatment should be connected to accomplish the need for clean water for drinking purposes, the agriculture sector, etc. This design of the plant is totally based on the above results of characterization.

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