IJIRR

International Journal of Information Research and Review
Vol. 07, Issue, 01, pp.6668-6674, January, 2020

RESEARCH ARTICLE

STUDY OF GROUND WATER QUALITY OF MANDIDEEP INDUSTRIAL AREA, MADHYA PRADESH, INDIA

Reeta Kori, Alok Saxena, Harish Wankhade, Asad Baig, Ankita Kulshreshtha*, Saket Mishra and Smriti Sen

Central Laboratory, Madhya Pradesh Pollution Control Board, Paryavaran Parisar, E-5, Arera Colony, Bhopal, India

ARTICLE INFO

Article History:

Received 10th October, 2019
Received in revised form
07th November, 2019
Accepted 29th December, 2019
Published online 30th January, 2020

Keywords:

Mandideep Industrial area,
Ground Water,
Water Pollutants,
Water quality.

ABSTRACT

Ground water quality, especially within industrial area is increasing interest for study. This paper is focus on the ground water quality status of Mandideep industrial area of Madhya Pradesh India. Study of physico-chemical parameters of ground water was carried out during different quarters of year 2018- 2019. In present study, total thirteen ground water samples were collected from selected locations at Mandideep industrial area. Ground water was monitored and samples were analyzed by standard methods. It is concluded that trace amount of pollutant in ground water was observed at few locations in Mandideep industrial area. The results are compared with BIS: 10500 (2012). Parameters like fluoride and ammonical nitrogen were not detected in ground water at all monitoring locations during this study. Anthropogenic activities (mainly industrial), in the area may have direct or indirect impact on the groundwater quality.

