



Assessment of Physico-Chemical Studies on Groundwater in and Around Banda City, Uttar Pradesh

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Assessment of Physico-Chemical Studies on Groundwater in and Around Banda City, Uttar Pradesh.

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Abstract—Banda district lies between latitude 25°00'00"north and longitude 80 000'00" and 81°00'00" east. Total geographical area of the district is 4460 sq. Km. The present study was investigated various physico-chemical parameters like Temperature, PH, DO, COD, TDS, TSS, Alkalinity, Total Hardness, Nitrate, Chloride and Sulphate etc. The results of the above work show that most of the physico-chemical Parameters are well within the permissible limit. DO was reported at all the sampling station are more than the permissible limit. Fifteen percent samples of BOD are higher than the permissible limit prescribed by WHO. COD was found at sampling station BG1, BG2, BG4, BG5, BG6, BG7, BG8, BG10, BG14 and BG15 are above the permissible limit set by WHO. Cadmium concentration was found at sampling station BG6, BG12 and BG14 are exceeding the limit. Mn and Cr were detected at all the samples were below the permissible limit of WHO.

Keywords— Physico- chemicals Parameters; Ground water; Banda City; Uttar Pradesh

1. INTRODUCTION

The present study was investigated various physico-chemical parameters like Temperature, PH, DO, COD, TDS, TSS, Alkalinity, Total Hardness, Nitrate, Chloride and Sulphate etc. The ground water samples were collected different sampling stations are as; Bijalikheda, Bus stand, ITI collage, Pili kothi mayur takize, Jilakarawas, Railway station, Government hospital, Kali devi chauraha, Ghoda chauraha, Hanuman chauraha, Kalu kunva, Govt.inter college, chauradi chauraha, palhari banda, babulal chauraha and subji mandi etc. At present there is no major industry in and around the study area, yet household waste water and garbage (municipal sewage) are directly discharged into the area. The water supply for human consumption is often directly sourced from ground water without biochemical treatment and the level of pollution has become a cause for major concern. The water used for drinking purpose should be free from toxic elements, living and non-living organisms and excessive amount of minerals that may be harmful to health1.

In many parts of the country available Disposal on creates local/regional environmental problems. Watershed management for any city requires the estimation of both point and nonpoint sources of water pollution. An affective land-use planning plays a crucial role in efficient management of water resources of any area2.

Ground water occurs in weathered portion, along the joints and water is rendered non-potable because of the presence of heavy metal in excess. The situation gets worsened during the summer season due to water scarcity and rain water discharge. Contamination of water resources available for household and drinking purposes with heavy elements, metal ions and harmful microorganisms is one of the serious major health problems3.

Polluted groundwater is the major causes for the spread of epidemics chronic diseases of man. It causes typhoid, jaundice, dysentery, diarrheic, tuberculosis and hepatitis. In India almost 90% of the rural population depends on untreated ground water for potable water supplies. The quality of ground water is highly related with the local environmental and geological conditions4.

Banda district lies between latitude 25°00'00"north and longitude 80 000'00" and 81°00'00" east. Total geographical area of the district is 4460 sq. Km. district headquarter is at Banda having 04 Tehsils and 8 blocks. Geologically the area comprises Precambrian Bundelkhand granites unconformable overlain by Vindhyan are quaternary alluvium. The main and major drainage of the district are Yamuna, Ken and Baghain which are part of groundwater in Yamuna river system. Agriculture is the main source of economy of the district. Ground waters are used for irrigation. The net irrigated area is 153804 Ha and the net area sown is 336000 Ha, which shows that 45.77% area is irrigated by ground water.

2. MATERIAL AND METHOD:

2.1 Sample Collection:

Assessment of Physico-Chemical on ground water in and around Banda City, Uttar Pradesh during months of April to June 2015 and samples were collected from fifteen sampling station. All the sampling stations are presented in table-1. Sampling was done in accordance with grab sampling method polyethylene bottles of one liter capacity to avoided leaching of methods and interaction with the surface wall of the containers bottles were first cleaned with detergent and then soaked in HNO₃, for 24 hours. Finally the bottles were cleaned and rinsed with distill water during sampling bottles were two to three times with sample to be examined before filling

with it .Samples were collected by immersing the rinsed bottles in ground water .All the samples were labeled, showing the source date and time of collection, the samples were refrigerated at 40 C in the laboratory 5-7 and procedures were followed as per the standard methods 8-9and different physico-chemical parameters like Temperature, PH, DO, COD, TDS, TSS, Alkalinity, Total Hardness, Nitrate, Chloride and Sulphate and heavy metals were analyzed.

