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RESEARCH ARTICLE

PRESENCE OF CONTAMINATION IN GROUND WATER AROUND MANDIDEEP INDUSTRIAL AREA, MADHYA PRADESH, INDIA.

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Abstract

Ground water contamination can often have serious harmful effects on human health. Ground water is one of the major resources of the drinking water in India. Mandideep industrial area, Madhya Pradesh is located near Bhopal capital of Madhya Pradesh, India. For present ground water study, Mandideep industrial area were divided in to 20 Blocks in which 13 blocks were selected for this study and other 7 blocks have open area around was no monitoring blocks. Study of all Physico-chemical parameters of ground water was carried out during different four quarters of year 2017 to 2018. All ground water monitoring was done as per standard guidelines followed by Central Pollution Control Board and analyzed by standard methods. It is concluded that high contamination in ground waters observed at few locations around Mandideep Industrial area during this study as compare to drinking water standard BIS , 10500 (2012). The observation reveals minimum average concentration of nitrate was found 3.74 mg/l (G5) & maximum concentration 27.88 mg/l (G8) and minimum average concentration of fluoride was found 0.23 mg/l (G10) & maximum concentration 1.11 mg/l (G 2) during this study. All activities, such as industrial discharge, subsurface injection of chemicals and hazardous which carried out at industrial area may reason of source of ground water pollutants.

Introduction:-

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 [1]. Water pollution is the contamination of water bodies such as lakes, rivers, oceans and groundwater [2]. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful constituents. The composition of ground water is influenced mainly by geology, climate, hydrogeology and also human activities . It has excellent natural quality, usually free from pathogens, color , turbidity and can be consumed directly without treatment [3]. 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. The water used for drinking purpose should be free from any toxic elements, living and nonliving

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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. 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.

Groundwater contributes to about eighty percent of the drinking water requirements in rural areas, fifty percent of urban water requirements and more than fifty percent of the irrigation requirements of the nation, but due to rapid industrialization and population explosion the groundwater quality and quantity have been significantly affected and overexploited [4,5]. The problems of ground water quality in several parts of the country have become so acute in the areas that are densely populated and thickly industrialized and have shallow ground water tube wells [6]. There are many sources that contribute contaminants to the ground water, e.g. land disposal of solid wastes, disposal on land, agricultural activities, urban runoff and polluted surface water. The quality of water is of vital concern for man since it is directly related to the human health. The most common and widespread health risk associated with drinking water is microbial contamination which has the potential to cause large outbreaks of water born diseases like dysentery, cholera, typhoid, skin infections etc. The chemical contaminations do not cause immediate, acute health problems unless they are present in massive quantities through some accident and use of drinking water sources [7].

Methodology:-

Study Area

Mandideep is a municipality in Goharganj subdistrict of Raisen district in the Indian state of Madhya Pradesh. Mandideep is Industrial area established in year 1975, is situated near Bhopal, 25 KM away from state capital of Madhya Pradesh. It is situated between the latitude 22^{o} 47' and 23^{o} 33' north and the longitude 77^{o} 21' and 78^{o} 49' east and is bounded in the west by Sehore District, in the north by Vidisha District, in the east and southeast by Sagar District, and in the south by Hoshangabad and Sehore districts [8].

Monitoring Locations

Mandideep industrial area were divided in to 20 Blocks in which 13 blocks were selected for this study and other 7 blocks have open area around was no monitoring blocks. Total thirteen locations were selected for ground water is depicted in table no 1 and figure no 1.

Table 1:-Monitoring Locations around Mandideep industrial area

S.N	Code	Monitoring Locations	Monitoring Points
1	G1	Block 2	Near St Chavara, H. S. School, New Satlapur Mandideep
2	G2	Block 5	Near M/S Bansal Extraction & Exports Pvt, Ltd Mandideep
3	G3	Block 6	Near M/S Bhaskar Industry, Mandideep
4	G4	Block 7	Near M/S Proctor & Gamble, Mandideep
5	G5	Block 8	Near M/S Mahindra Steel Service Centre, Mandideep
6	G6	Block 9	Near M/S Dawat Food Industry, Mandideep
7	G7	Block 11	Near M/S TMTL (Eicher Tectors), Mandideep
8	G8	Block 12	Near M/S HEG, Mandideep
9	G9	Block 13	Near M/S Lupin ltd, Mandideep
10	G10	Block 14	Near M/S Vardhman Yarns, Mandideep
11	G11	Block 16	Near Lalit Gitanjali Hospital, Mandideep
12	G12	Block 17	Near AKVN, Mandideep
13	G13	Block 18	Near M/S Crompton & Greaves (Transformer Div), Mandideep
Remark -Block 1,3,4,10,15,19,20 are no monitoring zones			