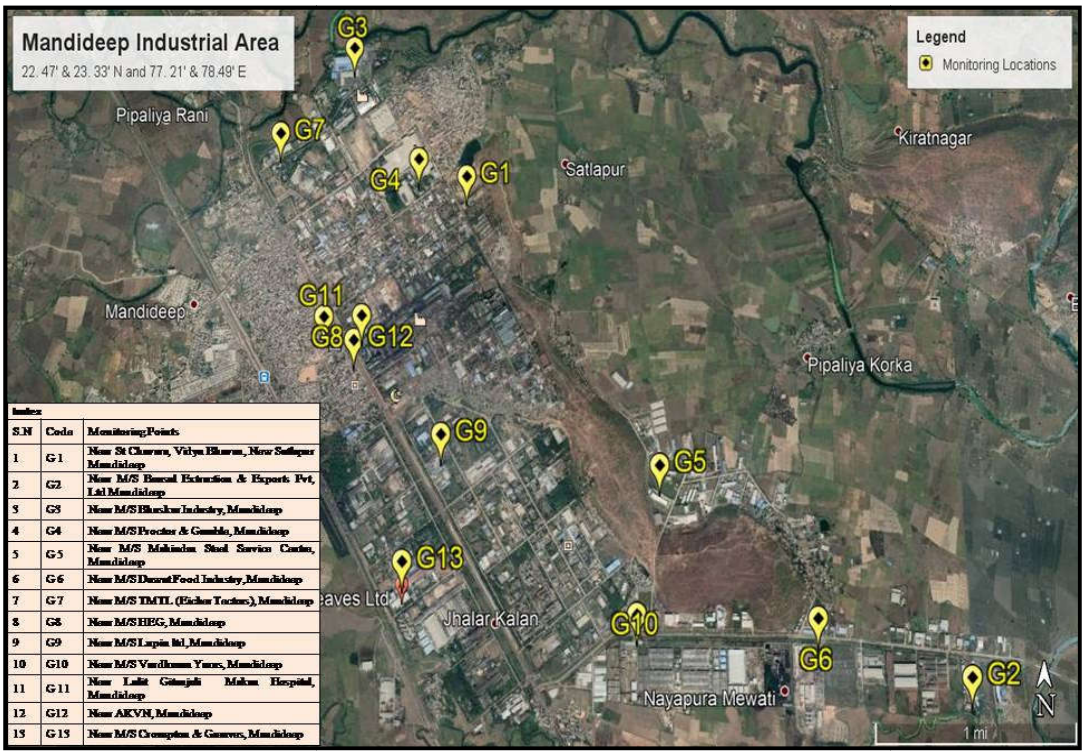
INTRODUCTION

The quality of ground water is of great importance in determining the suitability of particular ground water for a certain use (public water supply, irrigation, industrial applications, power generation etc.). This depends on a large number of individual hydrological, physical, chemical and biological factors that have acted on the water from the moment it condensed in the atmosphere to the time it is discharged by a well (Jerome, 2010; Shanmugam et al., 2007; Ravichandran, 2010). Adverse effects on ground water quality are a result of anthropogenic activity at ground surface such as unintentionally by agriculture, uncontrolled release of domestic and industrial effluents, by sub-surface or surface disposal of sewage and industrial wastes. It is important to know the geochemistry of the chemical-soil groundwater interactions in order to assess the fate and impact of pollutant discharged on to the ground (Mehta, 2010; Yadav, 2010; Hariharan, 2011; Agarwal, 2011). Ground water pollution is intrinsically difficult to detect, since the problem may well be concealed below the surface and monitoring is costly, time consuming and hard to resolve. Pollutants move through several different hydrologic zones as they migrate through the soil to the water table. The contamination of ground water by heavy metals and pesticides has assumed much significance during recent years due to their toxicity and accumulative behavior.

Corresponding author: **Ankita Kulshreshtha,**
Central Laboratory, Madhya Pradesh Pollution Control Board, Paryavaran Parisar, E-5, Arera Colony, Bhopal, India.

Ground water is an invaluable commodity available in very limited quantities to human being and other living beings. The usefulness of ground water to a great extent depends on its chemistry (Singh, 2011). The quality of groundwater depends on a large number of individual hydrological, physical, chemical and biological factors. Generally higher proportions of dissolved constituents are found in groundwater than in surface water because of greater interaction of ground water with various materials in geological strata (Kori et al., 2019). The Composition of ground water is influenced mainly by geology, climate, hydrogeology and also human activities (Telebi, 1994).

Industrial disposal of chemicals by surface and sub surface runoff, direct release into natural water bodies or waste, dumped near the factories can be subjected to reaction with percolating rain water and reach the ground water level. Solid wastes are dumped into the ravines of river, as fill in for village ponds and as spread over the grazing or waste lands. The percolating water picks up a large amount of dissolved constituents and reaches the aquifer system and contaminates the ground water (Gupta et al., 2010; Radhakrishnan, 2007). The water used for drinking purpose should be free from any toxic elements, living and nonliving organism and excessive amount of minerals that may be hazardous to health. Some of the heavy metals are extremely essential to humans, for example, cobalt, copper, etc., but large quantities of them may cause physiological disorders.



S.N	Code	Monitoring Points
1	G1	Near St Clarens, Vidya Bhawan, Near Satlapur Mandideep
2	G2	Near M/S Bansal Extraction & Exports Pvt, Ltd Mandideep
3	G3	Near M/S Bhaskar Industry, Mandideep
4	G4	Near M/S Procter & Gamble, Mandideep
5	G5	Near M/S Mahindra Steel Service Centre, Mandideep
6	G6	Near M/S Durant Food Industry, Mandideep
7	G7	Near M/S TMTL (Eicher Tractors), Mandideep
8	G8	Near M/S HPG, Mandideep
9	G9	Near M/S Lupin ltd, Mandideep
10	G10	Near M/S Vardhman Yarns, Mandideep
11	G11	Near Lalit Ginajali Mahan Hospital, Mandideep
12	G12	Near AKVN, Mandideep
13	G13	Near M/S Crompton & Greaves, Mandideep