Table 1: List of sampling stations in Banda city

For the purpose of representative of ground water quality of Physico-Chemical in the study area following locations is the presented in table –

S.No.	Code	Name of sampling station	Description of sampling locations
1.	BG1	Vijali Kheda	In front of power house Banda.
2.	BG2	Bus Stand	Inside the state label Banda.
3.	BG3	ITI College	Near the Gove. Collage Banda.
4.	BG4	Pili Kothi Mayur Takiz	Picture Takiz Banda.
5.	BG5	Jail Caravans	Distract caravans Banda.
6.	BG6	Railway Station	Near the Plate form Banda.
7.	BG7	Ghoda chauraha	S
8.	BG8	Kali Devi Chauraha	In front of kali Devi temple Banda.
9.	BG9	Kalu Kunwa	Near of the over Bridge Banda.
10.	B.G10	Govt. Hospital	In front of police Line Banda.
11.	B.G11	Hanuman Chauraha	Near of the Hanuman temple Banda.
12.	B.G12	Gove. Inter College	In front of the DIET Banda.
13.	B.G13	P.J.N. College	In front of the College Banda.
14.	B.G14	Palhari Banda	Near the Primary Gove. School.
15.	B.G15	Sabji mandi Chauraha	Near the Sabji mandi Banda

3. RESULT AND DISCUSSION:

In the present study we are analyzed some physico-chemical properties of ground water samples in Banda city, all the results were shown in table-2 and table-3

Study of physico-chemical characteristics of ground water samples:

Temperature of ground water ranged from 23.5-31 OC. Minimum temperature was recorded 23.50C at Bus stand maximum temperature was recorded 31.50C at Bijali kheda. PH is used to determine the acidity or alkalinity of water and the concentration of hydrogen ions in the water. The minimum value of pH 6.65mg/l was observed at Kali devi chaura and The maximum pH value was found 8.30mg/l at Bijali kheda. In terms of pH value, the groundwater samples are well within range of permissible prescribed by WHO . (Rao et al. 2014)10 studied physico chemical and biochemical characterization of ground water near point sources for assessing their quality for user and application and concentration of pH was reported ranged between 6.5 to 8.4. The TH value of all ground water samples is recorded to be range of 286-885mg/l. Minimum value was found 286mg/l at Railway station and the maximum value 885mg/l at Railway station. (Sunita et al. 2005)11Studied hydrogeo-chemistry of ground water, gooty Area, Anantapur District, Andhrapradesh and total hardness values were found ranged between 360 to 4040 mg/l.

The total dissolved solid was observed between 530-800mg/l, the minimum value of TDS 530 mg/l was recorded at station ITI college(BG3) and maximum value of TDS 800 mg/l was recorded at station Ghoda chauraha (BG9).TDS of all the water samples were below the permissible limit of WHO as 1500mg/l. (Mohanty et al. 2013) 12 Studied assessment of ground water quality due to coal mining at tilapia-I coal mine, Sumbalpur, odisha and TDS values was reported varied from 183 to 251 mg/l. Total suspended solid ranged from 106-190mg/l, the maximum value of TSS 190mg/l was found at the sampling station (BG9). The recorded TSS value of all samples are below the permissible limit prescribed by WHO as 250mg/l. Dissolved Oxygen (DO) varied from 6mg/l , Minimum value of DO at Palhari Banda (BG14) was found 5.30mg/l and the Maximum value of DO at Railway station(BG6) was found 7.80mg/l. Eighty seven percent sampling stations are higher than the permissible limit prescribed by WHO30.Biological Oxygen Demand(BOD) was observed between 1.4-9.9mg/l.The Minimum value of 1.4mg/l is recorded at Kali devi chauraha (BG8), and the Maximum value of 9.9mg/l is recorded at Ghoda chauraha (BG9).The value of BOD at sampling station (BG1) 6.5mg/l .Fifty percent sampling stations are higher than the permissible limit prescribed by WHO 6mg/l.