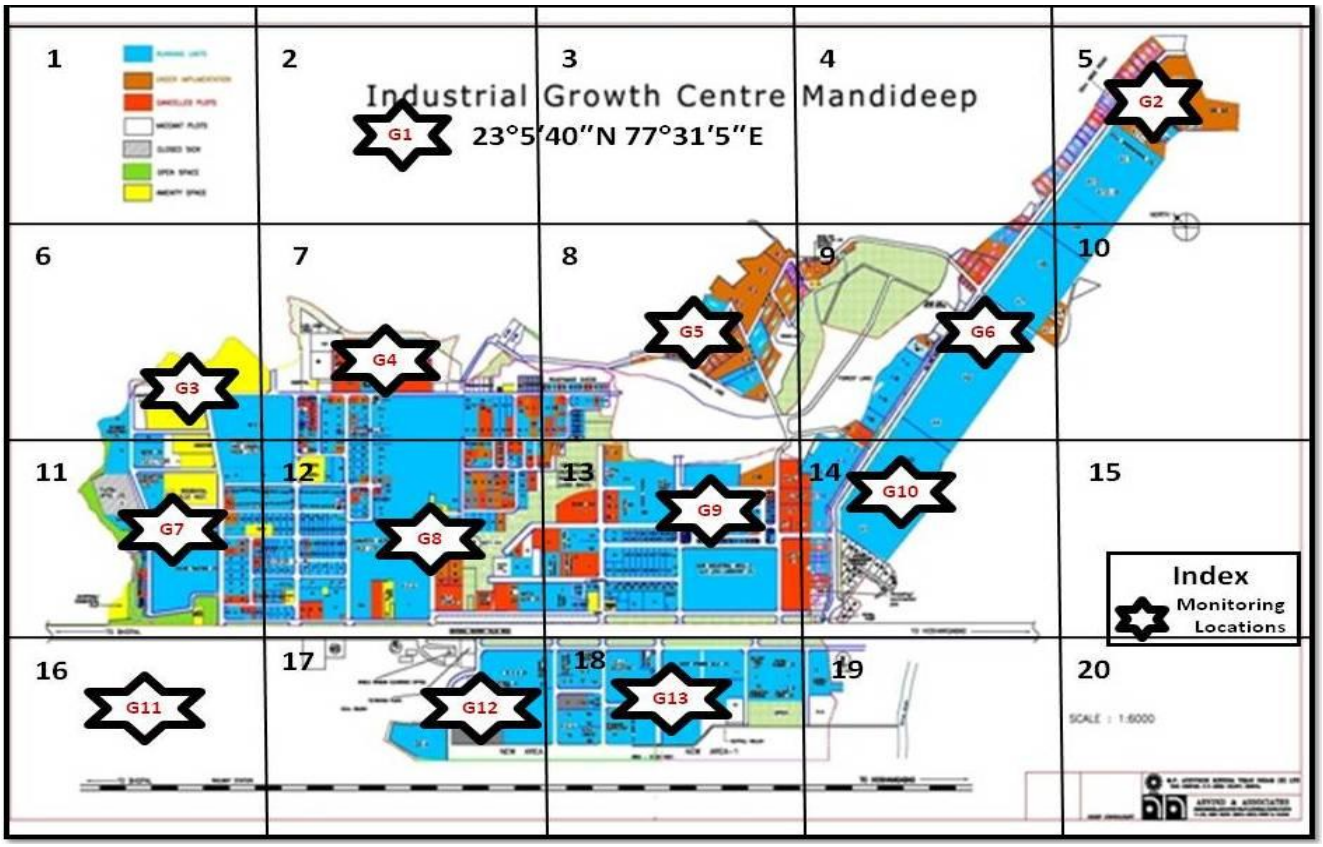

Figure 1:-Monitoring Locations around Mandideep industrial area

Monitoring and Analysis

All ground water monitoring was done as per standard guidelines followed by Central Pollution Control Board [9]. All ground water samples were drawn from bore wells and were analyzed by as per standard methods [10] during this study.

Result & Discussion:-

The study of ground water quality data is depicted in table no 2 and figure no 2 to 12.

Table 2:-Physicochemical study of ground water around 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	7.1	7.3	7.1	7.4	6.5	7.7	7.2
2	Total Dissolved Solids	mg/l	500	2000	508	679	629	583	236	395	701
3	Chloride	mg/l	250	1000	143	135	173	127	41	53	165
4	Ammonical Nitrogen	mg/l	0.5	Not Relaxation	BDL	BDL	BDL	BDL	BDL	BDL	BDL

5	Nitrate	mg/l	45	Not Relaxation	11.58	9.71	11.14	13.17	3.74	11.82	6.17
6	Total Alkalinity	mg/l	200	600	264	359	259	252	169	313	246
7	Total Hardness	mg/l	200	600	293	473	381	317	206	372	383
8	Sulphate	mg/l	200	400	40	45	59	55	2	26	93
9	Fluoride	mg/l	1	1.5	1.11	0.52	0.59	0.39	0.46	0.5	0.37
10	Calcium ion	mg/l	75	200	62.8	94.8	115.6	86.8	49.2	54.8	106.4
11	Magnesium ion	mg/l	30	100	33.17	57.56	22.43	24.39	20.24	57.3	28.53
12	Mn	mg/l	0.3	0.1	0.051	0.427	0.112	0.4	0.085	1.734	0.532
13	Cu	mg/l	0.05	1.5	0.015	0.958	0.134	ND	ND	0.821	ND
14	Zn	mg/l	5	15	0.687	0.111	ND	0.023	ND	0.16	0.032
15	Fe	mg/l	0.3	Not Relaxation	0.33	0.145	0.15	0.44	0.6	1.67	0.32

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	7.5	7.3	7.2	7.2	7.8
2	Total Dissolved Solids	mg/l	500	2000	453	657	451	637	488	973
3	Chloride	mg/l	250	1000	91	232	66	129	64	213
4	Ammonical Nitrogen	mg/l	0.5	Not Relaxation	BDL	BDL	BDL	BDL	BDL	BDL
5	Nitrate	mg/l	45	Not Relaxation	27.88	16.88	11.7	23.73	18.21	10.16
6	Total Alkalinity	mg/l	200	600	208	229	199	300	228	258
7	Total Hardness	mg/l	200	600	298	418	227	445	289	529
8	Sulphate	mg/l	200	400	53	64	24	49	50	132

