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Impact of Lime Stone on Groundwater and Soil

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Abstract: ***Unpredictable rapid increased growth of population with increased lifting of water from the deeper crusts of earth leads severe groundwater contamination and also unrepairable damage to soil structure and its stability. The extent and severalty of damage to the groundwater and the soil depends on the nature and the toxicity of the pollutants. It is very difficult to identify exact sources of groundwater contamination as the sources are hidden from the sight even the sources are predicted it is difficult to measure the extent of damage to the groundwater and soil. Taken to consider it, the present study was carried out at Piduguralla municipal region, Guntur district Andhra Pradesh which is surrounded by limestone beds. Due to the availability and the abundance of natural lime stone the area is very much familiar with other name as 'Lime city' which is surrounded by number of lime stone and white cement industries. It was observed that chemicals from lime stone quarries damaging quality of both groundwater and the soil. Twenty five sampling locations were identified to collect groundwater samples along with ten soil sampling locations. Samples were collected for three times during the study period of three months and the average values were noted as final values, water quality results were correlated with IS5000 – 2012 standards to find out the suitability of water consumption, all the tests for both groundwater and the soil were carried out by adopting standard analytical procedures.***

Key words: Groundwater, Limestone beds, Soil, quarries, White cement,

I. INTRODUCTION

Water is the most important component for all the living organisms on the earth which is available in nature as surface water and groundwater, surface water is more in quantity than the groundwater where as groundwater is good in quality for consumption than the surface water that is available in the form Oceans, Lakes, Rivers and Streams etc, even though surface water is more in quantity it is unable to use as it is in the form of sea water which is unfit for consumption. In order to meet the daily requirements of water, groundwater is the major resource at any area which leads to severe shortage due to various man made activities. An unscientific mining activity shows its impact on underground water as well as on associated soil strata. Lime stone beds are always associates with 'karst'[2] which disrupts natural aquifers and flow of underground water during the time of limestone mining. That is why mining at bodies and disrupts aquatic ecosystem. lime stone beds must be done by considering existed underlying conditions of the ground most particularly with reference to water table and associated soil conditions. The leachate from limestone quarries enters in to nearby water Explosives In the mining area damages soil and cause sinkholes which alters quality of water in the aquifers. Lime stone also influence the P^H of the soil that affects plants growth by reducing concentration of essential elements such as potassium, magnesium, calcium etc, which in turn leads to reduced agricultural crop yield at study area. In the present study both groundwater and the soil samples were collected and analyzed to understand the existed conditions of underground scenario with respect to groundwater and soil.

II. OBJECTIVE

To determine the groundwater quality and its associated soil along with management plan [10] with respect o water quality and soil conditions.

III. METHODOLOGY

III.I Collection of Samples:

1. Twenty five sampling locations were identified in and around the study area by considering possible interference of limestone quarry [3] activities.
2. Ten sampling locations were identified for soil samples
3. All the water samples were collected from underground bore wells.

III.II Water quality Analysis:

1. Water quality analysis [7] were carried out for the collected samples to find out the existed condition of groundwater
2. In the analysis of groundwater, the parameters of P^H, Colour, Turbidity, Magnesium, Calcium, Ferrous, Chlorine, Sulphur, Silica, Sodium, Potassium, ,fluorides, Biological Total alkalinity, Total hardness ,Oxygen Demand(BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO)
3. All the tests were carried out by standard test procedures [4] for three times during the study period of three months

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4. Average values of all three months results[8]were correlated with IS 10500-2012 standards and considered as final values of various parameters of water quality.

III.III Soil quality Analysis:

1. Soil samples were collected as three samples for each location at the different depths [9] and the average value was considered as final result.

2.In the analysis of soil [6] all the major soil quality influencing parameters like, P^H,

Bulk density, Moisture content, Electrical conductivity, Organic matter, Calcium, Magnesium, Nitrates, Phosphorous, Potassium were analyzed analyzed to determine the Soil quality index (SQI) at study area.

$SQI = (DOM+DP+DK+DEC+DP^H) = 0$

DOM = 1 If Organic Matter (OM) > 2 otherwise it is '0'

DP = 1 If Phosphorous (P) > 20 otherwise it is '0'

DK = 1 If Potassium > 80 otherwise it is '0'

DEC = 1 If Electrical Conductivity < 2 otherwise it is '0'

DP^H =1 If P_H>6.5 otherwise it is '0'

Soil quality at all the locations were analyzed the results were categorized based on the following scale

Above 0.7 is Very Good, 0.6 – 0.7 is Good, 0.5- 0.6 is Average, below 0.5 is Poor.