Figure 1. Monitoring locations in Mandideep industrial area

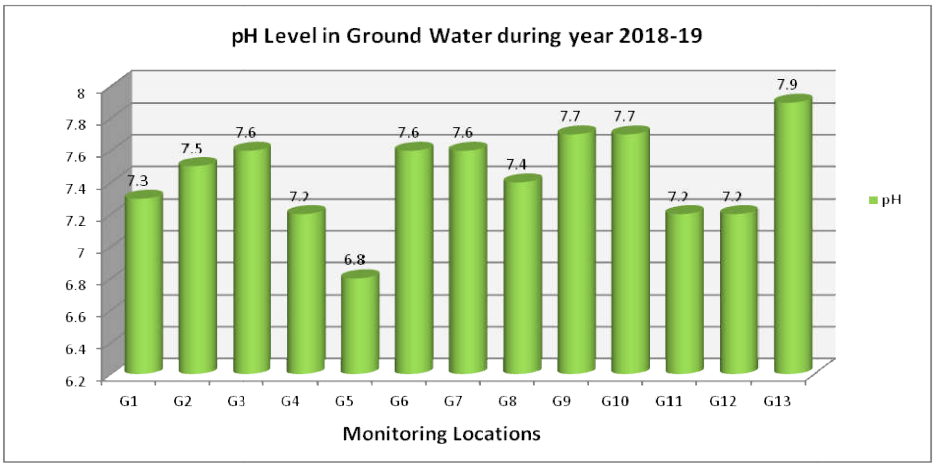


Figure 2: pH level of ground water

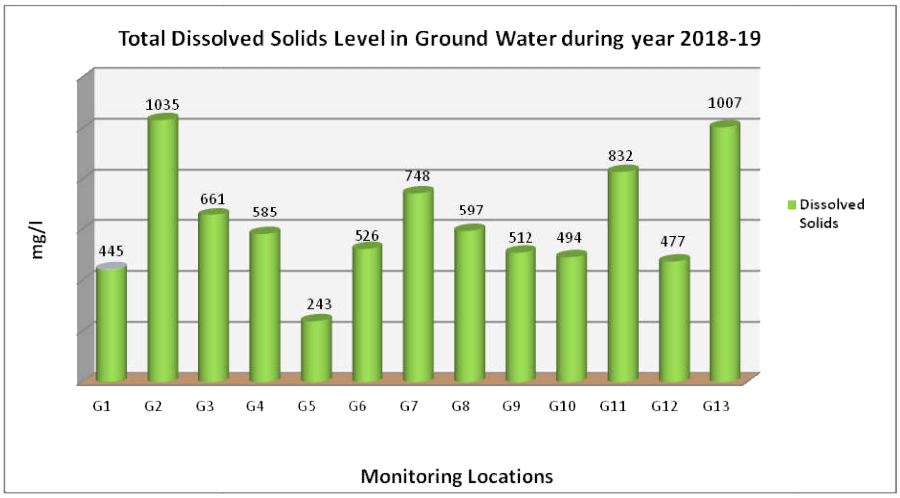


Figure 3. Total Dissolved Solids level of ground water

The contamination of groundwater by heavy metals has assumed great significance during recent years due to their toxicity and accumulative behavior. These elements, contrary to most pollutants, are not biodegradable and undergo a global eco-biological cycle in which natural waters are the main pathways. Ground water qualities, especially within industrial area are of increasing interest for study. Therefore this paper is important for evaluation of ground water quality of Mandideep industrial area of Madhya Pradesh, India.

METHODOLOGY

Study Area: Mandideep is a municipality in Goharganj subdistrict of Raisen district in the Indian state of Madhya Pradesh. Mandideep is 23 km from Bhopal and it is basically an industrial township which came into existence in late 1970s. It is situated between the latitude 22° 47' & 23°33' north and the longitude 77° 21' & 78°49' east and is bounded in the west by Sehore District, in the north by Vidisha District, in the east & southeast by Sagar District and in the south by Hoshangabad and Sehore districts (https://en.wikipedia.org/wiki/Mandideep).