Chemical oxygen demand (COD) in ground water samples was found range between 6.8-29.3 mg/l, Minimum value of (COD) at Govt. Inter College (BG12) was found 6.8mg/l and the Maximum value of (COD) at Bus stand (BG2) was found 29.3mg/l. Sixty seven percent are sampling stations COD values of higher than the permissible limit prescribed by WHO as 10mg/l. (Pradhan et al. 2012) 13 studied assessment of physico Chemical parameters of Chilika lake water and recorded the Chemical oxygen Demand to be 16.0 to 416 mg/l.

The value of Nitrate in all the ground water samples is found range between 0.65-21.5mg/l .Minimum value of Nitrate 0.65mg/l was recorded at Bijali kheda(BG1) and the Maximum value of Nitrate 21.5mg/l was recorded at Pilikothi mayor takiz (BG4) . Nitrate values of all the sampling stations are below the permissible limits prescribed by WHO as 45mg/l. The value of sulphate was recorded in the ranged of 2.20-23.0mg/l.The Maximum value of Sulphate 23.02mg/l was found at Kalu Kunwa(BG11). Sulphate values of all the ground water samples were below the permissible limit set by WHO as 200 mg/l. (Raman et al. 2012) 14 studied the correlation analysis and Prediction of Characteristics parameters and water quality Index of ground water observed the sulphate values varied from 40.0 to 65.0 mg/l. Chloride was recorded in the ranged of 14-38mg/l, Minimum value of at Govt. Inter college (BG12) was found 14mg/l and the Maximum value of at Sabji Mandi Chauraha (BG15) was found 38mg/l. All the Chloride value was recorded below the recommended level set by WHO as 250 mg/l.

4. HEAVY METAL:

The concentration of iron was recorded in the range between 0.2-1.03 mg/l. The Maximum value of Iron 1.03mg/l was found at Hanuman chauraha (BG10).Values of iron of all the samples are below the permissible limits except one sample (BG10) . The concentration of cadmium was recorded in the range 0.008- 0.02mg/l. Minimum value of cadmium 0.008mg/l was found at Bus stand (BG2) and the Maximum value of cadmium 0.02mg/l was found at Govt. Inter College (BG12). Fifty percent samples of cadmium are higher than the permissible limits set by WHO as 0.01mg/l. (Tripathi et al. 2014)15studied diffuse cadmium pollution of ground water in Vindhya Pradesh, India and reported concentration of cadmium content in all the samples of study area found ranged between 0.0009 to 2.25 ppm. The value of Manganese was recorded as 0.006-0.018mg/l. the Maximum value 0.018mg/l was found at Bijali kheda (BG1).Manganese of all the ground water samples were below the permissible limits prescribed by WHO 0.05mg/l. The value of Lead was recorded as 0.01-0.86mg/l, Minimum value of at Palhari Banda (BG14) was found 0.01mg/l and the Maximum value of at Bus stand(BG2) was found 0.86 mg/l five sampling stations are higher than the permissible limits prescribed by WHO 0.05mg/l. (Singh et al. 2008) 16studied assessment of the impact of landfill on ground water quality A Case study of the Piran  site in western India and reported the lead content in the ranged between 3.0 to 42.0 mg/l. The value of chromium was as 0.005-0.039mg/l, Minimum value of at I.T.I. College (BG3) was found 0.005mg/l, and the maximum value of at Railway station was found 0.039mg/l. All the water samples of chromium concentration are below the range of permissible limit set by WHO as 0.05 mg/l. (Gupta et al. 2009) 17studied analysis of heavy metals in the river and water sediment and fish from river Ganges at Allahabad and found to be 0.0 to 0.018 ppm.

