RESEARCH ARTICLE

SAMRIDDHI Volume 13, Issue 2, 2021 Print ISSN : 2229-7111 Online ISSN : 2454-5767

Chemical Analysis of Surface Water of Raipur, Chhattisgarh to Evaluate The Consequences of Industrial Effluents

Ghanshyam Shakar[*1] , Bhumika Das[2] ,Brijesh Patel[3]

[1,*] MATS School Of Engineering And IT, MATS University, Raipur, India; e-mail : ghanshyamsakar@matsuniversity.ac.in

[2,3] MATS School Of Engineering And IT, MATS University, Raipur, India.

ABSTRACT

According to current estimates, industrial effluent discharge has contaminated around one-third of INDIA's water, solid waste, and other hazardous waste.The bulk of these defaulting industries are petrochemicals, sugar mills, distilleries, leather processing industries, paper mills, agrochemical and pesticide manufacturing sectors, and pharmaceutical businesses.For these industries, surface water is the major waste disposal method.Untreated or ostensibly treated effluents have raised the quantity of surface water pollution by up to 20 times the acceptable limit in 22 seriously polluted locations throughout the world. Almost all water bodies in INDIAwas found to be contaminated by industrial activity. Although the strict guidelines of the Central Pollution Control Board(CPCB) apply to all industries in India, the current state of the environment is far from ideal.

Keywords: Effluent, Solid waste, Petrochemical industries, Pesticides, Contamination, Contamination.

SAMRIDDHI : A Journal of Physical Sciences, Engineering and Technology, (2021); DOI : 10.18090/samriddhi.v13i02.10

INTRODUCTION

In the global economy, water plays an important role. Approximately 70% of human-used freshwater goes to agriculture. For many parts of the world, fishing in salty and freshwater bodies is a significantfood source. Most of the long-distance trade in goods and manufactured Ships transfer commodities (such as oil and natural gas) across seas, rivers, lakes, and canals.For cooling and heating, large volumes of water (H_2O), ice, and steam are utilized in industry and residences.Water is a unique solvent for a wide range of chemical substances; it is frequently used in manufacturing, cooking, cleaning [1-4]. Swimming, pleasure boating, boat racing, surfing, sport fishing, and diving are among activities that include water, is also central to many sports and other forms of entertainment. It is a vital natural resource, and social, economic and ecological sustainability is affected by its availability. The demands for water supply have increased immensely owing to expanding industrialisation on the one side and the exploding population on the other [6-10]. Furthermore, sewage, industrial waste, and a wide range of synthetic chemicals pollute a substantial percentage of this restricted water quality. Freshwater, a valuable and finite resource, must be protected, maintained, and used properly. Unfortunately, as the world's contaminated lakes, rivers, and streams attest, this is not the case., this has not been the case. The security of drinking water within the global village is an ongoing concern. Traditionally, disinfection, typically through

Corresponding Author : Ghanshyam Shakar, MATS School Of Engineering And IT , MATS University, Raipur, India; e-mail : ghanshyamsakar@matsuniversity.ac.in

How to cite this article : Shakar, G., Das, B., Patel, B. (2021). Chemical Analysis of Surface Water of Raipur, Chhattisgarh to Evaluate The Consequences of Industrial Effluents.

SAMRIDDHI : A Journal of Physical Sciences, Engineering and Technology, Volume 13, Issue (2), 118-124.

Source of support : Nil

Conflict of interest : None

chlorination and coliform population figures, has regulated the safety of potable water sources.

MATERIALS AND METHODS

Location of Study Area

Raipur city is located near the center of the vast and fertile Chhattisgarh plain. The town is situated between latitudes of 22^0 33'N and $21^0$14'N and longitudes of 82^0 6'E to 81^0 38'E (Figure 1). The total land area of the city, located on average 298 m above sea level, is around 226 km2. The region encounters a tropical wet and dry climate. The moderate temperature exists throughout the year with an exceptional month from March to June due to high temperature. Raipur is predominantly an industrial city and is India's biggest steel market. With a population of 2.0 million, it is the capital of the state of ChhattisgarhSteel, coal, energy, cement, and rice milling businesses are also present in the area.In Raipur, there are at least 500 medium and large-sized businesses in two industrial sectors: Siltara and Urla. Factories in Siltara spill their rotten batches many times and waste materials in open areas. These products contain extremely toxic chemicals. Massive amounts are released into the drain of partially processed but too contaminated effluents. The water from the drain is used by people living around the area for domestic purposes [11-14].

