International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-26, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

Assessment of Effect of Industrial Effluent on Ground Water of Pali, Rajasthan, India

Arvind Chouhan
Assistant Professor (Zoology), Government College Luni (Jodhpur)

ABSTRACT: A study was conducted to assess the present status of the ground water in Pali town. The city is known as an industrial hub especially for the textile industry. Ten sampling locations were selected at random and the ground water samples were selected from tube wells and wells in and around Pali town. For this purpose, these samples were analysed for major physical and chemical water quality parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), Alkalinity, Total Hardness (TH), Sodium, Phosphate, Nitrate, Carbonate, Bicarbonate and Chloride. The results were compared with standards prescribed by WHO (World Health Organization).

It was found that most of the samples of the ground water quality were substandard, may be due to the industrial effluents, discharge by industrial units in the Bandi River and on open surface. The sampling sites Punayata and Mandia showed high deviation from standards prescribed by WHO. Hence the present study concluded that the ground water quality in the study area was polluted. So, it is necessary to take periodic monitoring of the ground water quality and strict rules and regulation on industrial effluent in this region for future sustainability.

KEYWORDS: ground water, physicochemical parameters, industrial effluent, WHO standards, Bandi River.

INTRODUCTION

There are four industrial areas in the town these are- Mandia Road Area, Industrial Area I (Sojat Road, Pali), Industrial Area II (Anand Nagar, Pali) and Punayata Industrial area. Mandia Road Area is the biggest and oldest of all. More than 500 units of textile, leather-based industries, paper industries, chemical industries, agricultural instruments, mineral bases, especially stone crushers are running (CSC, 2006; DIPR, 2014).

Of these units, textile related units- printing, bleaching, dyeing, manufacturing are dominant and substantially contribute to the economy in the form of employment and income. Almost all units discharge their industrial effluent in and nearby Bandi River. There is adequate evidence suggesting that the disposal of untreated wastewater has affected the quality of surface water, ground water and the soil not only in Pali town but also downstream. Groundwater contamination is the result of polluted water infiltrating the soil and rock. Once the groundwater is contaminated, it is almost impossible to remediate.

In Rajasthan most of the population is dependent on groundwater source as the only source of drinking water. Dependency upon groundwater increases day by day. Ground water in general is considered as a safe source of fresh drinking water. But in reality, the wells and tube wells are the worst type of water source due to man made contamination.

According to Ail, et al., (2006) in their analysis of textile effluent pointed out that pH of most of the samples were highly alkaline and above the permissible limits of the Environment Protection Agency. Manikandan, et al., (2015) also revealed in their study that textile industrial effluent is responsible for the high levels of hardness in water. Wang, et al., (2021) conclude that textile effluent is highly saline in nature. Rajput, et al., (2017) studied that ground water in and nearby areas of textile industries contain higher concentration of Chloride. The objective of the present study is to investigate qualitative analysis of some physicochemical parameters of ground water in the study area.

EXPERIMENTS

During January-February 2022, ground water samples were collected mostly from tube wells at Bandi River Basin in and around Pali town. The water samples were collected during the daytime between 9 a.m. to 5 p.m. They were collected in five litre plastic bottles. Before sampling the bottles were cleaned thoroughly to remove all contamination, rinsed with double distilled water and dried. The collected samples were brought to the laboratory for experiments. Suspended matters were removed by filtering

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-26, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

through Whatman Filter No. 41. Then it was stored in the refrigerator at 37° C. The samples were analysed for major physical and chemical water quality parameters like pH, Alkalinity, Electrical Conductivity, Sulphate, Chloride, Ferrous, Sodium, Magnesium, Nitrate, Carbonate, Total Hardness (TH), Total Dissolved Suspended (TDS), Bicarbonate, Phosphate and Fluoride. The analyses were carried out systematically both volumetrically and by instrumental technique. The procedure was followed from Sunita and Sumanjee (1999) Laboratory manuals. The pH of the samples was determined by using digital pH meter (Model VT-P) before measuring the pH of the sample water, pH meter standardized using pH buffer of 4.0 and 9.0. Electrical conductivity (EC) was measured using Model 1152 conductivity meter and sulphate by turbidimetric method using Spectronic-20.

RESULTS AND DISCUSSION

To analysis physicochemical status of ground water in and nearby Pali town water samples were collected from following 10 sites-

Table-1. Sample site with Site Code

S.N.	Sample Site	Site Code
1.	Akrawas	P1
2.	Lambiya	P2
3.	Rawalwas	P3
4.	Naya Gaon	P4
5.	New Bus Stand	P5
6.	Indira Colony Vistar	P6
7.	Punayata	P7
8.	Mandia	P8
9.	Jawariya	P9
10.	Kerla	P10

Of these 10 sites Site P1, P2 and P3 located in and nearby Industrial area 1, Site P4 and P5 situated in and around Industrial area 2, site P6 and P7 situated in and nearby Punayata Industrial area, site P8, P9 and P10 situated in and nearby Mandia Industrial area. All samples were collected and analysis during August-September, 2021 and results are as follow:-

