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Evaluation of Heavy metals pollution index and suitability studies for drinking, agricultural criteria and also study of removal of contamination by using nano particles-A case study of Dobbaspet industrial area surrounding region, Bangalore rural part

Prof Nandeesha, Karunakara H K, Mallukumar, Manohar P, M N Harsha

Department of Civil Engineering Dayananda Sagar college of Engineering Bengaluru-560078

ABSTRACT

Groundwater is one of the important sources of water in both urban and rural India. Since a vast part of our country depends upon the Monsoons for water availability, there are certain places where the precipitation of monsoons is quite less. In these study areas, the surface water stored in local sources will not last long. So, the people living in these areas, have become dependent on the groundwater sources (Aquifers). These groundwater sources will eventually get recharged by the infiltration of run-off. During this phenomenon of the percolation through the soil layers, some salts, minerals, chemicals, heavy metals from industries and industrial waste where present in the strata gets dissolved in the water and this leads to the dissolved in the water and this leads to the degradation of the problems related to the usage and health of consumers.We collected 50 representative groundwater, surface water and also pubic storage tank samples in around dobaspeteindustrial area as and we have also collected 5 soil samples in order to determine the suitability of the soil for the agricultural activities. The collected samples were tested for various parameters like pH, EC, TDS, Ca, Na, k, Fe, F etc.., The results obtained were interpreted by using certain methods techniques like WQI.

INTRODUCTION

1.1 General

Ground water is the main source of drinking water in India and is also an important source of water for agricultural and industrial fields. Being an important and essential part of the hydrological cycle, its availability in an area depends on its rainfall and the recharge conditions. The demand for water has increased over the years and this has led to a water crisis in many parts of the world. the situation gets even harsher by the problem of water pollution. India is facing a fresh water crisis, mainly due to improper water management techniques and environmental pollution, leading to a reduced access to safe water supply. Many states in the country are facing serious hazards due to industrial waste and also contain heavy metals in water Karnataka is one of them. We chose Dobbaspet industrial area from Bangaluru rural part in Karnataka for our research.
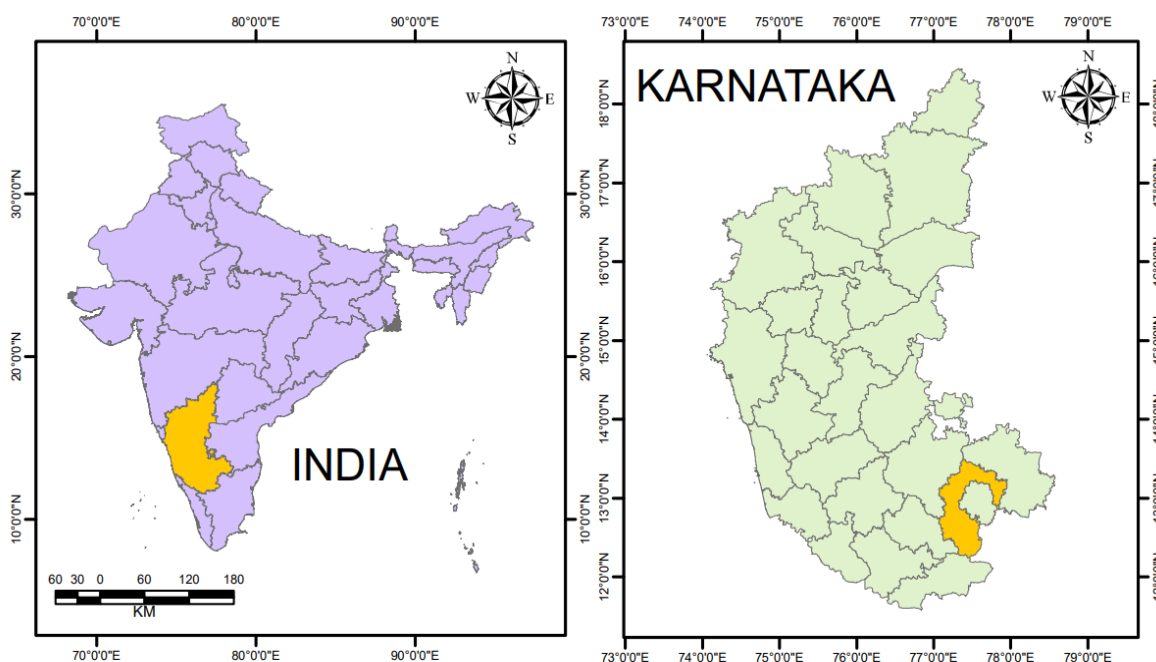
1.2 Objectives

The objective of this project are listed below;

- Groundwater quality analysis of Dobbaspet industrial area by determination of variousPhysico - chemical parameters.
- Analysis of heavy metals
- Biological testSoil assessment of the study area.
- Use of nano particles for removal of excesses contamination.