Sample Collection

Industrial wastewater samples between 10.00 am and 12.00 pm from November to February in the afternoonWater samples were collected from eleven different locations for physicochemical investigation. Plastic bottles of 2.5 L and 2.0 L were used to collect the catchwater samples.The bottles were carefully cleaned with hydrochloric acid, washed with acid-free tape water, washed again with distilled water, rinsed with the water sample to be collected, and then filled with the sample, leaving just a little air space at the top.Stoppard sample bottles were used, and they were wax-sealed. Each sample was correctly labeled and taken back to the chemical analysis laboratory. The sampling of industrial effluents requires more outstanding care and attention.

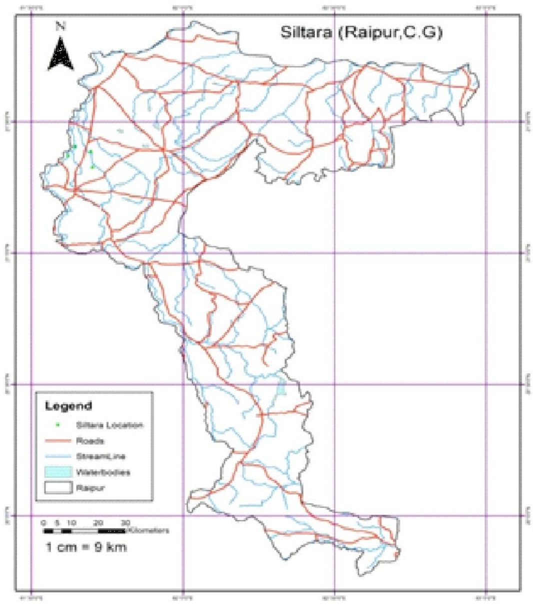


Figure 1: Location map of Study area

EXPERIMENTAL ANALYSIS

Temperature

The temperature of water samples obtained from various locations ranges from 22 to 28.90 degrees Celsius.

Table-1: Data showing temperature (0C) of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site – 1	24.0	23.9	22.0	24.5
2	site -2	26.3	25.4	25.2	27.2
3	site – 3	28.0	24.0	25.6	27.5
4	site – 4	27.0	25.6	24.8	27.4
5	site – 5	29.1	25.8	24.8	28.5
6	site – 6	27.7	27.2	24.9	28.0
7	site – 7	28.6	26.8	25.4	28.8
8	site – 8	27.2	25.4	24.9	27.6
9	site – 9	24.6	23.7	23.6	25.1
10	site - 10	26.8	24.6	23.3	25.8
11	site - 11	29.0	24.9	23.4	28.9

pH factor

The pH of water is the most essential factor in determining how corrosive it is.It has no direct negative impact on one's health.A low number below 4.0, on the other hand, indicates a sour flavor, while a higher value beyond 8.5 indicates an alkaline taste.According to ISI standards, a pH range of 6.5–8.5 is usually appropriate.The pH in the samples varied between 6.5 and 7.4 in the current investigation.

Table-2: Data showing pH value of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site - 1	6.6	6.7	6.7	6.5
2	site -2	7.1	7.1	7.0	6.8
3	site - 3	7.3	7.2	7.4	7.4
4	site - 4	7.1	7.2	7.3	7.3
5	site - 5	7.3	7.4	7.2	7.2
6	site - 6	7.1	7.3	7.0	7.0
7	site - 7	7.0	7.1	6.8	6.7
8	site - 8	6.9	6.9	6.7	6.7
9	site - 9	6.9	7.0	7.3	7.0
10	site - 10	7.2	7.3	7.4	7.2
11	Site-11	7.3	7.4	7.3	7.2

Alkalinity

Phenolphthalein Alkalinity was not found in any of the samples in this research.The alkalinity of Methyl Orange was measured between 240 and 440 mg/l, indicating the lack of Hydroxyl and Carbonate and the presence of Bicarbonate.

Table-3: Data showing Alkalinity (mg/l) of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site – 1	380	390	390	400
2	site -2	400	420	420	410
3	site – 3	410	410	420	430
4	site – 4	410	420	430	440
5	site – 5	350	360	380	380
6	site – 6	280	300	310	320
7	site – 7	320	350	370	380
8	site – 8	340	360	370	380
9	site – 9	290	310	320	340
10	site - 10	250	270	290	300
11	site - 11	240	260	270	270

Acidity

The value of acidity in the collected water sample is from 30mg/l to 90mg/l.