Table-2. Various physico-chemical parameter status at sample sites

S.N.	Parameter	WHO Standard	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
1.	pH	6.5-8.5	7.2	7.4	7.7	7.9	8.1	8.4	8.9	9.4	8.8	8.4
2.	Alkalinity (mg/l)	21-200	197	171	543	672	794	856	1284	1409	894	784
3.	EC (µS/cm)	200-1500	653	847	912	958	1088	1394	1847	2654	1542	1258
4.	SO_4 (mg/l)	200-400	422	428	491	526	722	881	1014	1284	914	528
5.	Cl (mg/l)	50-250	88	104	257	384	428	647	1048	814	441	281
6.	Fe (mg/l)	1-3	0.54	1.10	1.62	1.91	2.20	2.80	3.45	4.52	3.12	2.04
7.	Na (mg/l)	20-200	68	141	247	313	541	871	1154	1466	938	542
8.	Mg (mg/l)	31-100	41	71	146	187	212	254	347	524	381	264
9.	NO_2 (mg/l)	46-100	22	40	54	72	91	98	102	112	91	58
10.	CO_3 (mg/l)	60-120	8	21	34	28	24	20	36	29	18	17
11.	TH (mg/l)	60-180	110	210	230	290	340	560	740	880	780	530
12.	TDS (mg/l)	501-2000	180	197	284	742	980	1270	1798	2074	1358	984
13.	HCO_3 (mg/l)	250-400	184	282	161	385	457	552	614	780	804	654
14.	PO_4 (mg/l)	0.05-0.50	0.08	0.41	0.71	1.10	1.12	1.27	1.70	1.88	1.94	1.51
15.	F (mg/l)	1-1.5	1.0	1.5	3.0	3.8	3.5	3.8	4.2	4.4	4.2	2.84

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-26, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

Table-3. Normal, moderate and heavy pollution indication of physicochemical parameter

Total Samples	Physico-chemical Parameter			Physico-chemical Parameter		
P1 to P10 (10)	Iron (Fe) (mg/l)			Magnesium (mg/l)		
	0-0.9	1-3	>3	0-30	31-100	>100
	1	6	3	0	2	8
	TDS (mg/l)			Phosphate (mg/l)		
	0-500	501-2000	>2000	0-.004	0.005-0.05	>0.06
	4	5	1	2	1	9
	Total Hardness (TH) (mg/l)			Sulphate (mg/l)		
	0-59	60-180	>180	0-200	200-400	>400
	0	1	9	0	0	10
	Alkalinity (mg/l)			Fluoride (mg/l)		
	0-20	21-200	>200	0-1.0	1.1-1.5	>1.5
	0	2	8	1	1	8
	Nitrate (mg/l)			Chloride (mg/l)		
	0-45	46-100	>100	0-250	251-1000	>1001
	2	6	2	2	7	1
	EC (µS/cm)					
	0-199	200-1500	>1501			
	0	7	3			

In the present study total 10 water samples were collected as shown in Table 1. These samples analysis with eleven physicochemical parameters- pH, Alkalinity, EC, Sulphate, Chloride, Ferrous, Sodium, Magnesium, Nitrate, Carbonate, Total Hardness, Total Dissolved Solids, Bicarbonate, Phosphate and Fluoride and compared with the WHO standards. The results indicate that the quality of ground water considerably varies from location to location. The variation is mainly due to salinity and other dissolved materials from the nearby dyeing, bleaching and textile industries in the study area.

In the present study the highest value of EC was at Mandiya (P8) sample site which was 2654 µS/cm while lowest at Akrawas (P1) sample site. According to Harilal, et al., (2004) Electrical Conductivity depends upon total dissolved salts in water. Hence it is a barometer to represent the total concentration of soluble salts in water . The bicarbonate contamination from the salt which is mixed with the dyes from the textile industries is found to increase the electrical conductivity of the water.

Out of 10 samples, one sample was found higher than WHO's permissible limit. The excess TDS value could be due to the dissolved solid waste originating from discharge of the effluent from the dyeing industries. About seven sites show an alarming situation. High concentration of TDS harmful to those who are suffering from kidney and heart diseases (Kumaraswamy, et al., 1999; Gupta et al., 2004). The pH values in the study area vary from 7.2 to 9.4, and highest at sample site Mandia (P8). According to Ball (1994) alkalinity around 150 mg/L has been found conductive to higher productivity of water bodies. In present studied samples almost all samples show Total hardness moderate to higher concentration. It is clear that effluent has affected the ground water. According to Boardman, et al., (1995) textile effluent increases total hardness of nearby water bodies. In the present study chloride concentration varied from 88 to 1048 mg/l, and lowest at Akrawas sample site (P1) and higher than WHO recommended permissible limit at eight sites. In Pali it may be due to continuous usage of chloride salts in the industries preferably in dyeing and bleaching. Carbonate, Magnesium and total hardness in the water are interrelated. In the present study Magnesium concentration varied from 41 to 524 mg/l and out of 10 samples, 8 samples indicate it was higher than WHO recommended acceptable limit. Paul, et al., (2012) in their study concluded that textile effluent is directly responsible for higher concentration of Magnesium.