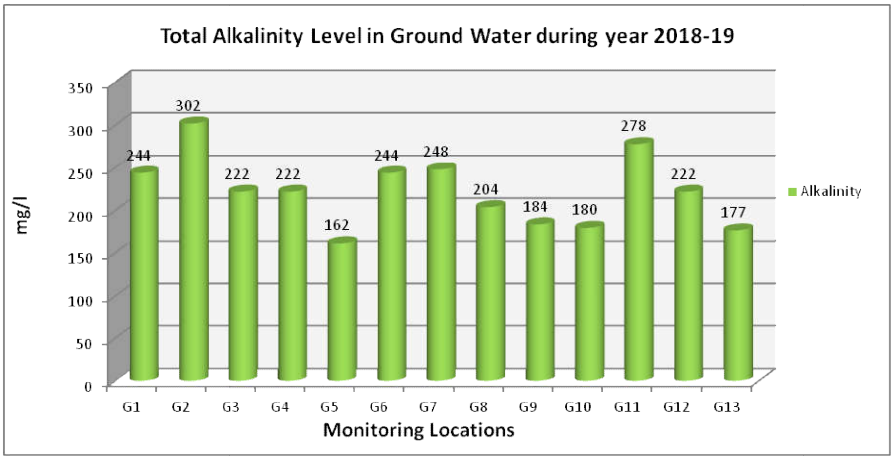


Figure 4. Total alkalinity level of ground water

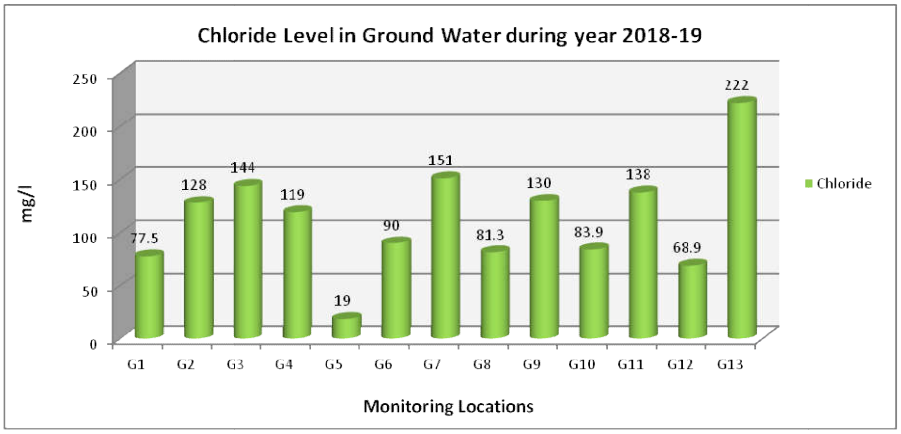


Figure 5: Chloride level of ground water

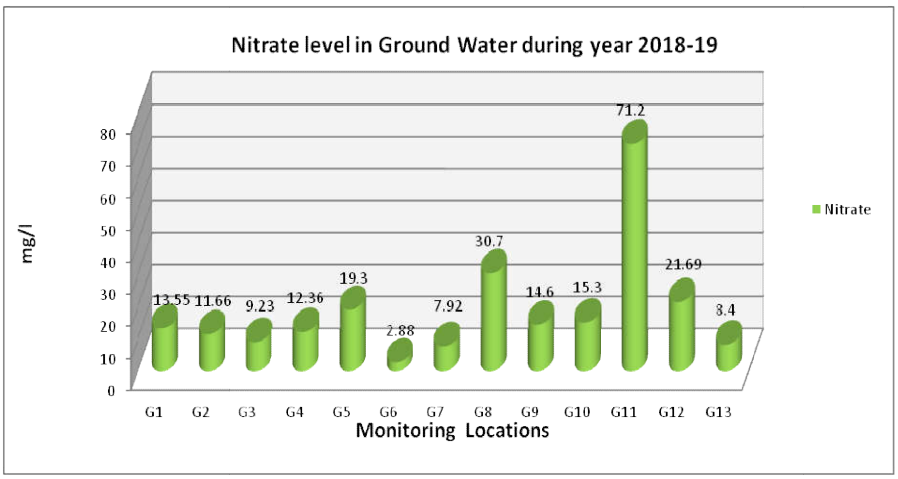


Figure 6. Nitrate level of ground water

Sampling Locations: Total thirteen locations were selected for ground water sampling is depicted in table no 1 and figure no 1.

Sampling and Analysis: All ground water were drawn from bore wells of selected sampling locations. Water samples were monitored and analyzed by as per standard methods (14-15) during this study. All results were compared with standard limits prescribed of drinking water of BIS 10500 (2012) (16).

RESULT AND DISCUSSION

The study of ground water quality data is depicted in table no 2 and figure no 2 to 11.