Table-4: Data showing acidity (mg/l) of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site – 1	40.0	50.0	70.0	60.0
2	site -2	30.0	40.0	60.0	60.0
3	site – 3	40.0	40.0	60.0	50.0
4	site – 4	50.0	70.0	80.0	80.0
5	site – 5	50.0	60.0	70.0	50.0
6	site – 6	60.0	70.0	80.0	70.0
7	site – 7	60.0	60.0	80.0	80.0
8	site – 8	40.0	60.0	70.0	70.0
9	site – 9	50.0	70.0	80.0	80.0
10	site – 10	40.0	50.0	70.0	50.0
11	site – 11	50.0	80.0	90.0	80.0

Total Dissolved Solids (TDS)

The total quantity of inorganic compounds in a solution is expressed as TDS.Water with a dissolved solid content of less than 500 mg/l is typically suitable for household and industrial usage.Water with more than 1000 mg/l dissolved solids generally contains minerals that give it a particular flavor or render it unfit for human consumption.TDS levels in these studies vary from 280 to 574 mg/l.

Table-5: Data showing total dissolved solids (mg/l) of collected water samples

S.No.	SampleSite	November	December	January	February
1	Site – 1	480.0	485	482.0	480
2	site -2	442.0	449	453	467
3	site – 3	460.0	470.0	486	492
4	site – 4	430.0	455	478	480
5	site – 5	280.0	289	296	303
6	site – 6	282.0	296	308	280.0
7	site – 7	304.0	325	340	330
8	site – 8	481.0	493	520	515
9	site – 9	574.0	496	510	490
10	site – 10	532.0	535	520	525
11	site – 11	320.0	340	365	380

Total Suspended Solids (TSS)

Total suspended solids (TSS) is the measure of dry-weight of suspended particles present in the sample of water, that is not dissolved, it can be measured using a filter that is analyzed using a filtration apparatus.

Table-6: Data showing total suspended solids (mg/l) of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site – 1	0.05	0.06	0.06	0.05
2	site -2	0.05	0.05	0.06	0.05
3	site – 3	0.04	0.05	0.06	0.05
4	site – 4	0.05	0.05	0.06	0.05
5	site – 5	0.05	0.03	0.05	0.06
6	site – 6	0.02	0.03	0.04	0.05
7	site – 7	0.01	0.02	0.04	0.06
8	site – 8	0.09	0.09	0.07	0.08
9	site – 9	0.03	0.04	0.06	0.05
10	site – 10	0.02	0.04	0.05	0.06
11	site – 11	0.02	0.03	0.05	0.04

Chloride

The high chloride concentration in water might be attributed to contamination from sewage and municipal waste chloride affluent effluent. Chloride concentration variations in the research ranged from 94.97 mg/l to 208.56 mg/l. In most of the study region, chloride, which has been linked to pollution as an indicator, is found below the permitted limit of 250 mg/l.Excess chloride (> 250 mg/l) gives water a salty flavor, and those who aren't used to high chloride levels may have laxative effects.

Table-7: Data showing Chloride (mg/l) of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site – 1	94 .97	96.07	97	97.02
2	site -2	149.95	150.95	152.28	152.26
3	site – 3	129.95	128.0	130.02	133.78
4	site – 4	144.95	146	146.02	147.56
5	site – 5	174.94	178.26	175.28	177.67
6	site – 6	204.93	205.93	208.56	206
7	site – 7	164.94	166.98	167.57	167.66
8	site – 8	119.96	119.98	121.43	122.46
9	site – 9	179.94	182.28	185.97	185.95
10	site – 10	129.95	134.95	136.9	137.75
11	site – 11	119.86	119.28	123.3	123.54

Sulfate

Natural water contains sulfate ions, and most of these ions are also soluble in water. The oxidation process of their ores produces many sulfate ions. They also present in industrial wastes. The desirable limit for Sulphate is 200 and 400 mg/l in the Permissible limit. In this study, sulfate ranges from 7.89mg/l to 19.74mg/l.