Fyamfi, et al., (2012) in their analysis confirmed that higher concentration of Bicarbonate is a toxin for humans. The permissible limit for Bicarbonate recommended by WHO is 400 mg/l, above it harmful for living organisms. In the present study six sample sites showed higher concentration of Bicarbonate than permissible limit and highest at sample site Jawariya (P9).

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-26, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

Chloride is a widely distributed element in all types of rocks in one or other form. Its affinity with sodium is high. Soil porosity and permeability play a key role in building up the chloride concentration.

Chloride is a widely distributed element in all types of rocks in one or other form. Its affinity with sodium is high. Soil porosity and permeability play key roles in building up the chloride concentration (Chanda, D. K., Hydrology Journal, 1999, 7(5), 431-439.) The permissible range limit of WHO is 50-250 mg/l, in present study out of 10 samples nine showed higher than limit and highest at sample site Punayata (P7) was 1048 mg/l.

CONCLUSION

Among 10 samples of ground water most of them were contaminated when compared with standards prescribed by WHO. It is found that samples of Industrial area II and Mandiya Road were more polluted, due to heavy discharge of industrial discharge of effluents in the Bandi River and on open surface, due to soil porosity; it will be logical to say that the industrial effluent from has impacted on the quality of ground water. Therefore, for future sustainability proper disposal of solid slurry after treatment as well as recycling of wastewater along with periodic monitoring of the ground water is the need of the hour.

REFERENCES

1. Ali, S., Nadeem, R., Bhatti, H. N., Hayat, S. H. A. T., Ali, S., Chatta, S., and Muneer, M. (2006). Analyses and treatment of textile effluents. *Int J Agric Biol*, *8*, 641-644.
2. Al-Alwani, N. H., and Yassin, R. A. (2016). Identification of Potable Water Using Water Quality Index Technique in the City of AZ-Zantan, Libya. *Iraqi Bulletin of Geology and Mining*, *16*(3), 43-52.
3. Ball, R. C. (1994). Fertilization of Lake Good or Bad Michigan. *Conservation*, 7-14.
4. Boardman, G. D. (1995). Pollution prevention studies in the Textile wet processing Industry. Department of Civil Engineering, *VPI and SU, Blacksburg, Virginia*.
5. Chanda, D. K. (1999), *Hydrology Journal*, 1999, 7(5), 431-439.
6. CSC. (2016). CSE study on pollution of Bandi river by textile industries in Pali town. *Retrieved November 8, 2022*, from https://www.cseindia.org.
7. DIPR. (2014). Brief Industrial Profile of Pali District. *Retrieved November* 14, 2022, from http://dcmsme .gov.in.
8. Fyamfi, E. T., Ackah, M., Anim, A. K., Hanson, J. K., Kpattah, L., Enti-Brown, S., and Nyarko, E. S. (2021). Chemical analysis of potable samples from selected suburbs of Accra, Ghana, *Proceedings of the International Academy of Ecology and Environmental Sciences*, *2*(2), 118.
9. Gupta, S., Kumar, A., Ojha, C. K., and Singh, G. (2004). *Journal of Environmental Science and Engineering*. *46*(1), 74-78.
10. Harilal, C. C., Hashim, A., Arun, P. R., and Baji, S. (2004). Hydro geochemistry of two rivers of Kerala with special reference to drinking water Quality. *Ecology Environment and Conservation*, *10*, 187-192.
11. Kumaraswamy, N. (1999). Physico-chemical Analysis of ground water of selected Area in City (Tamilnadu), India. *Journal of Pollution Research*, *10*(1), 13-20.
12. Manikandan, P., Palanisamy, P. N., Baskar, R., Sivakumar, P., and Sakthisharmila, P. (2015). Physico chemical analysis of textile industrial effluents from Tirupur city, TN, India. *Int J Adv Res Sci Eng*, *4*(2), 93-104.
13. Paul, S. a., Chavan, S. K. and Khambe, S. D. (2012). Studies on characterization of textile industrial waste in Solapur city. *International Journal of Chemical Sciences*, *10*(2), 635-642.
14. Rajpur, R. S., Pandey, S., and Bhaduria, S. (2017). Status of water pollution in relation to industrialization in Rajasthan. *Reviews on Environmental Health*, *32*(3), 245-252.
15. Sunitha Hooda and Sumanjee Kaur (1995). Laboratory Manual for Environmental Chemistry, *Edited by S Chand and Company Limited*, Ram Nagar New Delhi, 1999.
16. Wang, K., Ran, T., Yu, P., Chen, L., Zhao, J., Ahmad, A., and Shi, Y. (2021). Evaluation of renewable pH-responsive starch-based flocculant on treating and recycling of highly saline textile effluents. *Environmental Research*, *201*, 111-489.

Cite this Article: Arvind Chouhan (2023). Assessment of Effect of Industrial Effluent on Ground Water of Pali, Rajasthan, India. International Journal of Current Science Research and Review, 6(2), 1103-1106