IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12628

CHARACTERIZATION OF SEWAGE AND DESIGN OF SEWAGE TREATMENT PLANT

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Abstract: A study on domestic waste water characterization has been performed followed by the design of sewage treatment plant. The present study involves the analysis of pH value, total solids, total suspended solids, hardness, acidity, alkalinity, chloride, chlorine, BOD, DO and heavy metals such as Iron, Copper, Zinc, Magnesium, Nickel, Chromium, Lead, Calcium, Aluminum, Silicon, Potassium. A sewage treatment plant is quite necessary to receive the domestic and commercial waste and removes the materials which pose harm for general public. Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer). The samplings of the domestic waste from hostels have been done in different times of the day to have an average data of the measured parameters. The average values of pH, Turbidity, Acidity, Chloride, Residual Chlorine, Hardness, Total Solid, BOD, DO, Alkalinity, Total Iron Content, Zinc Content, Potassium, Copper, Magnesium, Nickel, Chromium, Lead, Calcium, Aluminum and Silicon are found out. A sewage treatment plant has been designed with the treatment units, a bar screen of dimension 1.7m, an aeration tank of dimension 4.5 x 4.5 x 3.7 m3,a collection pit of diameter 4m and depth 5 m.

Keywords: Characterization, sewage, treatment plant**.**

I. INTRODUCTION

Pollution in its broadest sense includes all changes that curtail natural utility and exert deleterious effect on life. The crisis triggered by the rapidly growing population and industrialization with the resultant degradation of the environment causes a grave threat to the quality of life. Degradation of water quality is the unfavorable alteration of the physical, chemical and biological properties of water that prevents domestic, commercial, industrial, agricultural, recreational and other beneficial uses of water. Sewage and sewage effluents are the major sources of water pollution. Sewage is mainly composed of human fecal material, domestic wastes including wash-water and industrial wastes. The growing environmental pollution needs for decontaminating waste water result in the study of characterization of waste water, especially domestic sewage. In the past, domestic waste water treatment was mainly confined to organic carbon removal. Recently, increasing pollution in the waste water leads to developing and implementing new treatment techniques to control nitrogen and other priority pollutants. Sewage Treatment Plant is a facility designed to receive the waste from domestic, commercial and industrial sources and to remove materials that damage water quality and compromise public health and safety when discharged into water receiving systems. It includes physical, chemical, and biological processes to remove various contaminants depending on its constituents. Using advanced technology it is now possible to re-use sewage effluent for drinking water. The present study comprises the study on quality of domestic waste water that is discharged from the HB Hall of National Institute of Technology, Udaipur, through the kitchen outlets and bathroom effluents. The study includes characterization tests for pH value, acidity, alkalinity, chloride, residual chlorine, turbidity & DO.

II. OBJECTIVE

The objectives of the study are:
1. Physical, chemical and biological characterization of the domestic waste water from surrounding area of Badi lake
2. Comparison with the prescribed standard
3. Design of the sewage treatment plant

III. MONITORING PROTOCOLS

Achievement of a safe and healthful workplace is the responsibility of an organization, the people residing in the place and the workers who are given the charge to protect the environment. Waste disposal and minimization and pollution prevention should be the preferred approach.

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Stringent penalties for the improper disposal of wastes should be adopted. Udaipur is one of the most significant industrial hubs in the state of Rajasthan. It has got an integrated Steel Plant a number of sponge iron industries, cement manufacturing unit, chemicals, explosives, ceramics and distillery units and large number of small and medium industries. NIT Udaipur is one of the most important educational institutes in the state of Rajasthan which has a large number of people residing in its campus, a number of laboratories of various departments, residential units, academic blocks and number of hostels for the students studying here.

The following is the list of workplace which is the main sources of pollution generating unit in the study area:

a) Badi Lake in Udaipur,
b) Surrounding area of Badi lake.

IV. RESULTS AND DISCUSSIONS

Name of the Hall	Capacity of tank (Liters)				Total water supplied (Liters)	Strength
	1000	1500	2000	3000		
The Leela Palace	-	27	-	-	37000	130
Taj Lake Palace	-	32	-	-	45500	393
The Lalit Laxmi Vilas Palace	-	38	-	-	58500	529
Fateh Garh	-	40	-	-	59500	514
Chunda Palace	-	38	-	-	55500	289
Radisson Blu	-		10	10	45500	522
Hotel Swaroop Vilas	-	14	-	-	20500	245
Jagat Niwas Palace Hotel	-	45	-	-	75000	460
Amet Haveli	-	17	-	-	36000	665

Table1: Water consumption by various residential in Udaipur

Quarter Type	Number of rooms
A	19
B	22
C	30
D	65
E	40
F	108
G	117
FE type Flats	18
Bachelor Flats	24
Transit Flats	18
Director's	1

Table2: Water consumption Badi Talab in Udaipur

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Average water supplied=1.5 Lakh gallon
So, total waste water generated= 80% of Supplied Water
=0.8x1.5lakh gallon
=1.2 lakh gallon

The presence of non-metallic constituents and the metallic constituents from the waste water sample was determined.