Table-8: Different value of Sulphate in a collected water sample

S.No.	Sample Site	November	December	January	February
1	Site – 1	8.80	8.83	8.82	10.00
2	site -2	7.90	7.89	8.90	9.00
3	site – 3	12.40	12.45	10.90	12.90
4	site – 4	13.70	13.72	14.82	17.50
5	site – 5	16.50	16.53	17.53	19.74
6	site – 6	11.20	11.25	11.36	10.50
7	site – 7	14.10	14.16	16.90	15.90
8	site – 8	9.70	9.76	12.70	14.60
9	site – 9	10.40	10.45	16.90	15.89
10	site – 10	8.40	8.43	10.60	12.50
11	site – 11	8.30	8.37	10.70	13.53

Iron

Concentrations of iron in drinking-water are typically less than 0.3 mg/liter. However, in nations where different iron salts are employed as coagulating agents in water-treatment plants and cast iron, steel, and galvanized iron pipes are used for water distribution, they may be greater. The iron concentrations in these studies vary from 0.13 mg/l to 0.26 mg/l.

Table-9: Data showing Iron of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site – 1	0.15	0.13	0.18	0.15
2	site -2	0.14	0.20	0.27	0.19
3	site – 3	0.17	0.22	0.24	0.17
4	site – 4	0.13	0.18	0.26	0.15
5	site – 5	0.25	0.22	0.22	0.14
6	site – 6	0.17	0.26	0.20	0.13
7	site – 7	0.15	0.18	0.24	0.20
8	site – 8	0.19	0.23	0.25	0.17
9	site – 9	0.19	0.23	0.23	0.18
10	site – 10	0.20	0.24	0.24	0.14
11	site – 11	0.17	0.16	0.21	0.19

Dissolved Oxygen (DO)

The amount of dissolved oxygen in water is regulated by aquatic vegetation and represents the physical andbiological processes that occur in water. The DO of all wastewater samples sampled was between 0.4 and 0.9mg/l.DO levels below 1 mg/L are insufficient to maintain fish, while values below 2 mg/L may result in the death of most fish. DO concentration should be over 6.0 mg/L for drinking water, and more than 5.0 mg/L is advised for fisheries, recreation and irrigation.These values are insufficient to sustain the fish population in the water body.

Table - 10 : Data showing dissolved oxygen (mg/l) of collected water samples

S.No.	Sample Site	November	December	January	February
1	Site – 1	0.4	0.4	0.5	0.5
2	site -2	0.5	0.6	0.6	0.7
3	site – 3	0.5	0.7	0.9	0.9
4	site – 4	0.5	0.6	0.6	0.7
5	site – 5	0.6	0.6	0.8	0.9
6	site – 6	0.8	0.9	0.9	0.9
7	site – 7	0.6	0.7	0.7	0.8
8	site – 8	0.4	0.5	0.7	0.8
9	site – 9	0.5	0.6	0.8	0.8
10	site – 10	0.9	0.9	0.9	0.9
11	site – 11	0.1	0.3	0.5	0.7

Biochemical oxygen demand (BOD)

The amount of contaminants in a water body is measured by BOD.The quantity of organic material in water bodies rises as untreated municipal and residential wastes are discharged into bodies of water. As a result, water-borne bacteria require a greater quantity of oxygen to degrade.BOD concentrations vary from 1.6 mg/l to 20.0 mg/l.

Table-11: Data showing biological oxygen demand of collected water samples

S.No.	Sample Site	November	December	January	February
1	site – 1	1.9	1.7	1.6	1.8
2	site -2	2.5	2.3	2.3	2.4
3	site – 3	10.0	9.7	9.5	9.6
4	site – 4	16.7	16.4	16.4	16.3
5	site – 5	16.9	16.3	16.2	16.3
6	site – 6	20.0	19.5	19.3	19.5
7	site – 7	18.6	17.8	17.4	17.6
8	site – 8	18.9	17.9	17.4	17.4
9	site – 9	19.9	19.4	19.3	19.5
10	site – 10	19.7	19.5	19.3	19.4
11	site – 11	18.0	17.6	17.2	17.5

Chemical Oxygen Demand (COD)

COD is the amount of dissolved oxygen required to cause chemical oxidation of the organic material in water. Both BOD and COD are vital indicators of the environmental health of a surface water supply.