1.3 Study area

LOCATION MAP STUDY AREA

1.4 Sample Location

Sample Location names along with GPS data is shown in the following Table

Table-1 Sample Location data (water)

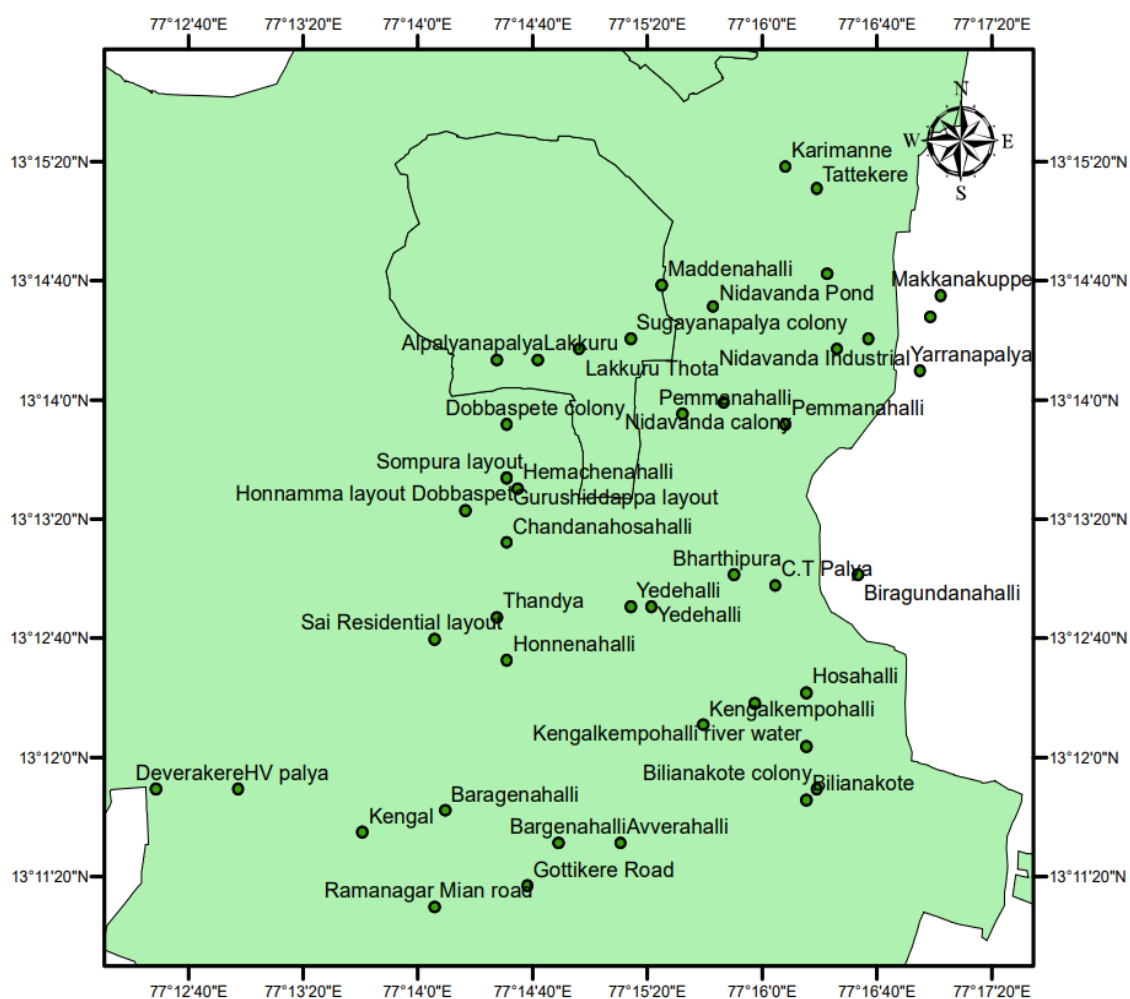| Samples	Name of village	Latitude	Longitude
1.	Sompura center	13°13' 44.16"	77°14' 23.4"
2.	Sompura	13°13' 36.53"	77°14' 40.87"
3.	Timmanayakanahalli	13°13' 56.23"	77°15' 2.07"
4.	Timmanayakanahalli	13°13' 59.22"	77°14' 53.68"
5.	Lakkuru Thota	13°14' 16.79"	77°14' 59.71"
6.	Lakkuru	13°14' 15.42"	77°14' 42.23"
7.	Pemmanahalli	13°13' 56.29"	77°15' 32.49"
8.	Nidavandacalony	13°14' 0.43"	77°15' 48.41"
9.	Pemmanahalli	13°13' 54.31"	77°16' 11.26"
10.	Nidavanda Railway station	13°14' 42.89"	77°16' 22.91"