Table -2: Physico- Chemical Characteristics of Ground water samples in Banda city, Uttar Pradesh

Sample location	Parameters										
	Temp	pH	Hardness	TDS	TSS	DO	BOD	COD	Nitrate	Sulphate	Chloride
B.G1	31.5	6.5	521	550	106	7.2	6.5	12.8	0.65	3.05	22.0
B.G2	25.5	6.8	489	580	120	6.3	7.8	29.3	18.5	2.20	21.0
B.G3	27.8	6.8	402	530	140	6.8	8.5	7.9	5.69	2.50	19.0
B.G4	26.5	6.7	286	620	135	7.5	2.5	14.6	21.5	3.40	24.0
B.G5	29.5	7.5	500	650	160	7.1	4.5	20.0	14.3	21.9	33.0
B.G6	30.5	7.24	485	690	180	6.6	7.3	13.0	2.78	3.40	39.0
B.G7	31.5	6.8	395	740	190	7.3	9.9	10.0	4.69	13.9	36.0
B.G8	31.7	6.2	487	760	175	7.8	1.4	19.6	19.2	3.10	37.0
B.G9	31.5	7.2	590	800	147	6.2	6.8	24.0	0.69	23.0	32.0
B.G10	30.5	6.7	497	730	145	6.7	2.7	16.5	6.5	12.48	30.0
B.G11	29.6	8.6	600	530	150	6.5	1.8	8.2	0.78	3.50	25.0
B.G12	30.8	7.4	590	750	180	7.3	2.5	6.8	1.89	2.65	14.0
B.G13	31.4	7.8	500	678	140	6.2	3.9	9.7	2.67	5.90	18.0
B.G14	28.9	6.5	665	800	108	5.3	4.6	15.5	8.10	3.94	29.0
B.G15	29.0	7.5	885	790	110	5.9	8.9	10.8	13.67	2.46	38.0
Mean	27.94	7.08	546.13	679.86	145.7	6.7	5.3	14.58	8.10	6.93	27.8

S.D	2.54	0.35	132.86	87.45	25.7	0.6	3.43	6.30	7.21	6.92	9.31
C.V	9.11	8.39	24.32	12.93	17.63	10.12	64.76	43.22	87.91	99.86	33.5

G1= Bijalikheda, G2= Bus stand, G3= ITI collage, G4= Pili kothi mayur takize, G5= Jila karawas, G6= Railway station, G7= Government hospital, G8= Kali devi chauraha , G9= Ghoda chauraha , G10= Hanuman chauraha, G11= Kalu kunva, G12=Govt.intercollege, G13= P.N.J.College, G14= Palhari banda, G15= Subji mandi

Table -3: Heavy metal concentrations in ground water samples of Banda city, Uttar Pradesh

Sampling location	Fe	Cd	Mn	Pb	Cr
BG1	0.16	0.010	0.018	0.03	0.043
BG2	0.13	0.008	0.005	0.86	0.034
BG3	ND	0.001	ND	0.04	0.005
BG4	0.05	ND	0.014	ND	0.017
BG5	0.09	0.002	0.021	0.02	ND
BG6	0.38	0.021	ND	0.16	0.039
BG7	0.05	0.003	0.004	ND	0.020
BG8	0.26	0.004	0.011	0.09	ND
BG9	0.06	0.007	0.003	0.07	ND
BG10	0.31	0.001	ND	ND	0.031
BG11	1.03	ND	0.006	0.03	0.010
BG12	0.03	0.02	ND	ND	ND
BG13	0.07	ND	0.006	0.05	0.026
BG14	0.09	0.031	ND	0.01	0.040
BG15	0.02	0.004	0.001	ND	ND

Table -4: Water Quality Parameter and Drinking Water Standards

S.N.	Parameter	WHO(2006)mg/l		BIS(2006) mg/l	
		Max.desirable	Max.permissible	Max.desirable	Max.permissible
1	Temp.	—	—	—	—
2	pH	7.0	8.5	6.8	8.5
3	Hardness	250	300	600	-
4	TSS	100	250	—	—
5	TDS	500	1500	500	1000
6	DO	4	6	—	—
7	BOD	6.0	-	2.5	—
8	COD	10	—	—	—
9	Nitrate	100	10	45	15
10	Sulphate	150	200	400	300
11	Chloride	200	250	1000	600