9	Fluoride	mg/l	1	1.5	0.42	0.43	0.23	0.34	0.32	0.36
10	Calcium ion	mg/l	75	200	75.6	118	64	118.8	60	129.2
11	Magnesium ion	mg/l	30	100	26.58	30	16.34	36.09	33.9	50.24
12	Mn	mg/l	0.3	0.1	0.104	0.104	0.05	0.007	0.184	0.03
13	Cu	mg/l	0.05	1.5	ND	ND	ND	0.023	ND	0.003
14	Zn	mg/l	5	15	ND	ND	ND	ND	ND	0.022
15	Fe	mg/l	0.3	Not Relaxation	0.01	0.01	0.1	0.01	0.03	0.76

In figure no 2, the pH ranges from 6.5 (G 5) -7.8 (G 13) which was within the limits of BIS: 10500 (6.5-8.5) at all monitoring locations during this study.

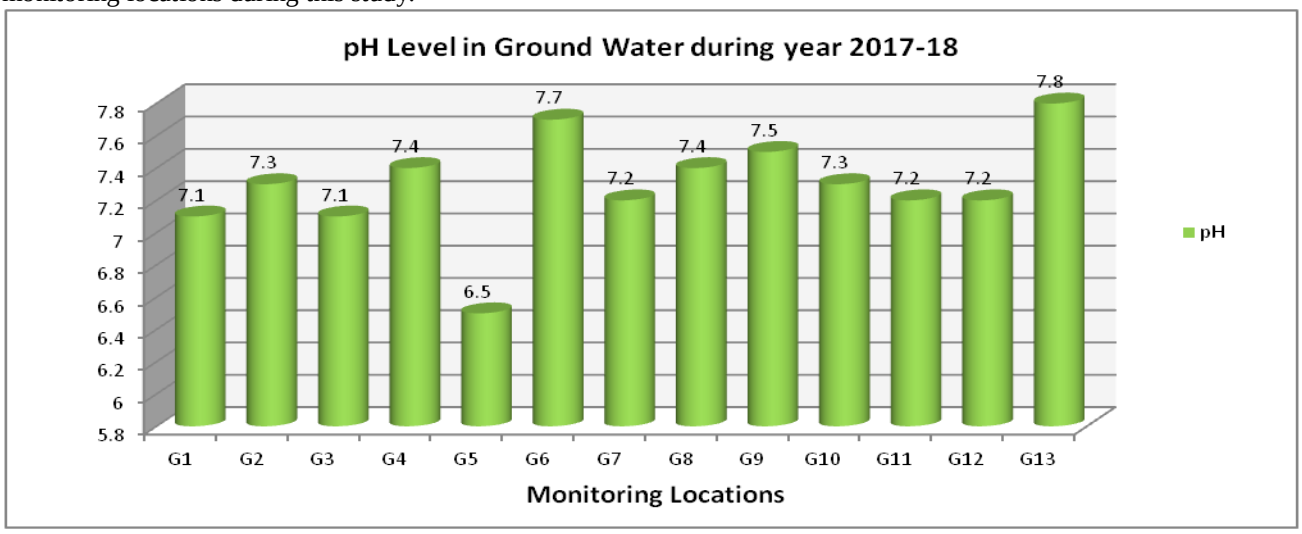

Figure 2:-pH level of ground water

In Figure no 3, total dissolved solids was found in the range of 236 (G 5) – 973 (G 13) mg/l during this study.

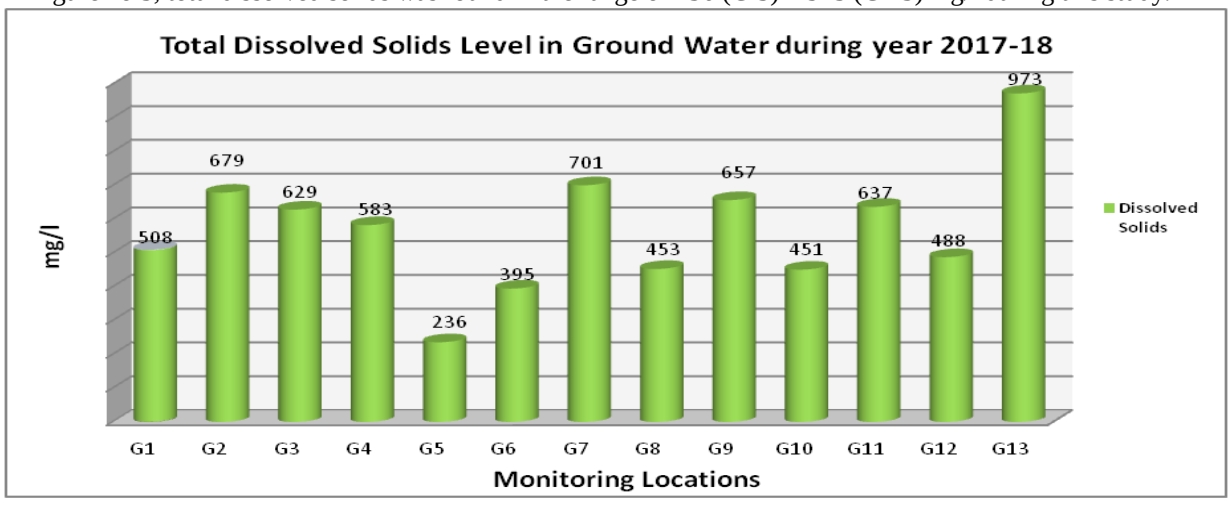

Figure 3:-Total Dissolved Solids level of ground water

Figure no 4 is showing that minimum average concentration of chloride was found 41 mg/l (G 5) and maximum concentration 232 mg/l (G 9) during this study.