11.	Nidavanda Pond	13°14' 33.27"	77°15' 45.05"
12.	Tattekere	13°15' 11.29"	77°16' 19.96"
13.	Nidavanda Industrial	13°14' 23.68"	77°16' 40.14"
14.	Nidavanda Cross NH – 207 Sompura	13°14' 15.12"	77°16' 28.46"
15.	Channalingaiahnapalya	13°14' 26.84"	77°16' 59.2"
16.	Makkanakuppe	13°14' 36.28"	77°17' 2.89"
17.	Yarranapalya	13°14' 11.38"	77°16' 56.4"
18.	Biragundanahalli	13°13' 1.95"	77°16' 36.6"
19.	C.T Palya	13°12' 57.83"	77°16' 7.13"
20.	Hosahalli	13°12' 24.56"	77°16' 15.36"
21.	Kengalkempohalli	13°12' 18.49"	77°15' 59.06"
22.	Yedehalli	13°12' 50.61"	77°15' 23.25"
23.	Bharthipura	13°13' 2.45"	77°15' 50.46"
24.	Karimanne	13°15' 18.6"	77°16' 10.76"
25.	Alpalyanapalya	13°14' 13.48"	77°14' 27.62"
26.	Chandanahosahalli	13°13' 12.82"	77°14' 33.32"
27.	Thandya	13°12' 49.62"	77°14' 24.18"
28.	Honnenahalli	13°12' 32.55"	77°14' 24.39"
29.	Baragenahalli	13°11' 43.44"	77°14' 11.82"
30.	Avverahalli	13°11' 31.76"	77°15' 12.96"
31.	Kengalkempohalli	13°12' 12.46"	77°15' 37.76"
32.	Bilianakote	13°11' 47.85"	77°16' 14.35"
33.	Bilianakote colony	13°11' 49.95"	77°16' 16.41"
34.	Kengalkempohalli river water	13°12' 5.95"	77°16' 13.22"
35.	Yedehalli	13°12' 50.89"	77°15' 16.84"
36.	Dobbaspete colony	13°13' 54.42"	77°14' 33.95"
37.	Sompura layout	13°13' 35.88"	77°14' 27.85"

38.	Hemachenahalli	13°13' 31.38"	77°14' 25.32"
39.	Maddenahalli	13°14' 39.75"	77°15' 25.58"
40.	Sugayanapalya colony	13°14' 22.93"	77°15' 14.58"
41.	Gurushiddappa layout	13°13' 36.89"	77°14' 34.06"
42.	Sai Residential layout	13°12' 39.41"	77°14' 9.02"
43.	Kengal	13°11' 36.06"	77°13' 39.77 "
44.	HV palya	13°11' 49.76"	77°12' 58.56"
45.	Devaganahalli	13°22' 13.48"	77°12' 58.56"
46.	Deverakere	13°11' 49.23"	77°12' 31.73"
47.	Ramanagar Mian road	13°11' 11.28"	77°14' 7.25"
48.	Gottikere Road	13°11' 17.97"	77°14' 36.92"
49.	Bargenahalli	13°11' 31.83"	77°14' 50.42"
50.	Honnamma layout Dobbaspet	13°13' 25.76"	77°14' 19.22"

Table-2 Sample Location data (Soil)

Samples	Name of village	Latitude	Longitude
1	Tattekere	13°15' 11.11"	77°16' 20.76"
2	Halenijgal	13°14' 41.62"	77°13' 42.92"
3	Bilinakote	13°13' 57.5"	77°14' 35.79"
4	Honnenahalli	13°11' 59.02"	77°14' 16.55"
5	Dobbaspete	13°13' 57.35"	77°14' 36.15"