In figure no 2, the pH ranges from 6.8 (G 5) -7.9 (G 13) which was within the limits of BIS: 10500 (6.5-8.5) at all monitoring locations during this study. In Figure no 3, total dissolved solids was found in the range of 243 (G 5) – 1035 (G 2) mg/l during this study. Figure no 4 is showing that minimum average concentration of total alkalinity was found 162 mg/l (G 5) and maximum concentration 302 mg/l (G 2) during this study. Figure no 5 is showing that minimum average concentration of chloride was found 19 mg/l (G 5) and maximum concentration 222 mg/l (G 13) during this study. Fluoride and ammonical nitrogen were not detected in ground water at all monitoring locations during this study. Figure no 6 is showing that minimum average concentration of nitrate was found 2.88 mg/l (G 6) and maximum concentration 71.2 mg/l (G 11) during this study.

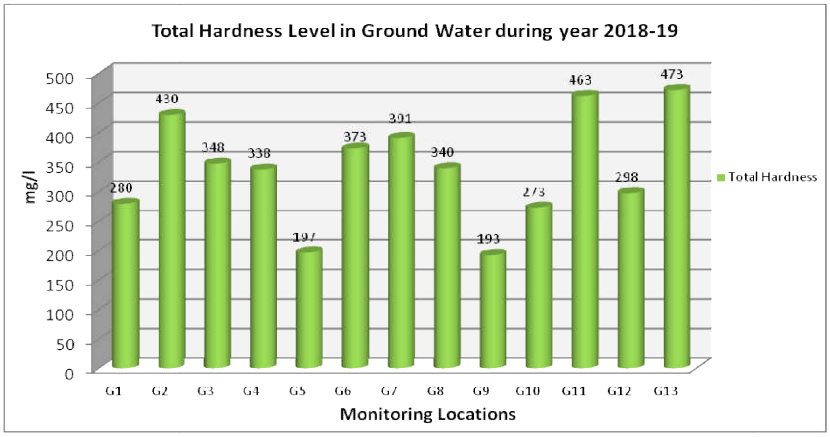


Figure 7. Total Hardness level of ground water

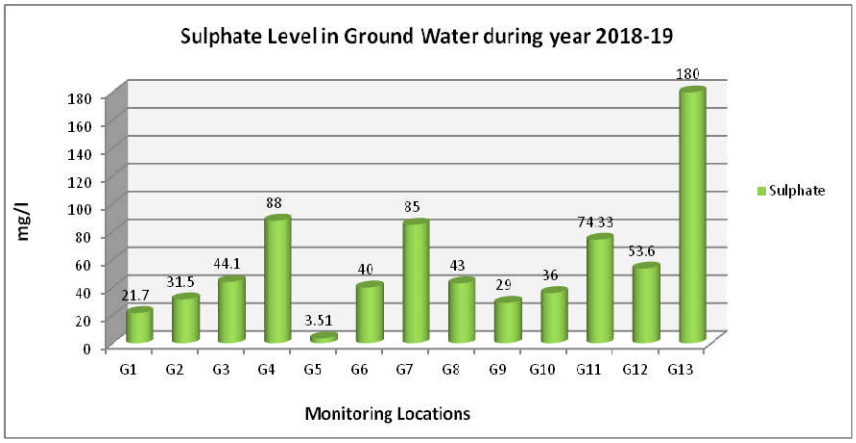


Figure 8. Sulphate level of ground water

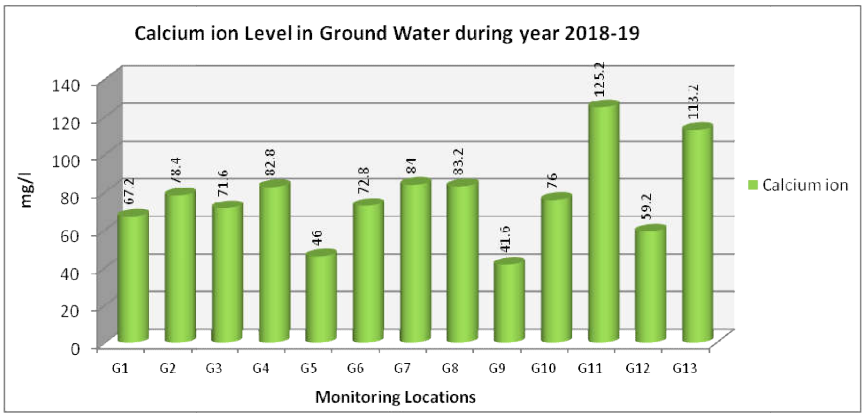


Figure 9. Calcium ion level of ground water

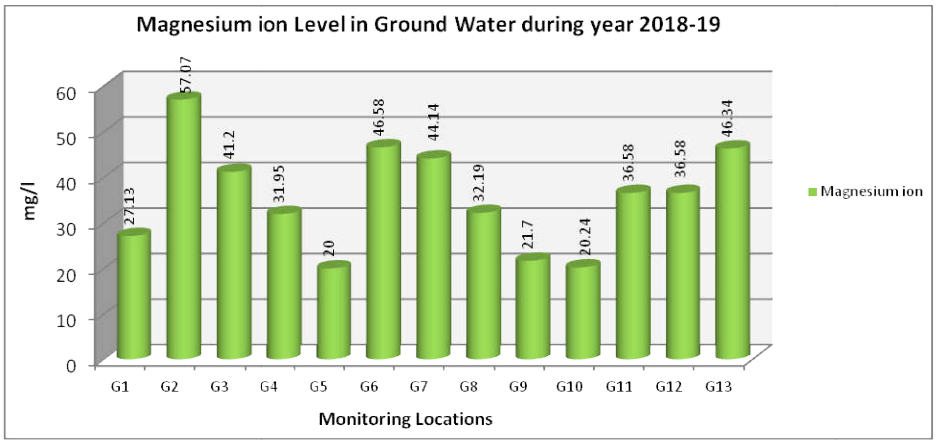