Table-5: Heavy metal standard ground water of parameters

S.N.	Parameter	WHO(2006)mg/l		BIS(2006) mg/l	
		Max.desirable	Max.permissible	Max.desirable	Max.permissible
1	Iron	1.0	1.0	1.0	1.0
2	Cadmium	0.003	0.01	0.003	0.01
3	Manganese	0.1	0.3	0.1	0.3

4	Lead	0.05	0.05	0.05	0.05
5	Chromium	0.05	0.05	0.05	0.05

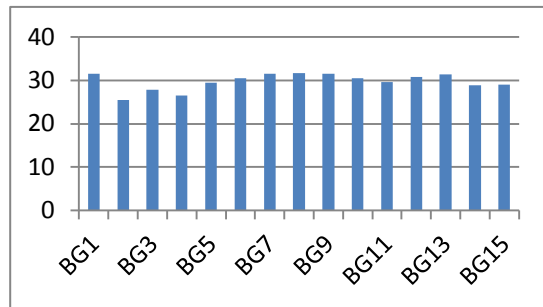


Fig-1: Temperature of Ground water samples in Banda city, Uttar Pradesh

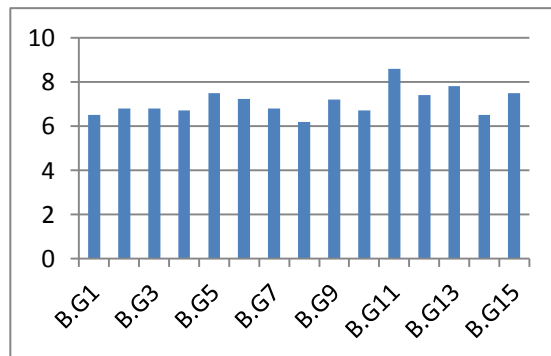


Fig-2 pH concentration in ground water samples of Banda City, Uttar Pradesh

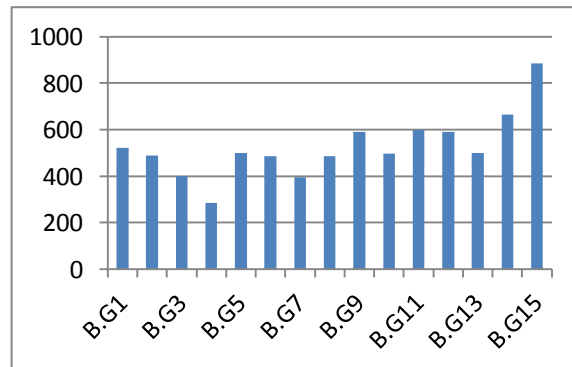


Fig-3: Total Hardness of Ground water samples in Banda city, Uttar Pradesh

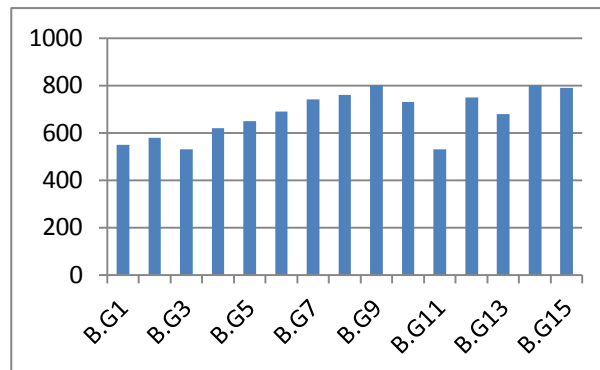


Fig- 4: TDS of Ground water samples in Banda city, Uttar Pradesh