SAMPLE LOCATION

IS 10500:2015 – Guidelines for drinking water standards:

SL.NO	TESTS	Maximum Acceptable limits (Mg/l) As per IS :10500 2015	Maximum Permissible limits (Mg/l)
1	pH	6.5-8.5	No Relaxation
2	Total Hardness	200	600
3	Sulphate	200	400
4	Iron	1.0	1.0
5	Fluoride	1.0	1.5
6	Electrical Conductivity	750	2000
7	Total dissolved solids	500	2000
8	Bi-carbonates alkalinity	200	200
9	Chloride	250	1000
10	Sodium	1	60
11	Potassium	1	5
12	Calcium	75	200
13	Magnesium	30	100
14	Nitrate	45	No Relaxation
15	Turbidity	1	5

PARAMETER ANALYIS DATA RESULTS

Sl no.	NAME OF VILLAGES	pH	TDS (ppm)	TH (mg/l)	Na (mg/l)	K (mg/)	Cl (mg/l)	HCO3 (mg/l)	Fe (mg/l)	F (mg/l)	Ca (mg/l)	Mg (mg/l)	NO³ (mg/l)	SO4 ²⁻(mg/l)	Turbidity (NTU)	Ec (µ/cm)
1	Sompura center	6.46	595	540	60.6	3	150	348	0.08	0.095	107.1	69.984	13	64	2.3	930
2	Sompura	7.51	405	252	34	18.2	124	212	0.18	0.01	76.95	14.58	2	63	4.7	632
3	Timmanayakanahalli	6.19	524	460	29.6	7.8	116	372	0.7	0.03	117.03	40.824	11.5	48	1.5	819
4	Timmanayakanahalli	7.89	377	320	25.6	15.4	70	308	0.1	0.065	78.55	16.524	2	37	3.5	589
5	Lakkuru Thota	7.25	646	608	36.6	6.4	146	360	0.48	0.095	101	86.508	5	158	1.8	1010
6	Lakkuru	7.6	607	448	38.6	5.2	132	364	0.138	0.005	113.82	39.852	12	97	1.2	949
7	Pemmanahalli	8.55	583	264	54	5.6	104	436	0.12	0.04	109.01	1.944	11	106	2.3	911
8	Nidavandacalony	7.36	252	180	24.6	9.6	60	144	1.08	0.0075	36.87	21.384	5	45	1.9	843
9	Pemmanahalli	8.07	421	120	27.2	3.2	114	312	0	0.055	84.96	22.356	2.5	45	2.9	657
10	Nidavanda Railway station	7.91	564	160	32	5	122	404	0	0.0525	112.22	29.16	1.5	105	1	881

Sl no.	NAME OF VILLAGES	pH	TDS (ppm)	TH (mg/l)	Na (mg/l)	K (mg/)	Cl (mg/l)	HCO3 (mg/l)	Fe (mg/l)	F (mg/l)	Ca (mg/l)	Mg (mg/l)	NO³ (mg/l)	SO4 ²⁻(mg/l)	Turbidity (NTU)	Ec (µ/cm)
11	Nidavanda Pond	8.11	300	492	36.4	13.2	80	164	0	0.0075	64.12	80.676	9.5	49	5.4	470
12	Tattekere	7.64	700	564	66	6.4	166	444	0	0.065	141.08	51.516	12.5	129	0.4	1034
13	Nidavanda Industrial	7.76	419	300	30.6	6	84	312	0	0.004	83.36	22.356	1	31	1.5	655
14	Nidavanda Cross NH – 207 Sompura	7.85	512	500	37	6.6	112	144	0.12	0.0775	102.6	59.292	1.5	79	1.1	800
15	Channalingaiahnapalya	7.8	355	268	32	4.2	50	280	0	0.085	64.12	26.244	6.5	58	1.5	554
16	Makkanakuppe	8.56	344	280	31.8	4.2	70	296	0	0.0725	49.69	37.908	4.5	56	0.8	538
17	Yarranapalya	7	643	548	28.2	4	144	320	0	0.01	105.81	69.012	12	63	1.3	1004
18	Biragundanahalli	7	422	320	32.6	8.8	66	328	1.26	0.08	72.14	34.02	6	70	0.2	659
19	C.T Palya	7	504	356	46.2	3.2	126	280	0	0.04	99.39	26.244	5.5	72	1.2	787
20	Hosahalli	7.33	490	360	37.4	5.4	96	292	0	0.0725	75.35	15.552	10	77	0.9	765