Figure 10. Magnesium ion level of ground water

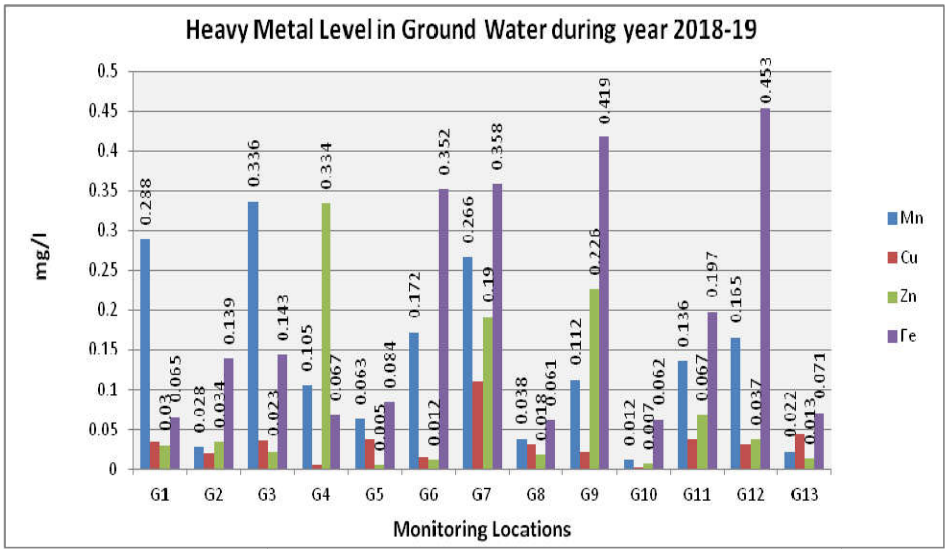


Figure 11. Heavy metals level of ground water

Table 1. Monitoring locations in Mandideep industrial area

S.N	Code	Monitoring Points
1	G 1	Near St Chavara, Vidya Bhavan, New Satlapur Mandideep
2	G2	Near M/S Bansal Extraction & Exports Pvt, Ltd Mandideep
3	G3	Near M/S Bhaskar Industry, Mandideep
4	G4	Near M/S Proctor & Gamble, Mandideep
5	G 5	Near M/S Mahindra Steel Service Centre, Mandideep
6	G 6	Near M/S Dawat Food Industry, Mandideep
7	G 7	Near M/S TMTL (Eicher Tectors), Mandideep
8	G8	Near M/S HEG, Mandideep
9	G9	Near M/S Lupin ltd, Mandideep
10	G10	Near M/S Vardhman Yarns, Mandideep
11	G 11	Near Lalit Gitanjali Makan Hospital, Mandideep
12	G12	Near AKVN, Mandideep
13	G 13	Near M/S Crompton & Greaves, Mandideep

The presence of little higher concentration of nitrate in water is an indication of pollution in ground water may cause eutrophication as a nutrient, hence reducing water quality. Figure no 7 is showing that minimum average concentration of total hardness was found 197 mg/l (G 5) and maximum concentration 473 mg/l (G 13) during this study.

