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RESEARCH ARTICLE

ANALYSIS OF WATER QUALITY PARAMETERS OF GROUNDWATER IN AND AROUND DIAMOND CEMENT INDUSTRY, JHANSI, CENTRAL INDIA

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ABSTRACT

The present study was carried out to assess the impacts of industrial activities on the ground water quality in and around the Diamond cement industry, Madora, Jhansi. The quality was assessed in terms of hydro chemical parameters. Groundwater samples were collected from ten sites (bore wells) in and around industry throughout the six months. Water quality parameters such as pH (7.58±0.21), EC(1.92±0.39 mmhos/cm), TDS (527.96±106.67 mg/l), alkalinity (226.50±27.58 mg/l), total hardness (161.38±14.60 mg/l), calcium (105.15±10.58 mg/l), magnesium (56.23±12.29 mg/l), chloride (172.78±10.81 mg/l), sulphate (198.56±34.63 mg/l) and fluoride (1.21±0.15 mg/l) were analyzed to know the present status of ground water quality. The results shows, that all the parameters were recorded under permissible limit.

INTRODUCTION

Natural resources are the important wealth of our country, water is one of them. Water is extremely essential for survival of all living organisms. In India, most of the population is dependent on groundwater as the only source of drinking water supply (Murhekar, 2011). The term groundwater is usually reserved for the subsurface water that occurs beneath the water table in soils and geologic formation that are fully saturated (Biswas, 2003). Ground water plays a vital role in the development of arid and semi-arid zones. It is believed to be comparatively much clean and free from pollution than surface water[3].But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and create health problem (Raje *et al*., 2002). Most of the industries discharge their effluent without proper treatment into nearby open pits or pass them through unlined channels resulting in the contamination of groundwater (Jinwal and Dixit, 2008). Ground water contamination is the result of polluted water infiltrating through the soil and rock and eventually reaching the groundwater. This process might take many years and might take place at a distance from the well where the contamination is found (Geetha *et al*., 2008). Groundwater is very difficult to remediate, except in small defined areas and therefore the emphasis has to be on prevention. So the knowledge of extent of pollution and the status of water become essential in order to preserve the valuable source of water for future generation (Mahananda *et al*., 2010). The main objective of the present study is focused on analyzing the groundwater quality parameters in and around the Diamond cement industry, Madora, Jhansi.

MATERIALS AND METHODS

Diamond cement industry, Madora is situated in Jhansi district at an elevation of $25^0$26'N and $78^0$34'E. Physico-chemical analysis of groundwater samples taken from different bore wells of ten sampling points in and around the industry were taken on monthly basis and analyzed by referring 'standards methods' (APHA, 2002) in terms of pH, E.C., TDS, alkalinity, total hardness, calcium, magnesium, chloride, sulphate and fluoride during January 2008 to June 2008. The temperature and pH were determined in the field. The collected samples were brought to laboratory and analyzed within 24 hours.

RESULTS AND DISCUSSION

The qualities of a water resource depend on the management of anthropogenic discharges as well as the natural physico-chemical characteristics of the catchment areas (Efe *et al*., 2005). Various water quality parameters were studied and are given in table-1 and there correlation in table-2. All the parameters are found positively correlated to each other.

pH

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the water samples are slightly alkaline due to presence of carbonates and bicarbonates (Murhekar, 2011). pH of ground water samples at all the sites varied between 7.25 to 7.85 with an average value of 7.58±0.21.

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Table No.1: Groundwater quality in and around Diamond Cement Industry, Madora, Jhansi.

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Min	Max	Overall
pH	7.85	7.72	7.62	7.60	7.25	7.32	7.27	7.30	7.62	7.62	7.25	7.85	7.58±0.21
EC (mmhos/cm)	1.47	1.36	1.63	1.86	2.06	2.42	2.45	1.63	2.11	2.22	1.36	2.45	1.92±0.39
TDS (mg/l)	391.34	407.83	353.76	583.33	510.00	620.00	623.33	565.00	646.67	578.33	353.76	646.67	527.96±106.67
Alk (mg/l)	194.17	288.67	189.17	216.50	225.00	217.00	239.67	227.67	239.67	227.50	189.17	288.67	226.50±27.58
TH (mg/l)	164.75	156.35	185.35	140.76	152.46	163.27	178.88	174.42	146.92	150.67	140.76	185.35	161.38±14.60
Ca (mg/l)	89.08	98.78	105.99	95.30	109.50	109.28	120.32	122.37	98.91	102.02	89.08	122.37	105.15±10.58
Mg (mg/l)	75.67	57.58	79.35	45.46	42.96	53.99	58.57	52.05	48.02	48.65	42.96	79.35	56.23±12.29
Cl^- (mg/l)	173.91	180.04	161.05	180.27	159.38	178.59	175.48	159.41	167.46	192.19	159.38	192.19	172.78±10.81
SO_4^{--} (mg/l)	173.41	201.82	189.02	148.45	211.35	229.21	230.44	229.45	231.90	140.56	140.56	231.90	198.56±34.63
F^- (mg/l)	1.19	0.99	1.18	1.28	1.44	1.17	1.36	1.11	1.01	1.32	0.99	1.44	1.21±0.15