Table-12: Data showing Chemical Oxygen demand of collected water samples

S.No.	Sample Site	November	December	January	February
1	site – 1	158.0	151	150.0	150
2	site -2	165	164	163	162
3	site – 3	203.0	197.0	193	191
4	site – 4	260.0	253	250	251
5	site – 5	265.0	258	247	245
6	site – 6	258.0	243	242	240.0
7	site – 7	189.0	185	184	185
8	site – 8	243.0	242	240	242
9	site – 9	238.0	238	240	241
10	site – 10	239.0	240	243	243
11	site – 11	242.0	240	242	241

Comparitive Analysis

To find out the difference in various evaluated parameter of all four months of post mansoon season we have done comparative analysis considering all the parameters. For this we have all the physicochemical parameter together month wise in an excel sheet and prepared column diagram for the same. The results of the analysis are as follows:

Table-13.1: Comparitive analysis of all the parameters for the month of November

Sample Site	Tempreture	pH	Alkalinity	Acidity	TDS	TSS	Chloride	Sulphate	Iron	DO	BOD	COD
Site - 1	24	6.6	380	40	480	0.05	94 .97	8.8	0.15	0.4	1.9	158
site -2	26.3	7.1	400	30	442	0.05	149.95	7.9	0.14	0.5	2.5	165
site - 3	28	7.3	410	40	460	0.04	129.95	12.4	0.17	0.5	10	203
site - 4	27	7.1	410	50	430	0.05	144.95	13.7	0.13	0.5	16.7	260
site - 5	29.1	7.3	350	50	280	0.05	174.94	16.5	0.25	0.6	16.9	265
site - 6	27.7	7.1	280	60	282	0.02	204.93	11.2	0.17	0.8	20	258
site - 7	28.6	7	320	60	304	0.01	164.94	14.1	0.15	0.6	18.6	189
site - 8	27.2	6.9	340	40	481	0.09	119.96	9.7	0.19	0.4	18.9	243
site - 9	24.6	6.9	290	50	574	0.03	179.94	10.4	0.19	0.5	19.9	238
site - 10	26.8	7.2	250	40	532	0.02	129.95	8.4	0.2	0.9	19.7	239
site - 11	29	7.3	240	50	320	0.02	119.86	8.3	0.17	0.1	18	242

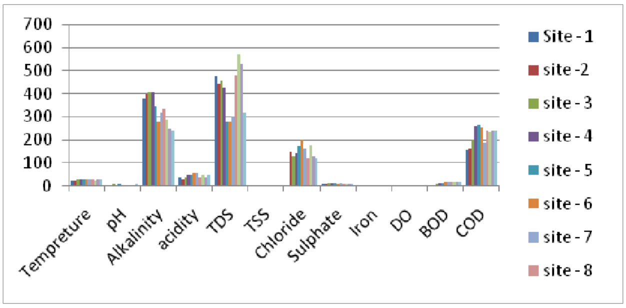


Figure 2: Comparitive analysis of all the parameters for the month of November

Table 13.2: Comparitive analysis of all the parameters for the month of December

Sample Site	Tempreture	pH	Alkalinity	acidity	TDS	TSS	Chloride	Sulphate	Iron	DO	BOD	COD
Site - 1	23.9	6.7	390	50	485	0.06	96.07	8.83	0.13	0.4	1.7	151
site -2	25.4	7.1	420	40	449	0.05	150.95	7.89	0.2	0.6	2.3	164
site - 3	24	7.2	410	40	470	0.05	128	12.45	0.22	0.7	9.7	197
site - 4	25.6	7.2	420	70	455	0.05	146	13.72	0.18	0.6	16.4	253
site - 5	25.8	7.4	360	60	289	0.03	178.26	16.53	0.22	0.6	16.3	258
site - 6	27.2	7.3	300	70	296	0.03	205.93	11.25	0.26	0.9	19.5	243
site - 7	26.8	7.1	350	60	325	0.02	166.98	14.16	0.18	0.7	17.8	185
site - 8	25.4	6.9	360	60	493	0.09	119.98	9.76	0.23	0.5	17.9	242
site - 9	23.7	7	310	70	496	0.04	182.28	10.45	0.23	0.6	19.4	238
site - 10	24.6	7.3	270	50	535	0.04	134.95	8.43	0.24	0.9	19.5	240
site - 11	24.9	7.4	260	80	340	0.03	119.28	8.37	0.16	0.3	17.6	240