Figure no 8 is showing that minimum average concentration of sulphate was found 3.51 mg/l (G 5) and maximum concentration 180 mg/l (G 13) during this study. Figure no 9 is showing that minimum average concentration of calcium ion was found 41.6 (G 9) and maximum concentration 125.3(G 11) during this study.

Table 2. Physicochemical study of ground water in Mandideep industrial area

S.N.	Analytes	Unit	BIS, 10500 (2012)		G1	G2	G3	G4	G5	G6	G7
			Requirement (Acceptable Limit)	Permissible Limit in the absence of alternate source							
1	pH	pH unit	6.5-8.5	Not Relaxation	7.3	7.5	7.6	7.2	6.8	7.6	7.6
2	Total Dissolved Solids	mg/l	500	2000	445	1035	661	585	243	526	748
3	Chloride	mg/l	250	1000	76	128	144	119	19	90	151
4	Ammonical Nitrogen	mg/l	0.5	Not Relaxation	BDL	BDL	BDL	BDL	BDL	BDL	BDL
5	Nitrate	mg/l	45	Not Relaxation	13.55	11.66	9.23	12.36	19.3	2.88	7.92
6	Total Alkalinity	mg/l	200	600	244	302	222	222	162	244	248
7	Total Hardness	mg/l	200	600	280	430	348	338	197	373	391
8	Sulphate	mg/l	200	400	21.7	31.5	44.1	88	3.51	40	85
9	Fluoride	mg/l	1	1.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10	Calcium ion	mg/l	75	200	67.2	78.4	71.6	82.8	46	72.8	84
11	Magnesium ion	mg/l	30	100	27.13	57.07	41.2	31.95	20	46.58	44.14
12	Mn	mg/l	0.3	0.1	2.888	0.028	0.336	0.105	0.063	0.172	0.266
13	Cu	mg/l	0.05	1.5	0.035	0.021	0.036	0.005	0.037	0.014	0.11
14	Zn	mg/l	5	15	0.03	0.034	0.023	0.334	0.005	0.012	0.19
15	Fe	mg/l	0.3	Not Relaxation	0.065	0.139	0.143	0.067	0.084	0.352	0.358
Remark : BDL – Blow Detection Limit											

Table 2: Continue.

S.N.	Analytes	Unit	BIS , 10500 (2012)		G8	G9	G10	G11	G12	G13
			Requirement (Acceptable Limit)	Permissible Limit in the absence of alternate source						
1	pH	pH unit	6.5-8.5	Not Relaxation	7.4	7.7	7.7	7.2	7.2	7.9
2	Total Dissolved Solids	mg/l	500	2000	597	512	494	832	477	1007
3	Chloride	mg/l	250	1000	81.3	130	84	138	69	222
4	Ammonical Nitrogen	mg/l	0.5	Not Relaxation	BDL	BDL	BDL	BDL	BDL	BDL
5	Nitrate	mg/l	45	Not Relaxation	30.7	14.6	15.3	71.2	21.69	8.4
6	Total Alkalinity	mg/l	200	600	204	184	180	278	222	177
7	Total Hardness	mg/l	200	600	340	193	273	463	298	473
8	Sulphate	mg/l	200	400	43	29	36	74.33	53.6	180
9	Fluoride	mg/l	1	1.5	BDL	BDL	BDL	BDL	BDL	BDL
10	Calcium ion	mg/l	75	200	83.2	41.6	76	125.2	59.2	113.2
11	Magnesium ion	mg/l	30	100	32.19	21.7	20.24	36.58	36.58	46.34
12	Mn	mg/l	0.3	0.1	0.038	0.112	0.012	0.136	0.165	0.022
13	Cu	mg/l	0.05	1.5	0.032	0.022	0.003	0.037	0.032	0.043
14	Zn	mg/l	5	15	0.018	0.226	0.007	0.067	0.037	0.013
15	Fe	mg/l	0.3	Not Relaxation	0.061	0.419	0.062	0.197	0.453	0.071

Figure no 10 is showing that minimum average concentration of magnesium ion was found 20 (G 5) and maximum concentration 57.07 (G 2) during this study. In Figure 11, Observed order of the analyzed heavy metals as Fe> Mn>Zn >Cu that represented, no higher concentration of heavy metals were found during this study.