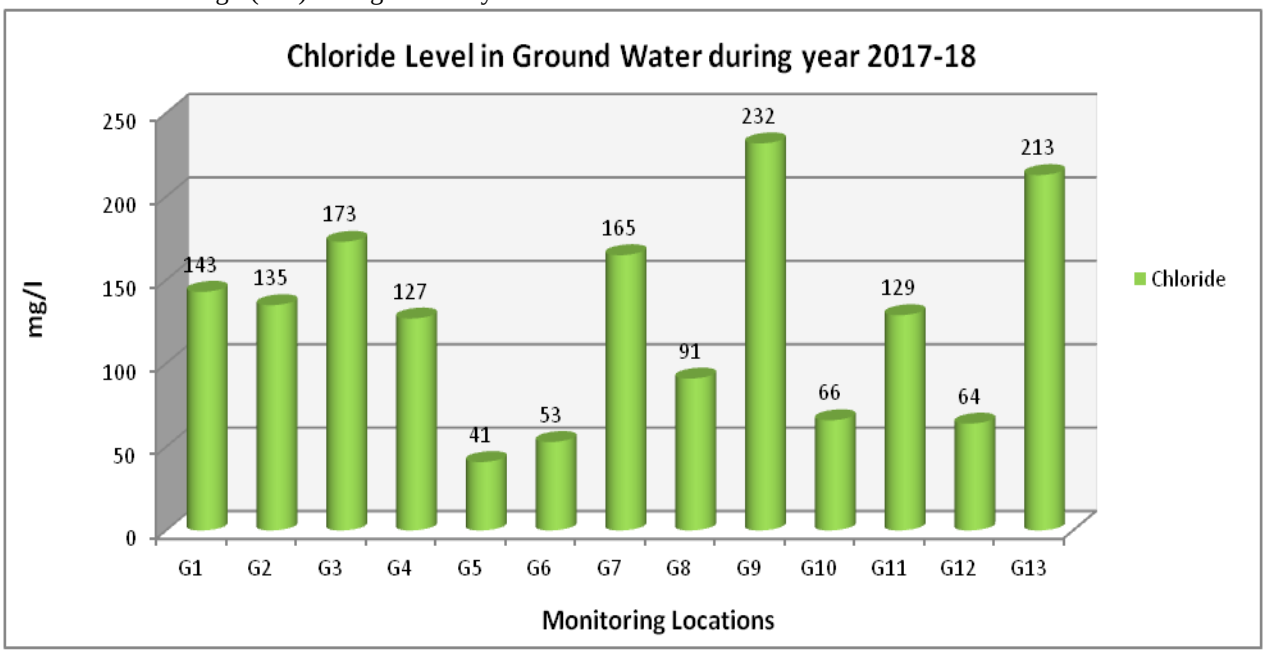

Figure 4:-Chloride level of ground water

Ammonical nitrogen was not detected in ground water at all monitoring locations during this study. Figure no 5 is showing that minimum average concentration of nitrate was found 3.74 mg/l (G 5) and maximum concentration 27.88 mg/l (G 8) during this study. 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.