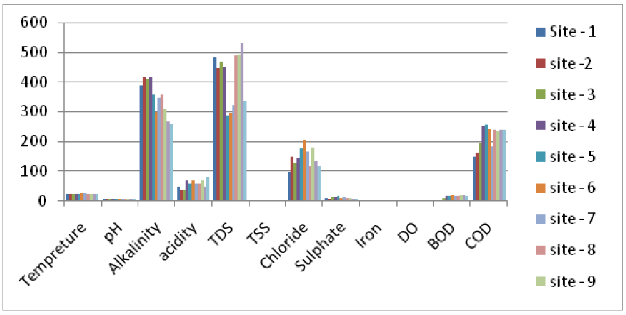


Figure 3: Comparitive analysis of all the parameters for the month of December

Table-13.3: Comparitive analysis of all the parameters for the month of January

Sample Site	Tempret ure	pH	Alkalinit y	acidity	TDS	TSS	Chloride	Sulphat e	Iron	DO	BOD	COD
Site - 1	22	6.7	390	70	482	0.06	97	8.82	0.18	0.5	1.6	150
site -2	25.2	7	420	60	453	0.06	152.28	8.9	0.27	0.6	2.3	163
site - 3	25.6	7.4	420	60	486	0.06	130.02	10.9	0.24	0.9	9.5	193
site - 4	24.8	7.3	430	80	478	0.06	146.02	14.82	0.26	0.6	16.4	250
site - 5	24.8	7.2	380	70	296	0.05	175.28	17.53	0.22	0.8	16.2	247
site - 6	24.9	7	310	80	308	0.04	208.56	11.36	0.2	0.9	19.3	242
site - 7	25.4	6.8	370	80	340	0.04	167.57	16.9	0.24	0.7	17.4	184
site - 8	24.9	6.7	370	70	520	0.07	121.43	12.7	0.25	0.7	17.4	240
site - 9	23.6	7.3	320	80	510	0.06	185.97	16.9	0.23	0.8	19.3	240
site - 10	23.3	7.4	290	70	520	0.05	136.9	10.6	0.24	0.9	19.3	243
site - 11	23.4	7.3	270	90	365	0.05	123.3	10.7	0.21	0.5	17.2	242

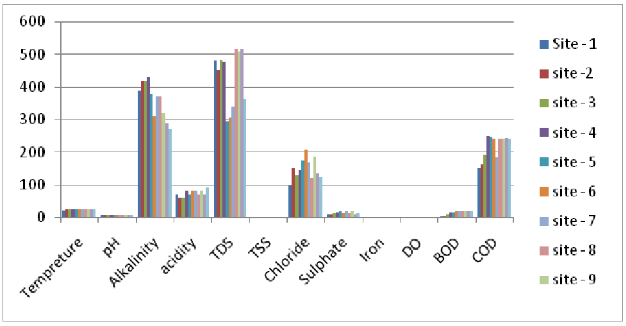


Figure 4 : Comparitive analysis of all the parameters for the month of January

Table 13.4: Comparitive analysis of all the parameters for the month of February

Sample Site	Tempret ure	pH	Alkalinit y	acidity	TDS	TSS	Chloride	Sulphat e	Iron	DO	BOD	COD
Site - 1	24.5	6.5	400	60	480	0.05	97.02	10	0.15	0.5	1.8	150
site -2	27.2	6.8	410	60	467	0.05	152.26	9	0.19	0.7	2.4	162
site - 3	27.5	7.4	430	50	492	0.05	133.78	12.9	0.17	0.9	9.6	191
site - 4	27.4	7.3	440	80	480	0.05	147.56	17.5	0.15	0.7	16.3	251
site - 5	28.5	7.2	380	50	303	0.06	177.67	19.74	0.14	0.9	16.3	245
site - 6	28	7	320	70	280	0.05	206	10.5	0.13	0.9	19.5	240
site - 7	28.8	6.7	380	80	330	0.06	167.66	15.9	0.2	0.8	17.6	185
site - 8	27.6	6.7	380	70	515	0.08	122.46	14.6	0.17	0.8	17.4	242
site - 9	25.1	7	340	80	490	0.05	185.95	15.89	0.18	0.8	19.5	241
site - 10	25.8	7.2	300	50	525	0.06	137.75	12.5	0.14	0.9	19.4	243
site - 11	28.9	7.2	270	80	380	0.04	123.54	13.53	0.19	0.7	17.5	241