Samples	Name of village	WQI
1	Sompura center	25.34428
2	Sompura	60.93447
3	Timmanayakanahalli	165.6956
4	Timmanayakanahalli colony	41.46268
5	Lakkuru Thota	118.8055
6	Lakkuru	38.87437
7	Pemmanahalli	37.94656
8	Nidavandacalony	253.4101
9	Pemmanahalli	8.732609
10	Nidavanda Railway station	8.633168
11	Nidavanda Pond	18.55535
12	Tattekere	9.95634
13	Nidavanda Industrial	8.414435
14	Nidavanda Cross NH – 207 Sompura	37.63601
15	Channalingaiahnapalya	8.648013
16	Makkanakuppe	9.074183
17	Yarranapalya	6.295536
18	Biragundanahalli	293.2074
19	C.T Palya	5.707228
20	Hosahalli	8.246574
21	Kengalkempohalli	270.5777
22	Yedehalli	15.00765
23	Bharthipura	31.28139
24	Karimanne	477.628
25	Alpalyanapalya	179.5231

Samples	Name of village	WQI
26	Chandanahosahalli	7.916523
27	Thandya	104.3822
28	Honnenahalli	8.639354
29	Baragenahalli	15.08207
30	Avverahalli	16.91187
31	Kengalkempohalli	79.47109
32	Bilianakote	14.45347
33	Bilianakote colony	37.8883
34	Kengalkempohalli river water	63.61651
35	Yedehalli	17.84308
36	Dobbaspete colony	9.824712
37	Sompura layout	7.79319
38	Hemachenahalli	84.71477
39	Maddenahalli	201.6401
40	Sugayanapalya colony	4.443419
41	Gurushiddappa layout	4.595174
42	Sai Residential layout	106.9629
43	Kengal	31.38063
44	HV palya	7.015107
45	Devaganahalli	4.821602
46	Deverakere	13.37719
47	Ramanagar Mian road	48.90498
48	Gottikere Road	12.57914
49	Bargenahalli	67.11272
50	Honnamma layout Dobbaspet	9.348733

RESULTS AND DISCSSIONS

Sl. No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
1	Copper (Cu), mg/l	0.05	1.5
2	Manganese (Mn), mg/l	0.1	0.3
3	Zinc (Zn), mg/l	5	15
4	Lead (pb), mg/l	0.01	No relaxation
5	Nickel (Ni), mg/l	0.02	No relaxation

5.1 **Comparison with Standards**

Table – 9 Comparison with Standards

Parameter	Mean 50 samples	Standard	Samples under acceptable limit	Samples outside permissible limit	% of samples under permissible limit
pH	7.878	6.5-8.5	37	13	64.87%
EC(µ/cm)		1000-2000(µ/cm)	50	0	100%
TDS (ppm)	449.22	500-2000ppm	50	0	100%
Chloride	102.92	250-1000mg/l	50	0	100%
Total Hardness	366.24	200-600mg/l	47	3	93.61%
Iron	0.234	1-1mg/l	46	4	91.30%
Magnesium	43.089	30-100mg/l	49	1	97.95%
Bi – carbonate	301.84	200-600mg/l	50	0	100%
Potassium	5.771	1-5mg/l	28	22	21.42%
Fluoride	0.087	1-1.5mg/l	50	0	100%
Calcium	78.633	75-200mg/l	49	1	97.95
Sodium	31.864	1-60mg/l	47	3	93.61%
Nitrate	7.01	45mg/l	50	0	100%
Sulphate	75.92	200-400mg/l	50	0	100%
Turbidity	0.940	1-5	49	1	97.95%

Drinking water – specification (IS 10500:2015)(Reaffirmed 2018)

Result of Heavy metal

Sl. No	Parameters	Unit	S-11	S-18	S-21	S-4	S-8	Test Method
1	Copper as (Cu)	mg/L	BDL	BDL	BDL	BDL	BDL	IS 3025(Part 42)
2	Zinc as Zn	mg/L	0.036	1.849	0.683	0.290	0.126	IS 3025(Part 490
3	Nickel as Ni	mg/L	BDL	BDL	BDL	BDL	BDL	IS 3025(Part 54)
4	Manganese as Mn	mg/L	0.240	BDL	0.064	0.079	0.125	APHA 23rdedition (3111B)
5	Lead as Pb	mg/L	BDL	BDL	BDL	BDL	BDL	IS 3025(Part 47)