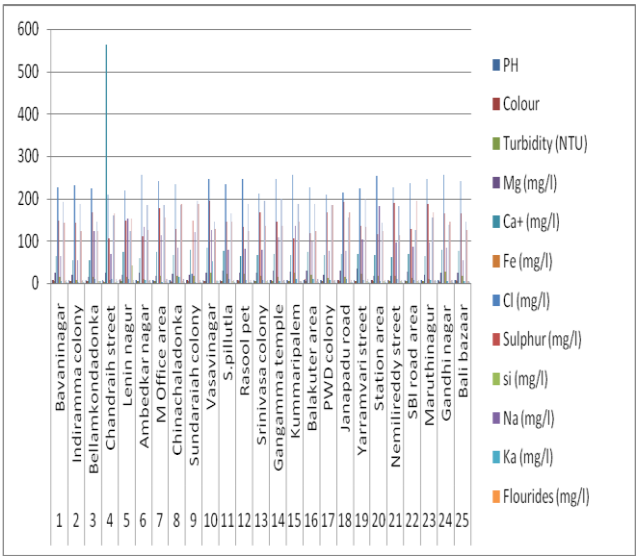
Table- I: Groundwater quality analysis during the study period

L.NO	LOCATION	P^H	C	T	Mg+	Ca+	Fe+	Cl	Na+	K	F	T.A	T.H	BOD	COD	DO
1	Bhavani nagar	7.2	8	5	25	62.8	0.2	226	64	4.8	0.5	192	142	4.6	7.5	3.6
2	Indiramma colony	7.2	5	5	19	55.2	0.4	231	54	2.8	0.4	186	124	4.8	7.4	3.6
3	Bellamkonda donka	7.5	4	5	15	54.6	0.6	223	124	8.2	0.2	145	124	4.2	5.6	4.8
4	Chandraih street	6.4	5	3	26	562	0.5	208	68	10.4	0.4	160	165	3.5	8.9	4.4
5	Lenin nagar	7.5	9	5	19	74.2	0.1	220	152	9.8	0.4	124	152	41	6.2	3.4
6	Ambedkar nagar	6.8	6	4	24	58.4	0.2	255	134	6.6	0.6	184	125	4.6	7.5	3
7	M.Office area	7.8	5	5	18	74.5	0.2	240	112	1.8	0.9	184	154	4.1	8.9	2.4
8	Chinachala donka	7.5	6	3	22	66.4	0.2	233	84	14.6	0.4	185	186	4.2	8.9	2.4
9	Sundaraiah colony	7.1	8	5	20	78.4	0.8	222	120	2.4	0.5	194	186	3.6	6.5	2.6
10	Vasavi nagar	7.2	6	4	24	82.6	0.3	246	125	52	0.5	146	128	4.6	7.8	3.9
11	S.pillutla	6.8	5	5	28	75.4	0.2	234	78	9.4	0.8	165	146	4.6	7.8	3.6
12	Rasool pet	7.2	8	6	25	64.2	0.4	245	82	7.6	0.4	186	124	3.4	6.8	3.4
13	Srinivasa colony	7.5	6	4	24	66.4	0.3	211	78	6.4	0.8	195	135	4.2	6.4	3.6
14	Gangamma temple	7.6	8	5	28	68.4	0.2	246	108	4.2	0.6	198	136	4.6	8.4	2.8
15	Kummari palem	7.6	4	6	26	65.8	0.2	255	136	8.6	0.4	186	145	3.8	5.8	3.2
16	Balakuter area	7.1	9	4	30	74.2	0.2	225	98	9.8	0.8	188	124	4.2	9.6	2.8
17	PWD Colony	7.4	6	5	19	66.4	0.2	210	76	7.2	0.6	184	185	4.8	8.5	3.2
18	Janapadu road	6.6	8	6	29	69.5	0.1	213	75	8.4	0.4	156	166	3.2	7.4	2.4
19	Yarramvari street	7.4	6	4	34	68.4	0.3	225	104	7.6	0.4	198	134	3.9	8.9	2.5
20	Station area	7.5	8	6	18	65.8	0.1	252	182	3.1	0.2	142	124	4.5	8.1	3.4
21	Nemili Reddy street	7.5	8	5	18	62.4	0.1	225	95	9.6	0.6	182	112	4.9	6.9	3.4
22	SBI road area	7.8	6	6	28	69.5	0.1	236	86	6.5	0.5	125	194	4.6	6.8	2.8