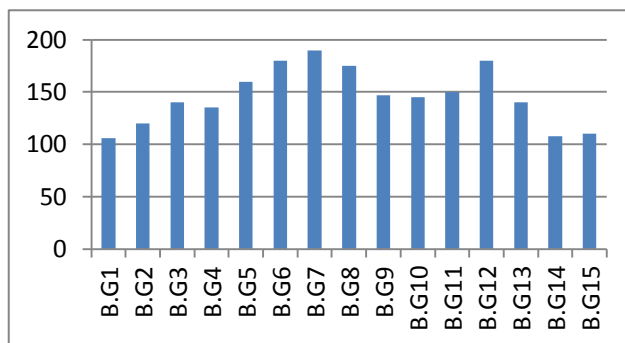


Fig-5: TSS of Ground water samples in Banda city, Uttar Pradesh

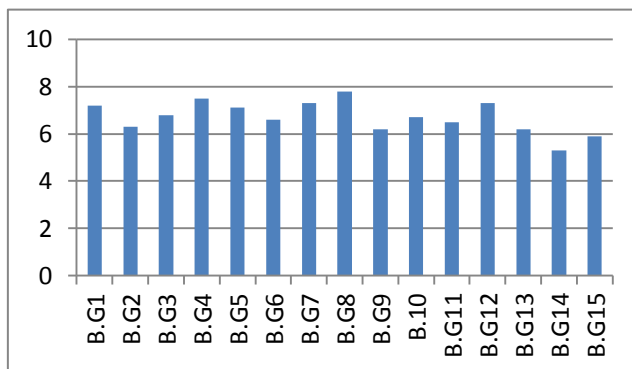


Fig:6: DO of Ground water samples in Banda city, Uttar Pradesh

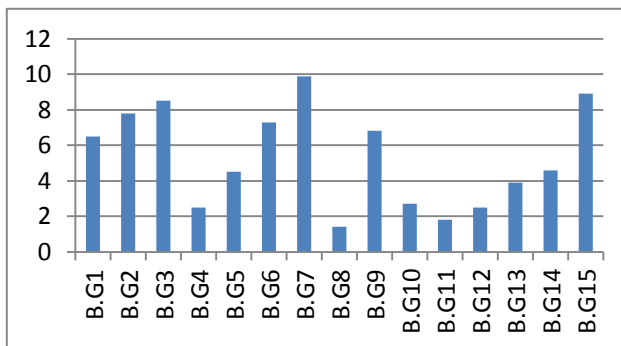


Fig:7 BOD concentration in Ground water samples of Banda city, Uttar Pradesh

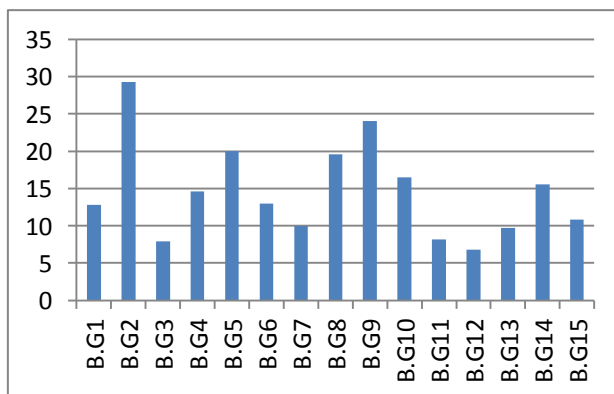


Fig: 8 COD concentration in Ground water samples of Banda city, Uttar Pradesh

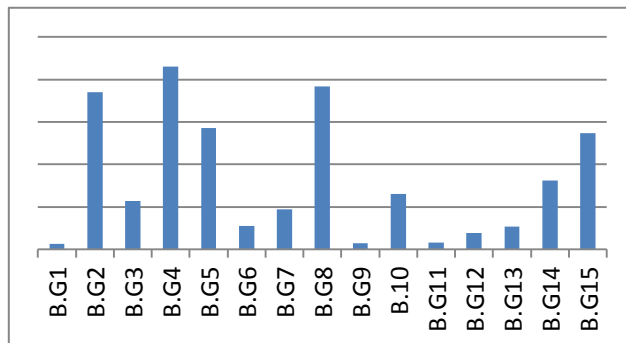


Fig: 9 Nitrate concentrations in Ground water samples of Banda city, Uttar Pradesh

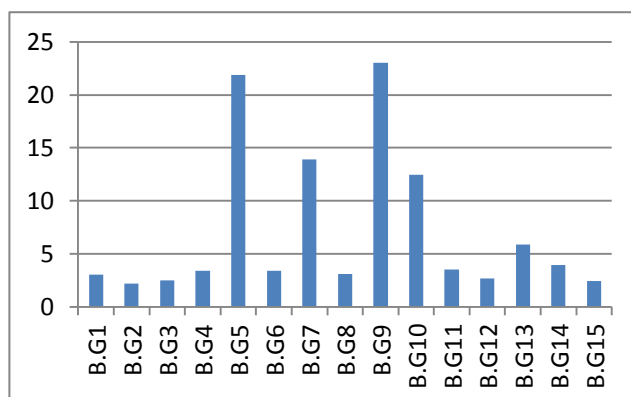


Fig:10 Sulphate concentrations in Ground water samples of Banda city, Uttar Pradesh