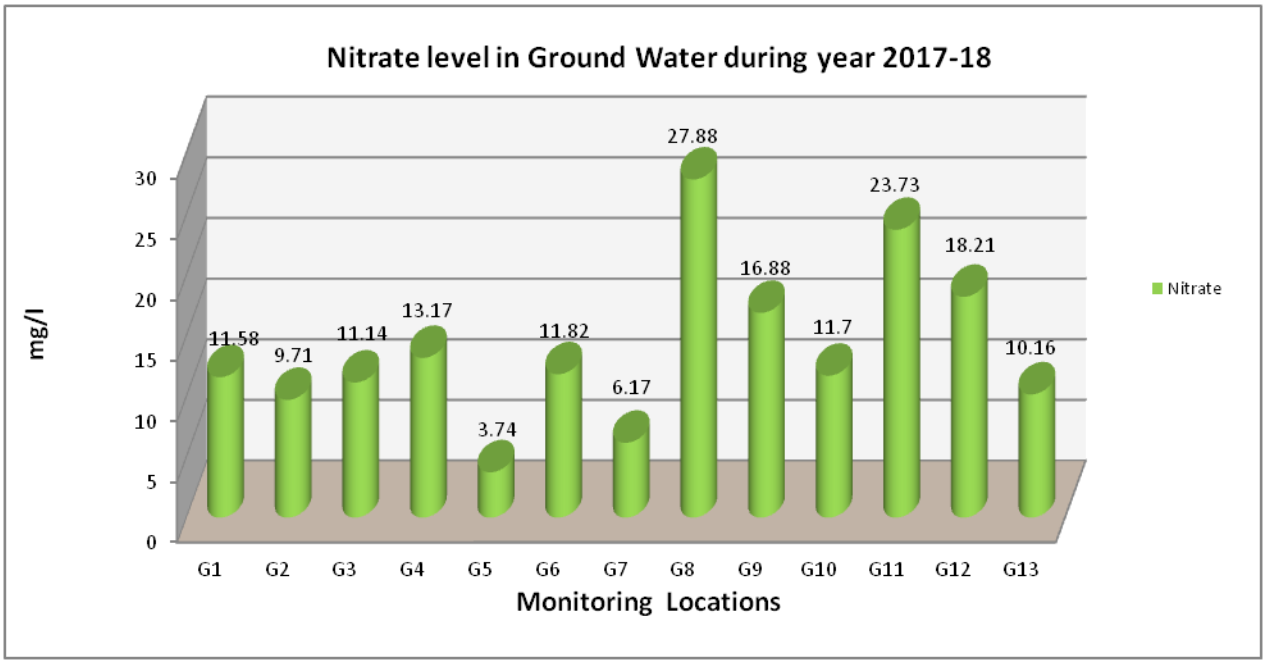

Figure 5:-Nitrate level of ground water

Figure no 6 is showing that minimum average concentration of total alkalinity was found 169 mg/l (G 5) and maximum concentration 359 mg/l (G 2) during this study.

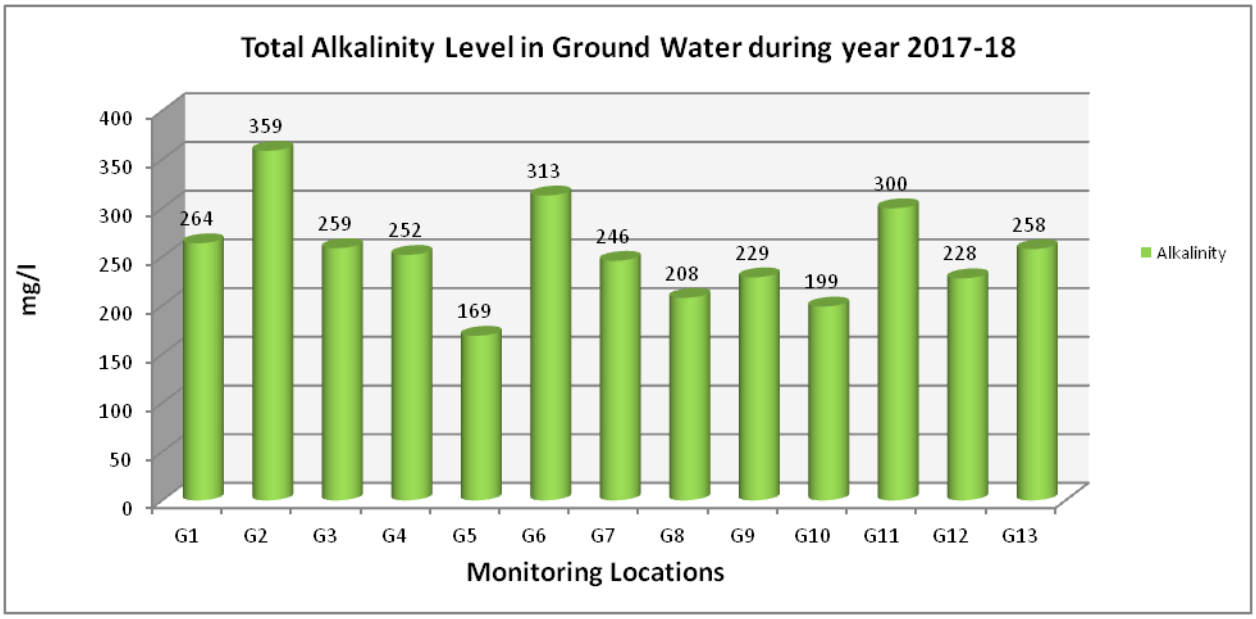

Figure 6:-Total Alkalinity level of ground water

Figure no 7 is showing that minimum average concentration of total hardness was found 206 mg/l (G 5) and maximum concentration 529 mg/l (G 13) during this study.