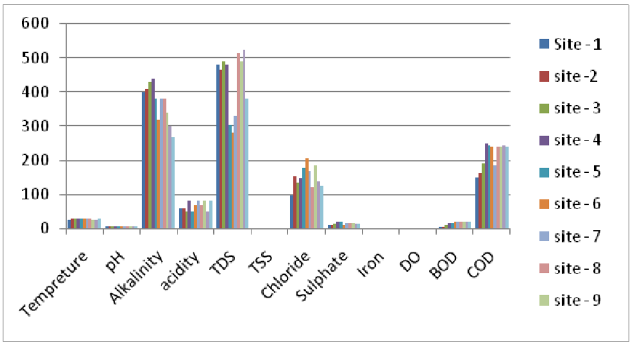


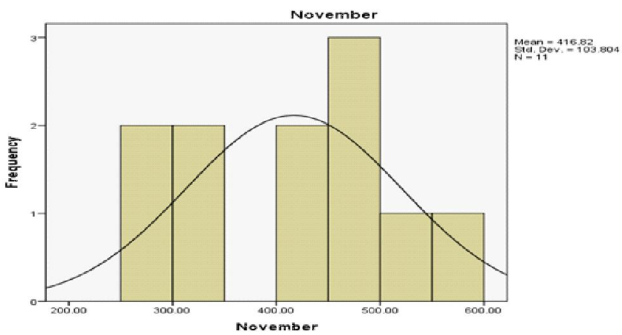
Figure 5 : Comparitive analysis of all the parameters for the month of February

STATICAL ANALYSIS FOR TDS

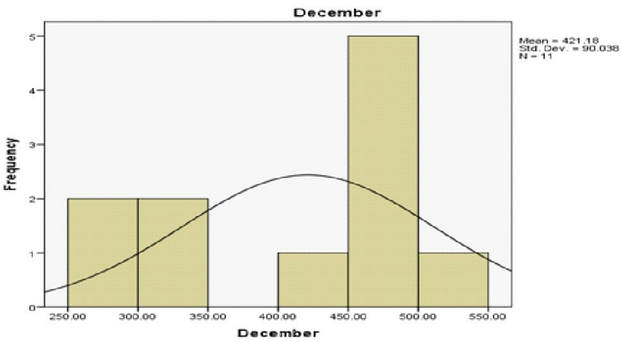
As reported from the study area we found out TDS to be the major problem in the study area so we have done all the statical analysis considering the tds of the area. The results of the analysis are as follows:

Table-14 : Statistical Analysis

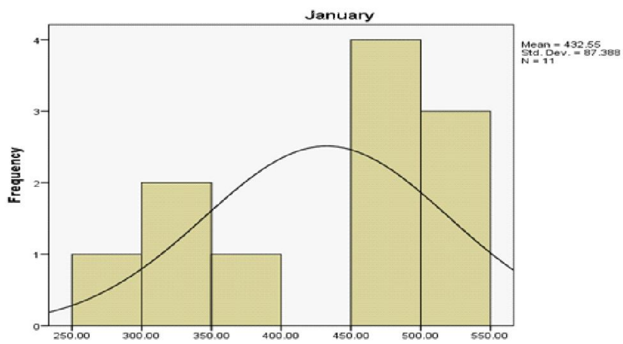
Statistics					
		November	December	January	February
N	Valid	11	11	11	11
	Missing	0	0	0	0
Mean		416.81	421.18	432.54	431.09
Std. Error of Mean		31.29	27.14	26.34	27.165
Std. Deviation		103.80	90.03	87.38	90.09
Variance		10775.364	8106.7	7636.67	8117.89
Range		294.00	246.00	224.00	245.00
Minimum		280.00	289.00	296.00	280.00
Maximum		574.00	535.00	520.00	525.00



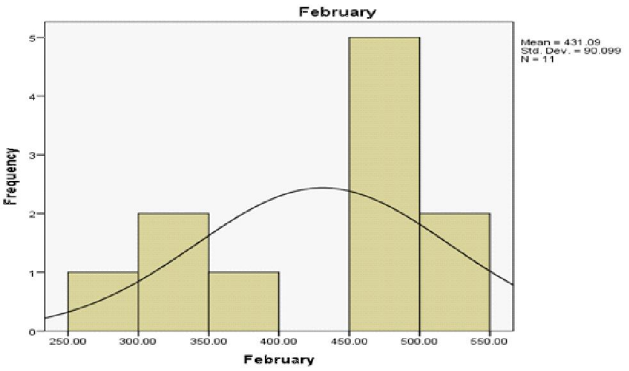
(a)



(b)



(c)



(d)

Figure 6 (a, b, c, d) : ROC curve shows the intensity of the TDS in the study area. Maximum the curvature denotes the higher concentration of the TDS in corresponding area or borewell/dugwell.