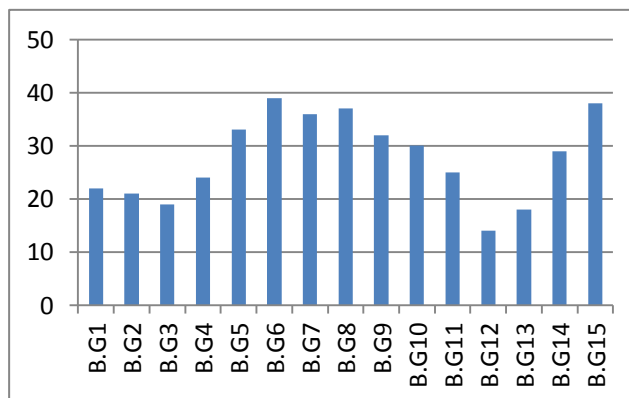


Fig:11 Chloride concentrations in Ground water samples of Banda city, Uttar Pradesh

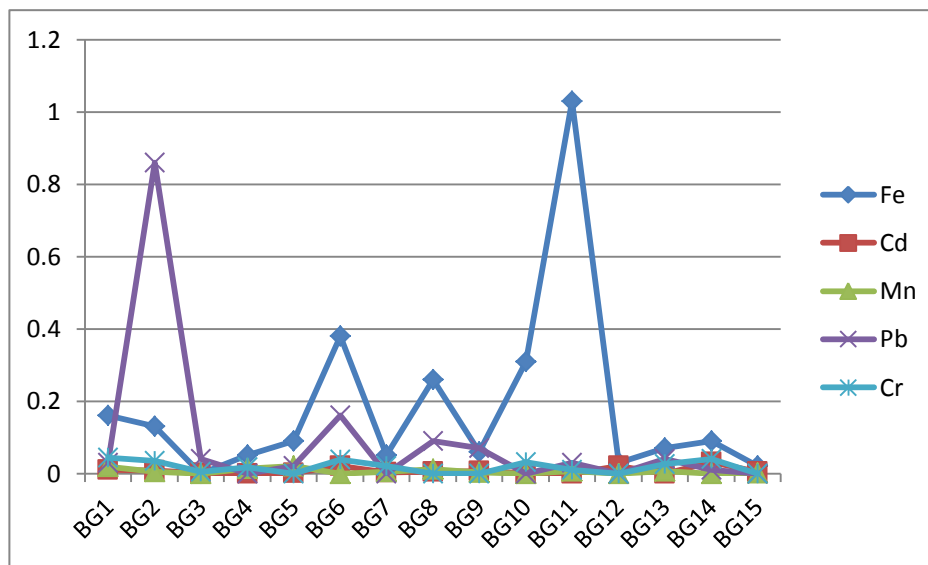


Fig-12: Heavy Metal concentrations in Ground water samples of Banda city, Uttar Pradesh

5. CONCLUSION:

The ground water of study areas were collected and analyzed for various physico-chemical parameters. The results of the above work show that most of the physico-chemical Parameters are well within the permissible limit. DO was reported at all the sampling station are more than the permissible limit. Fifteen percent samples of BOD are higher than the permissible limit prescribed by WHO. COD was found at sampling station BG1, BG2, BG4, BG5, BG6, BG7, BG8, BG10, BG14 and BG15 are above the permissible limit set by WHO. Iron content was observed at all the samples were below the limit except one samples BG11. Cadmium concentration was found at sampling station BG6, BG12 and BG14 are exceeding the limit. Mn and Cr were detected at all the samples were below the permissible limit of WHO. Pb was found at all the samples were below the permissible limit except only three samples BG2, BG8 and BG9 are more than the limit set by WHO. The data may also be shared with the public health Engineering authorities so that they will play their role in improving the quality of water for a safe and healthy life.

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