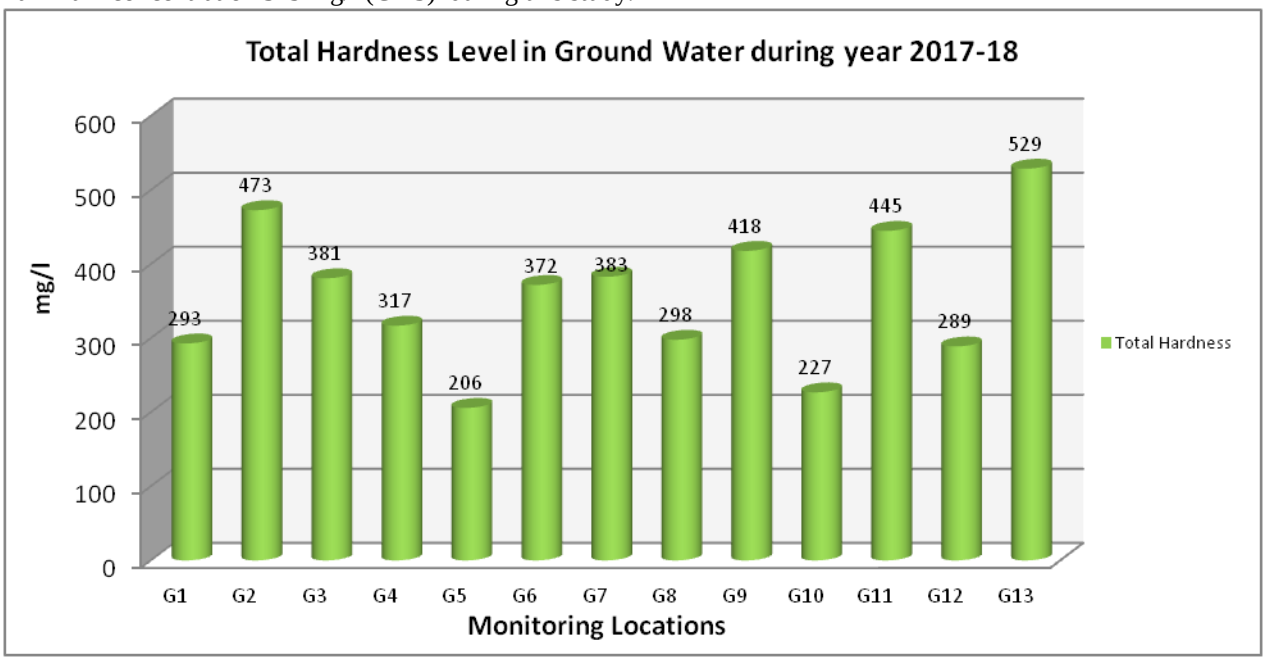

Figure 7:-Total Hardness level of ground water

Figure no 8 is showing that minimum average concentration of sulphate was found 2 mg/l (G 5) and maximum concentration 132 mg/l (G 13) during this study.

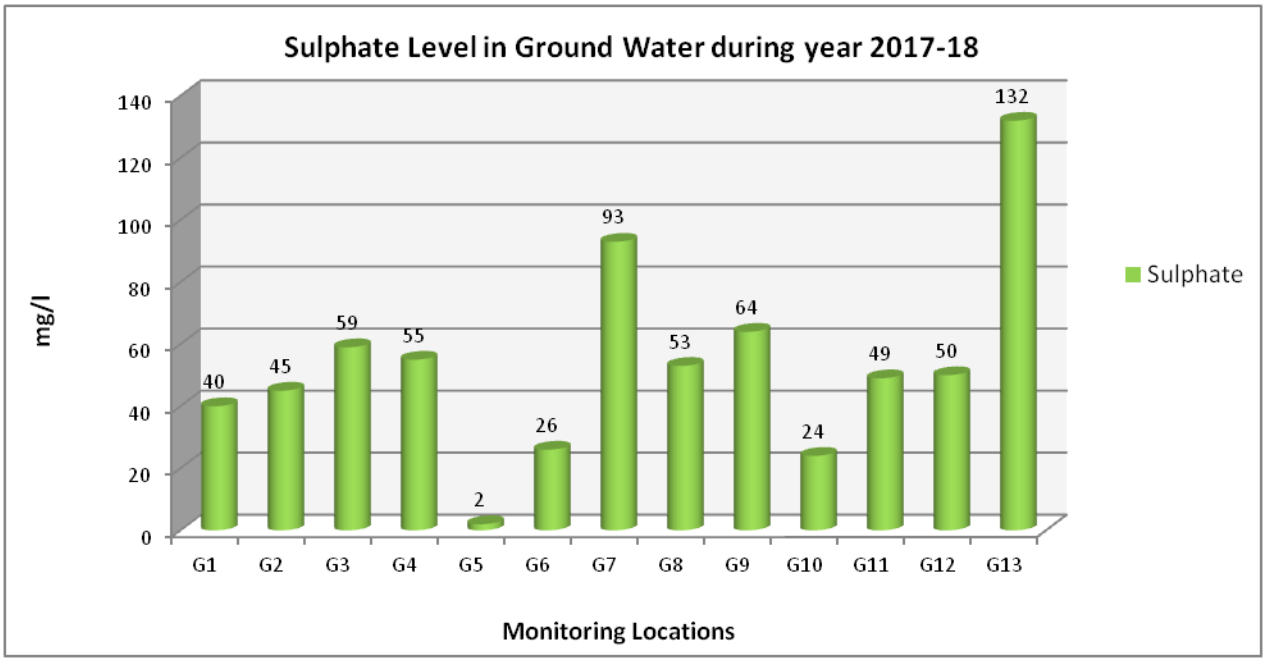

Figure 8:-Sulphate level of ground water

Figure no 9 is showing that minimum average concentration of fluoride was found 0.23 mg/l (G10) and maximum concentration 1.11 mg/l (G 2) during this study.