23	Maruthi nagar	7.4	6	6	19	64.5	0.2	246	96	5.6	0.9	156	168	4.2	6.4	4.1
24	Gandhi nagar	7.8	6	3	24	78.4	0.1	256	84	4.6	0.9	138	145	4.8	8.6	3.2
25	Bali bazaar	7.2	8	6	26	75.6	0.1	241	54	5.4	0.6	146	126	4.5	6.1	3.4

UNITS: Colour (c) – Hazen units , Turbidity(T) - NTU, Mg+ (mg/l), Ca(mg/l), Fe(mg/l), Cl (mg/l), Na(mg/l), K(mg/l), Ferrous(mg/l), Total Alkalinity –T.A (mg/l), Total Hardness – T.H (mg/l) BOD(mg/l), COD (mg/l), DO (mg/l)

S.NO	LOCATION	SQI	CONDITION
1	Chandra palem	0.8	Very Good
2	Ambedkar nagar	0.8	Very Good
3	Rasool peta	0.4	Poor
4	Gandhi nagar	0.8	Very Good
5	Maruthi nagar	0.8	Very Good
6	Gullapalli donka	0.8	Very Good
7	Janapadu road	0.6	Average
8	Mandulagadda	0.8	Very Good
9	Near railway station	0.4	Poor
10	SBI road area	0.6	Average



Graph 1: Graphical representation of groundwater quality at study area

Table 2: Soil quality analysis at study area

S.NO	LOCATION	Bulk Density	Moisture Content	Ca2+	Mg2+	OM	P^H	EC	So^4	N	P	K
1	Chandra palem	1.75	1.84	4.62	2.42	0.6	6.8	0.4	0.25	0.75	25.12	245
2	Ambedkar nagar	1.84	18.9	7.25	3.04	0.4	7.4	0.9	0.64	0.45	32.45	210
3	Rasoolpeta	1.35	20.1	3.26	1.58	1.6	6.4	0.8	0.34	0.61	15.2	245
4	Gandhi nagar	1.64	22.8	5.89	3.82	1.9	7.6	0.9	0.64	0.25	54.6	285
5	Maruthi nagar	1.82	18.2	7.38	3.25	0.5	6.9	0.8	0.75	0.46	38.6	234
6	Gullapalli donka	1.54	21.9	4.89	3.66	0.8	7.9	0.9	0.66	0.52	42.5	254
7	Janapadu road	1.72	20.4	4.35	3.74	0.8	6.8	0.8	0.74	56	18.6	235
8	Bellamkonda donka	1.24	19.6	5.94	2.85	0.9	7.5	0.9	0.54	0.42	48.9	282
9	Near railway station	1.89	21.5	5.59	3.92	1.4	6.4	0.6	0.65	0.69	18.5	260
10	SBI road area	1.62	22.4	7.22	3.46	1.9	7.4	0.9	0.66	0.65	30.2	246

IV. RESULTS AND DISCUSSIONS

Table 3: Soil Quality Index (SQI) at study area

S.NO	PARAMETER	EXPLANATON
1	P^H	The P^H of the water samples were within the permissible levels as per IS 10500-2012 water quality standards
2	Turbidity	The acceptable limit of Turbidity is up to 1%, the turbidity of all the locations were crossed their permissible levels
3	Magnesium (Mg+)	The acceptable limit of Magnesium (Mg+) in water is 30 mg/L. all the location were within the permissible levels except at L.No- 19
4	Calcium (Ca)	The Calcium (Ca) in the water samples of L.No:9 and 10 crossed the permissible levels remaining all are within the acceptable limits of 75mg/l as per IS10500-2012 water quality standards.
5	Iron (Fe)	Iron (Fe) in the water samples of L.No: 2, 3, 4, 9 crossed acceptable level of 5mg/l. where as in the remaining locations it was within the acceptable limits.
6	Chlorine (Cl)	Chlorine (Cl) in the water samples of L.No: 6, 16, 20, 24 crossed acceptable level of 250mg/l. where as in the remaining locations it was within the acceptable limits.
7	Fluoride (F),	The presence of fluoride (F), Total alkalinity and Total hardness at all the locations in the study area were within the acceptable limits.
8	SQI(Soil Quality Index)	Soil Quality Index (SQI) at L.No 3 and 9 was in Poor condition, L.No 10 and 7 was in average condition. The remaining locations were in very good condition.[8]

V. CONCLUSIONS

1. The water quality can be influenced by quarrying of limestone in a greater extent than any other activities
2. Groundwater in the study area required treatment [5] before consumption
3. Immediate monitoring with proper planning is required on further deterioration of water quality
4. It was observed that there is a loss of biodiversity, deterioration of landscape with increased pollution especially nearby lime stone mining areas, therefore an immediate action plan[1] for environmental management must be prepared to promote environmental sustainability.

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