SOURCE	CONCENTRATION IN PPM
Bath room waste water	3.6
Kitchen waste water	4.5
Tap water	2.3
Distilled water	1

1. Determination of acidity content

SOURCE	CONCENTRATION IN PPM	STANDARD
Bath room waste water	57.9	30 -100
Kitchen waste water	113	
Tap water	3.5	

2. Determination of chloride content

SOURCE	PH	STANDARD
Kitchen waste	7.89	7.8
Bath room waste	7.36	
Tap water	8.01	

3. Determination of Ph of the sample

SL NO	SOURCE	CONC. IN PPM	STANDARD
1	Kitchen waste	2	1 - 2 ppm
2	Bath room waste	2	
3	Tap water	1	

4. Determination of residual chlorine

SL NO	SOURCE	VALUE IN NTU
1	Bath room waste	14
2	Kitchen waste	116
3	Tap water	µ0

2 Determination of turbidity of sample

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Here utilization of sulphuric acid is used is zero. Thus it indicates presence of bicarbonate.

SOURCE	CONC. IN PPM	STANDARD CONC.
Kitchen waste	75	50 - 200
Bathroom waste	80	
Tap water	15	

3 Table for determination of alkalinity

Determination of metals by atomic absorption spectrometry

SL NO	SOURCE	CONC. IN MG/L
1	Kitchen waste	2.863
2	Bathroom waste	0.024
3	Tap water	0

1. Total iron content

SL NO	SOURCE	CONC. IN MG/L
1	Kitchen waste	0.115
2	Bathroom waste	0.086
3	Tap water	1.549

2. Zinc content

SL NO	SOURCE	CONC. IN MG/L
1	Kitchen waste	0.019
2	Bathroom waste	0.0
3	Tap water	0.007

2. Copper content

SL NO	SOURCE	CONC. IN MG/L
1	Kitchen waste	11.334
2	Bathroom waste	9.285
3	Tap water	2.491

4. Potassium content

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Time ⇨ / Property ⇩	8 a.m.	12 p.m.	1-2 p.m.	5-6 p.m.	PERMISSIBLE VALUE
Turbidity (NTU)	32	45	50	38	5
pH	8.76	8.01	8.22	8.4	6.5 - 8.5
Acidity (mg/l)	1.8	2.6	3	1.3	
Alaklinity (mg/l)	42	45	158	78	600
Chloride (mg/l)	11	17	20	15	1000
Residual Chlorine (mg/l)	2	2	2	2	1
Hardness (mg/l)	23	38	40	30	200
Total Solids (mg/l)	200	240	420	600	2000
BOD (mg/l)	1.3	1.21	1.23	1.03	10
DO (mg/l)	7.1	7.01	7.02	6.9	2000

Tabulation for physical and chemical characteristics in different time

Time ⇨ / Metals ⇩	8 a.m.	12 p.m.	1-2 p.m.	5-6 p.m.	PERMISSIBLE VALUE
Iron (mg/l)	0.077	0.213	0.532	0.052	0.3
Zinc (mg/l)	0.008	0.119	0.124	0.131	15
Copper (mg/l)	0.019	0.012	0.035	0.029	1.5
Magnesium (mg/l)	0.41	1.918	2.581	3.411	30
Nickel (mg/l)	0.01	0.011	0.044	0	0.02
Chromium (mg/l)	0.113	0.212	0.242	0.114	0.05
Lead (mg/l)	0.101	0.091	0.261	0.024	0.01
Calcium (mg/l)	5.41	12.1	19.76	11.23	200
Aluminum (mg/l)	0.07	0.05	0	0.01	0.2
Silicon (mg/l)	3.91	11	10.602	5.21	7-10
Potassium (mg/l)	1.121	1.31	2.41	3.75	-

Tabulation for determination of different mineral content at different time

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V. CONCLUSION

- The average ranges of physical, chemical and biological characteristics of waste water quality are experimented and found out.
- The pH ranges from 7.8 to 8.01. The Turbidity ranged from 10 to 120 NTU.
- The value of Turbidity was found to be within the permissible limit.
- The Chloride and Alkalinity were in the range of 3.5 to 120 mg/l and 15 to 80 mg/l respectively.
- The Total Iron content was in the range of 0 to 3 mg/l.
- The Zinc content was in the limits of 0.1 to 2 mg/l.
- Copper content ranged from 0 to 0.2 mg/l.
- Potassium was present in the limits of 2 to 12 mg/l.
- The parameters studied resemble the waste water quality. Total amount of waste water treated = 0.423 mld.
- Dimension of the collection pit is calculated to be 4 m in diameter and 5 m depth of the cylindrical tank.
- A bar screen of width 1.7 m is provided.
- Dimension of the aeration tank is 4.5 x 4.5 x 3.7 m3
- Dimensions of Sludge Drying Bed are 4.5 m x 4.5 m x 1 m of two numbers.

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