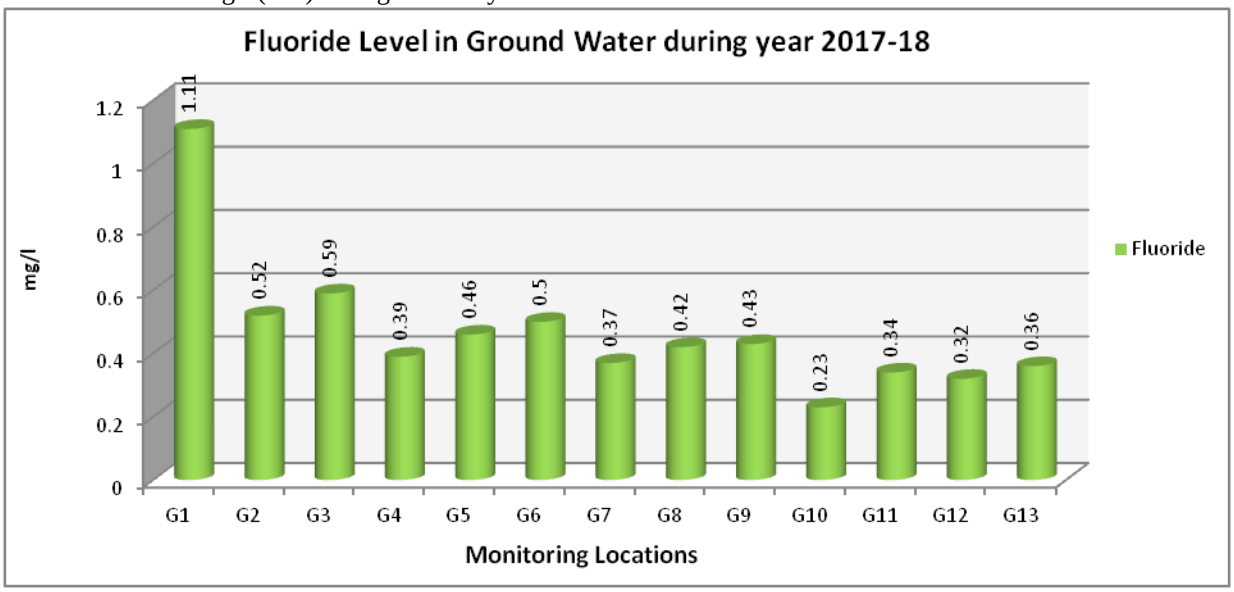

Figure 9:-Fluoride level of ground water

Figure no 10 is showing that minimum average concentration of calcium ion was found 49.2 (G 5) and maximum concentration 129.2 (G 13) during this study.

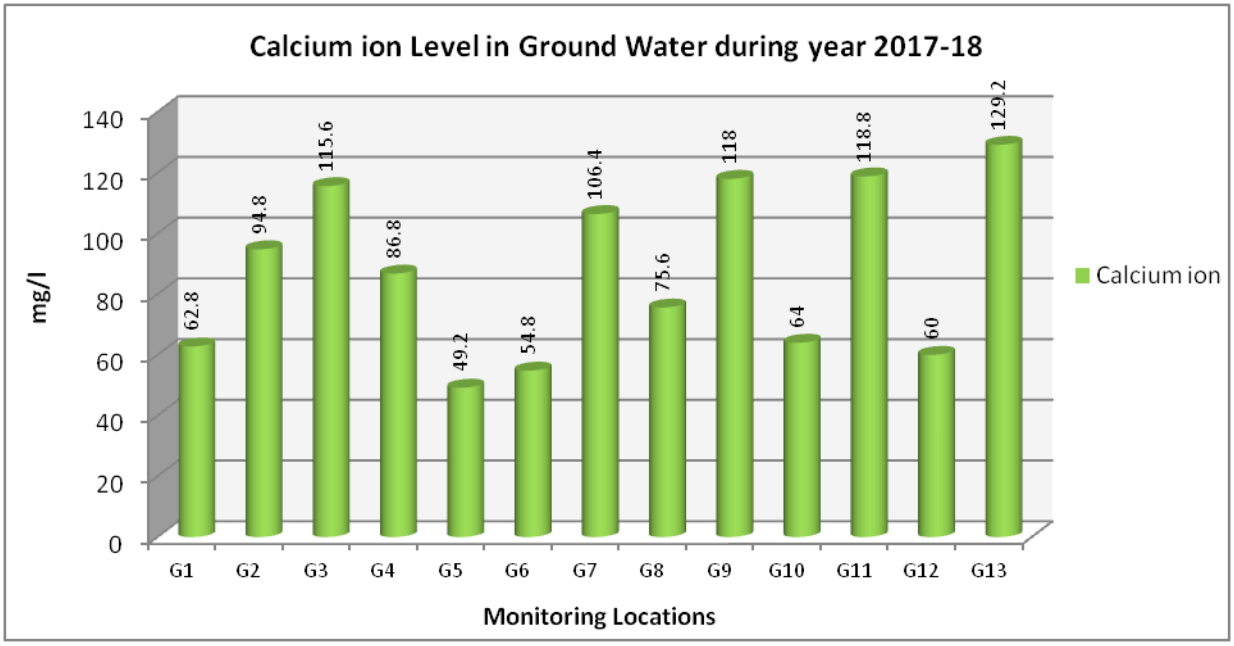

Figure 10:-Calcium ion level of ground water

Figure no 11 is showing that minimum average concentration of magnesium ion was found 16.34 (G 10) and maximum concentration 57.56 (G 2) during this study.