Soil Parameter Results

Sample 1: **Tattekere**

Sl.No	Parameter	Test value	Unit	Rating
1	Ph	7.19		**Normal**
2	EC	0.684	ms/cm	Slightysalin
3	Organic Carbon (OC)	0.504	%	Medium
4	Nitrogen(N)	281	Kg/ha	Medium
5	Phosphours(P)	22	Kg/ha	Medium
6	Potassium(K)	158	Kg/ha	Medium
7	Zinc(Zn)	6.5	Mg/Kg	Normal
8	Boron(B)	1.3	Mg/Kg	Normal
9	Iron(Fe)	66	Mg/Kg	Normal
10	Manganese	12.5	Mg/Kg	Normal
11	Copper(Cu)	2.4	Mg/Kg	Normal
12	Sulphur(S)	23	Mg/Kg	Normal

Sample 2: Bilinakote

Sl.No	Parameter	Test value	Unit	Rating
1	Ph	7.26		**Normal**
2	EC	0.701	ms/cm	Slightysalin
3	Organic Carbon (OC)	0.534	%	Medium
4	Nitrogen(N)	287	Kg/ha	Medium
5	Phosphours(P)	23	Kg/ha	Medium
6	Potassium(K)	155	Kg/ha	Medium
7	Zinc(Zn)	6.2	Mg/Kg	Normal
8	Boron(B)	1.1	Mg/Kg	Normal
9	Iron(Fe)	62	Mg/Kg	Normal
10	Manganese	11.5	Mg/Kg	Normal
11	Copper(Cu)	2.1	Mg/Kg	Normal
12	Sulphur(S)	22	Mg/Kg	Normal

Sample 3 :Bareganahalli

Sl.No	Parameter	Test value	Unit	Rating
1	Ph	6.59		**Normal**
2	EC	0.693	ms/cm	Slightysalin
3	Organic Carbon (OC)	0.532	%	Medium
4	Nitrogen(N)	268	Kg/ha	Medium
5	Phosphours(P)	24	Kg/ha	Medium
6	Potassium(K)	156	Kg/ha	Medium
7	Zinc(Zn)	5.9	Mg/Kg	Normal
8	Boron(B)	1.4	Mg/Kg	Normal
9	Iron(Fe)	64	Mg/Kg	Normal
10	Manganese	12.5	Mg/Kg	Normal
11	Copper(Cu)	2.4	Mg/Kg	Normal
12	Sulphur(S)	24	Mg/Kg	Normal

Sample 4: Dobbaspete

Sl.No	Parameter	Test value	Unit	Rating
1	Ph	7.16		**Normal**
2	EC	0.721	ms/cm	Slightysalin
3	Organic Carbon (OC)	0.543	%	Medium
4	Nitrogen(N)	277	Kg/ha	Medium
5	Phosphours(P)	25	Kg/ha	Medium
6	Potassium(K)	166	Kg/ha	Medium
7	Zinc(Zn)	5.8	Mg/Kg	Normal
8	Boron(B)	1.5	Mg/Kg	Normal
9	Iron(Fe)	66	Mg/Kg	Normal
10	Manganese	13.5	Mg/Kg	Normal
11	Copper(Cu)	2.5	Mg/Kg	Normal
12	Sulphur(S)	25	Mg/Kg	Normal

Sample 5: Halenijgal

Sl.No	Parameter	Test value	Unit	Rating
1	Ph	7.34		**Normal**
2	EC	0.714	ms/cm	Slightysalin
3	Organic Carbon (OC)	0.547	%	Medium
4	Nitrogen(N)	278	Kg/ha	Medium
5	Phosphours(P)	24	Kg/ha	Medium
6	Potassium(K)	168	Kg/ha	Medium
7	Zinc(Zn)	5.3	Mg/Kg	Normal
8	Boron(B)	1.4	Mg/Kg	Normal
9	Iron(Fe)	67	Mg/Kg	Normal
10	Manganese	13.2	Mg/Kg	Normal
11	Copper(Cu)	2.3	Mg/Kg	Normal
12	Sulphur(S)	25	Mg/Kg	Normal

Conclusion :

- The Ph, TH, Fe, Mg, k, Ca, Na, Turbidity, where not in the permissible range.
- 5 soil sample in different places where in within the limit.
- 5 water sample not exceed in heavy metal analysis.
- Ec, TDS, Cl, Bi-Carbonate, F, Sulphate, where within the limit as per IS-10500 2015(Reaffirmed 2018)

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