Whereas EC= Electrical Conductivity, TDS= Total Dissolved Solid, Alk= Alkalinity, TH= Total Hardness, Ca= Calcium, Mg= Magnesium, Cl^-= Chloride, SO_4^{--}= Sulphate, F^-= Fluoride.

Table 2: A Correlation matrix of ground water quality in and around Diamond Cement Industry, Madora, Jhansi

	pH	EC	TDS	Alk	TH	Ca	Mg	Cl^-	SO_4^{--}	F^-
pH	1.000									
EC	0.986	1.000								
TDS	0.996	0.987	1.000							
Alk	0.996	0.990	0.993	1.000						
TH	0.994	0.992	0.997	0.997	1.000					
Ca	0.993	0.993	0.997	0.996	1.000	1.000				
Mg	0.994	0.989	0.996	0.998	0.999	0.999	1.000			
Cl^-	0.995	0.994	0.991	0.999	0.996	0.995	0.996	1.000		
SO_4^{--}	0.991	0.979	0.983	0.995	0.989	0.987	0.992	0.994	1.000	
F^-	0.997	0.992	0.996	0.999	0.999	0.998	0.998	0.998	0.994	1.000

EC

Electrical Conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved solid (Dahiya and Kour, 1999). EC in groundwater samples from all sites was recorded within the range of 1.36 mmhos/cm. to 2.45 mmhos/cm. with an average value of 1.92±0.39 mmhos/cm.

TDS

Total dissolved solid is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro granular suspended form (Sarvankumar and Ranjitkumar, 2011). TDS in groundwater water samples of all sites was found to be ranging between 353.76 mg/l to 646.67 mg/l with an average value of 527.96±106.67 mg/l.

Alkalinity

The cause of alkalinity is the minerals which dissolve in water from soil. The various ionic species contribute to alkalinity include bicarbonate, hydroxide, phosphate, borate and organic acids (Shyamala et *al*., 2008). Alkalinity in groundwater samples of all sites was recorded in the range of 189.17 mg/l to 288.67 mg/l with an average value of 226.50±27.58 mg/l.

Total Hardness, Calcium and Magnesium

Hardness is the property of water which prevents the lather formation with soap and increasing the boiling points of water (Trivedi and Goel, 1986). Total hardness of groundwater of all sites was ranged between 40.76 mg/l to 185.35 mg/l, Ca was 89.08 mg/l to 122.37 mg/l, Mg was 42.96 mg/l to 79.35 mg/l with an average value of 161.38±14.60 mg/l, 105.15±10.58, and 56.23±12.29 respectively.

Chloride

Chloride is a widely distributed element in all types of rocks in one or other form. Its affinity towards sodium is high. Therefore, its concentration is high in groundwater, where the temperature is high and rainfall is less. Soil porosity and permeability also has a key role in building up the chloride concentration (Chanda, 1999). Chloride concentration in groundwater samples of all sites was found to be ranged between 159.38 mg/l to 192.19 mg/l with an average value of 172.78±10.81 mg/l.

Sulphate

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals (Manivaskam, 2005). Sulphate concentration in groundwater samples of all sites was found to be ranging between 140.56 mg/l to 231.90 mg/l with an average value of 198.56±34.63 mg/l.

Fluoride

Probable source of high fluoride in Indian waters seems to be that during weathering and circulation of water in rocks and soils, fluorine is leached out and dissolved in groundwater (Murhekar, 2011). Fluoride in groundwater samples of all sites was ranged between 0.99 mg/l to 1.44 mg/l with an average value of 1.21±0.15 mg/l.

CONCLUSION

The hydro chemical analysis of groundwater has been carried out in and around diamond cement industry, Madora, Jhansi. From the present study it can be concluded that all the

analyzed parameters of water quality were found under the permissible limits and not harmful for drinking purpose.

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