Conclusion

It is concluded that trace amount of pollutant w.r.t parameters under study in ground water was observed at few locations in Mandideep industrial area. The results were compared with BIS: 10500 (2012). Anthropogenic activities (mainly industrial), in the area may have direct or indirect impact on the groundwater quality. Discharges from such activities in terms of pollutants mainly responsible for environmental degradation in the industrial area.

May deepness of water source, sewage source, anthropogenic, industrial activities and other anthropogenic activities are reason of presence of trace amount of pollutant in ground water of Mandideep industrial area.

Acknowledgement

The authors acknowledge the help received from authorities of selected monitoring locations in Mandideep. Authors also acknowledge the Chairman and Member Secretary, Madhya Pradesh Pollution Control Board, for encouragement of study work and kind permission to publish this paper.

REFERENCES

Agarwal, R. 2011. Physicochemical analysis of some groundwater samples of Kotputli Town, Jaipur, Rajasthan. Int J Chem Env Pharama Res. 1 (2): 111-13.

Guidelines for the water monitoring, Central Pollution Control Board, New Delhi, India, (2007).

Gupta, V.K. Jain, V.K. Gupta, G.K. Shrivastava, V.S. Sonawane, G.H. 2010. Studies on Drinking Water Quality of Ground water of Auraiya District (Uttarpradesh), J App Chem Res. 14:27-36.

Hariharan, W.A.L.S.H. 2011. Evaluation of Ground water Quality in the vicinity of Jindal ferroalloys coporation, Vishkahapatnam District, (A.P). J Chem Pharm Res. 3(3):93-97.

https://en.wikipedia.org/wiki/Mandideep

Indian Standard drinking water — specification (Second Revision), IS 10500 : (2012). Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.

Jerome, C. and Pius, P. 2010. Evaluation of the water Quality Index and its impact on the quality of life in an industrial area in Bangalore, South India, Amrcn J Sci & Ind Res. 1(3): 595-603.

Kori, R. Saxena, A. Wankhade, H. Baig, A. Kulshreshtha, A. and Sen, S. 2019. Presence of Contamination in Ground Water around Mandideep Industrial Area, Madhya Pradesh, India. Int J Adv Res. 7(8): 1-11.

Mehta, K.V. 2010. Physico-chemical characteristics and Statistical study of ground water of some places of Vadagam taluka in Banaskantha district of Gujarat State (India*). J Chem Pharm. Res*.2 (4):663.

Radhakrishnan, R. Dharmaraj, K and Kumari R. 2007. A comparative study on the physicochemical and bacterial analysis of drinking, borewell and sweage water in the three different places of Sivakase. J Env Bio. 28 (1):105-108.

Ravichandran, K. and Jayaprakash, M. 2010. Seasonal variation on physicochemical parameters and trace metals in ground water of an industrial area of north Chennai, India. Ind. J Sci Tech. 4(6).

Shanmugam, P. Neelamani, S. Ahn, Y.H. Philip, L. Hong, G. 2007. Assessment of the levels of coastal marine pollution of Chennai City, Southern India. Water Resource Manager. 21 (7): 1187–1206.

Singh. A. and Choudhary, S.K. 2011. Chemical Analysis of ground water Nathnagar Block under Bhagalpur district, Bihar (India). J Envi Sci & Engg. 53: 469-474.

Standard Methods for the Examination of Water and Wastewater. American Public Health Association (APHA), American Water Works Association and Water Pollution Control Federation, Washington DC, 23rd edition, (2017).

Telebi, A. Chandrashekhara, M.J.G. Fazlli, M.S. Khosra, F.V. and Bhole, A.G. 1994 Hydrogeo Chemistry and Quality of Ground Water in yenne Hole watershed. JIAEM. 21: 8-16.

Yadav, S.S. and Kumar, R. 2010. Assessment of ground water pollution due to fluoride content and water quality in and around Tanda Taluka of Rampur district, Utrapradesh, *India, J. Chem and Pharm Res*. 2(4):564-568.

****