Conclusion

According to the aforementioned analysis, the water of the Siltara phase II, Raipur (C.G.), has been severely polluted by the addition of municipal, residential, and industrial waste.Direct discharge of human and animal waste not only has a negative influence on water quality, but it also has a negative impact on people's health.Because this water is used for laundry, bathing, and even drinking. The pH of the water is between 6.5 and 7.4. The TDS and TSS were 0.01 to 0.09 mg/l and 280 to 574 mg/l, respectively. The concentrations of chloride, alkalinity, and acidity were 94.97 to 208.56 mg/l, 240 to 440 mg/l, and 30 to 90 mg/l, respectively. Because these lakes are often used for fishing, it is clear that heavy metals can enter the food chain and, as a result, enter the human body via bio-magnification. As a result, periodic water quality monitoring is required to evaluate the status of the water body's surface water, and prompt steps to control human activities surrounding the lake should be performed. It would be helpful to protect the lake against heavy metal pollution.

References

[1] Singare P.U., Dhabarde S.S., (2014) Pollution due to Textile along Dombivali Industrial Belt of Mumbai, India. International Letters of Chemistry, Physics and Astronomy Vol. 22, pp. 24-31.

[2] Husain Arshad., Ashhar M.M., and JavedIram., (2014) Analysis of Industrial wastewater in Aligarh City. Journal of Chemical and Pharmaceutical Research Vol 6(1), pp. 614-621.

[3] Bansal Jyoti., and Dwivedi A.K. (2018) Assessment of Ground Water Quality by Using Water Quality Index and Physico Chemical Parameters: Review Paper Vol. 7(2), pp. 170-174.

[4] Ghosh Bidisha Bhattacharya. (2018) Physicochemical Analysis of Pond Water in PurbaBarddhaman, West Bengal, India. International Research Journal of Environmental Sciences Vol. 7(2), pp. 54-59.

[5] Sikdaret.etal. (2013) River water pollution in developed and developing countries: Judge and assessment of Physicochemical characteristics and selected dissolved metal concentration. Academia.edu, clean journal Vol. 41(1), pp 60-68.

[6] Soja R., Wiejaczka L. (2013) The Impact of Reservoir on the Physicochemical Properties Of water in Mountain River. Water and Environment Journal Vol. 28.

[7] Kalra Neeraj et.al. (2012) Physico-chemical analysis of ground water taken from five blocks of southern Bhojpur Bihar. Journal of Chemical and Pharmaceutical Research Vol. 4(3), pp. 1827-1832.

[8] Kumar Rai et. al,. (2011) A study on the Sewage disposal on water quality of Harmu River in Ranchi City Jharkhand, India. The International Journal of Plant, Animal and Environmental Sciences Vol. 2 (

[9] 1), pp. 102-106.

[10] Kansal Ankur., Siddiqui Nihal., and Gautam Ashutosh. (2013) Assessment of heavy metal and their Interrelationships with some physiochemical parameters in eco-efficient rivers of Himalayan region. Environmental Monitoring and Assessment Vol. 185, pp. 2553-2563.

[11] Linthoingambidevininingombam. (2011) Physicochemical characteristics of paper industry effluents- a case study of South india Paper Mill (SIPM). Environmental Monitoring and assessment, Vol 177(1-4). Pp. 23-33.

[12] Younas, S., Junaid, F., Gul, S., Rehman, H. U., Adnan, K., Rauf, F., Ahmad, I., Najoom, S., Sadia, H., & Usman, K. (n.d.). Physiochemical parameters of water and soil of three Dams of district Karak, KP, Pakistan. Journal of Entomology and Zoology Studies, 1, 6.

[13] Nduka, John Kanayochukwu, et al. (2008) Some Physicochemical Parameters of Potable Water Supply in Warri, Niger Delta Area of Nigeria. Sci. Res. Essays, p. 5.

[14] Agbogu, et.al. (2006) Study of bacteriological and physiochemical indicators of pollution of surface water in Zaria Nigeria. African journal of Biotechnology, Vol. 5(9) pp. 732-737