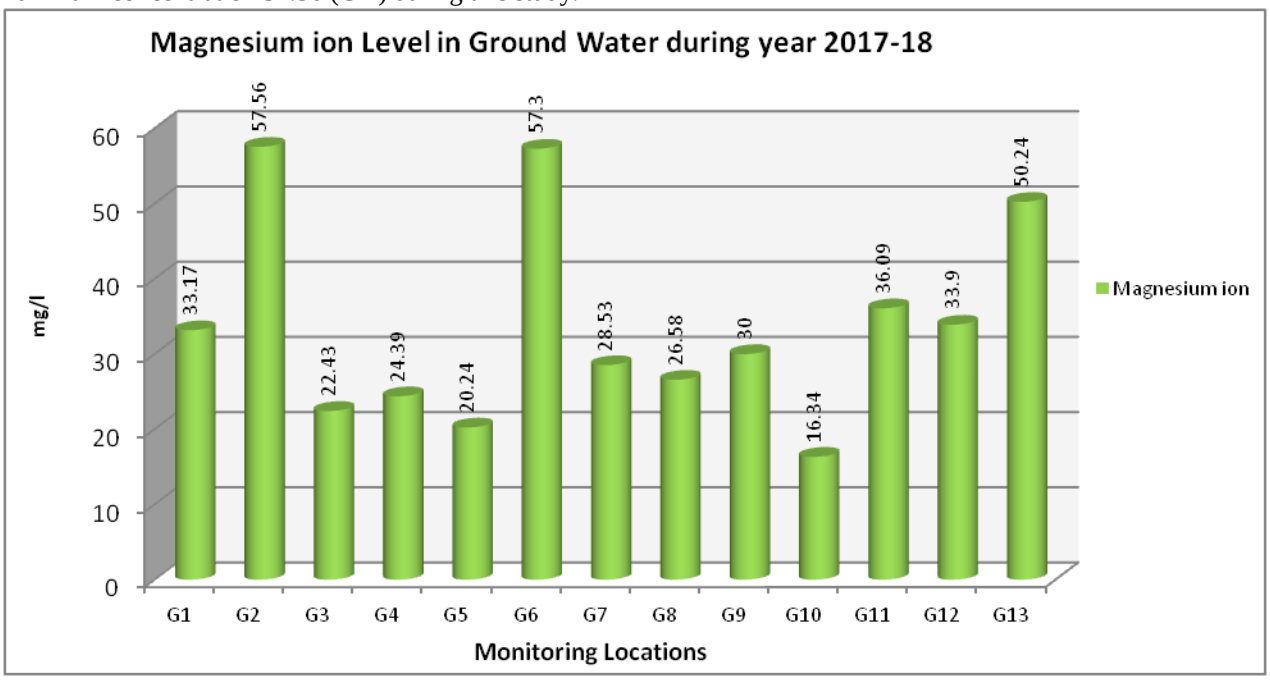

Figure 11:-Magnesium ion level of ground water

In Figure 12, Observed order of the analyzed metals as Mn >Fe> Cu>Zn were found during this study

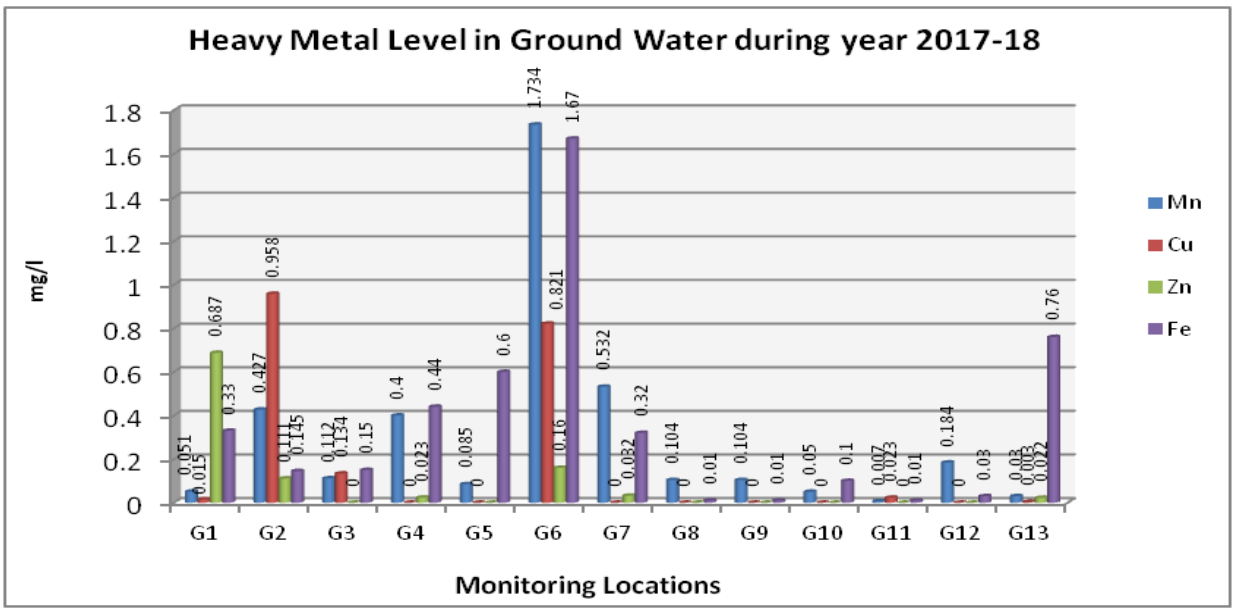

Figure 12:-Heavy metals level of ground water

Conclusion:-

It is concluded that high contamination in ground water observed at few locations around Mandideep Industrial area during this study as compare to drinking water standard BIS-10500 (2012). Deepness of water source, sewage source, anthropogenic, industrial activities and other sources are reason of presence of trace amount of pollutant in ground water. All activities, which carried out on the ground surface have direct or indirect impact on the ground water whether associated with urban, industrial or agricultural activities large scale concentrated source of pollutants such as industrial discharge, and subsurface injection of chemicals and hazardous are obvious source of ground water pollutants.

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