DOI:10.33451/florafauna.v24i1pp177-182
FLORA AND FAUNA
ISSN 2456 - 9364 (Online)
2018 Vol. 24 No. 1 PP 177-182
ISSN 0971 - 6920 (Print)

PHYSICOCHEMICAL ANALYSIS OF GROUND WATER AND SURFACE WATER IN KOTA REGION, RAJASTHAN, INDIA

NITU SINGH* AND FATIMA SULTANA[1]

Department of Life Science,
Career Point University, KOTA (RAJASTHAN) INDIA
[1]Department of Zoology,
J. D. B. Govt. Girls College,
KOTA (RAJASTHAN) INDIA
*Corresponding Author
Email- nitusingh2606@gmail.com

Received : 18.01.2018; ***Accepted*** : 22.02.2018

ABSTRACT

India is a developing nation and is dependent on its natural resources for growth and development. Water, being one of the vital natural resource, must be used judicially for the sustainable development. Present study focuses on the analysis of physicochemical parameters (pH, Turbidity, Alkalinity, Total Hardness, Total dissolved solids, Conductivity, Chloride, Sulfate, Fluoride contents) of ground water and surface water in Kota City (Rajasthan). The study shows the adverse impact of exploitation and urbanization on water resources of Kota City (Rajasthan). Some physicochemical parameters exceed the desirable limits as defined by WHO and Indian Standards in the selected sites. The level of pollution in ground water and surface water of Kota City is increasing due to urbanization.

Figures : 10 References : 16 Table : 01
KEY WORDS : Analysis, Ground water, Physicochemical parameters, Surface water, Urbanization.

Introduction

The availability of liquid water and to a lesser extent its gaseous and solid forms, on earth are important for existence of life. The earth is located in the habitable zone of the Solar System. If it were slightly closer or farther from the sun, the conditions would have been adverse which may not support life on earth[6]. The collective mass of water on, under and over the surface of planet is known as Hydrosphere. India is a country with diverse landforms. Every State holds a unique geographical feature. Rajasthan is located in the North West region of India and is considered as a dry state, as it lacks sufficient rainfall and water resources. Still the South Eastern part of Rajasthan is blessed with sufficient annual rainfall and natural water resources. Therefore this part of the state has great social, economical and political importance. Being highly populated these resources are under the threat of overexploitation. Groundwater, rivers and ponds in Kota have provided livelihood to millions of people over the century. Owing to the human activities the water in these resources is getting polluted. With the increase in population the requirement for clean water increases constantly. The collection and disposal of domestic wastes is a major problem in urbanized area. The intensive use of natural resources and large production of waste in modern society often poses threat to ground and surface water quality[5]. Water from most of the resources is therefore unfit for immediate consumption without some sort of treatment. The selected sites for the present study, Kishore Sagar Talab, Chambal River, Kala Talab and Anantpura Talab cover almost every direction of Kota City area.

Materials and Methods

The present study was undertaken to examine the quality of the surface water and ground water in Kota city (Rajasthan) and to evaluate the potability of surface water and ground water in the vicinity. For surface water analysis the water was sampled at the following points-

i) Kishore Sagar Talab (lake water)
ii) Chambal River (river water)
iii) Kala Talab (lake water)
iv) Anantpura Talab (pond water)

The water samples were collected in November 2017 between 7:00 am to 9:00 am so as to obtain the least disturbed samples. The physicochemical

ACKNOWLEDGEMENTS : We are highly thankful to Dr. Shala Alam (Senior Chemist) and Tarun Sharma (Junior Chemist), Akelgarh Kota (Rajasthan) for their assistance during the work.

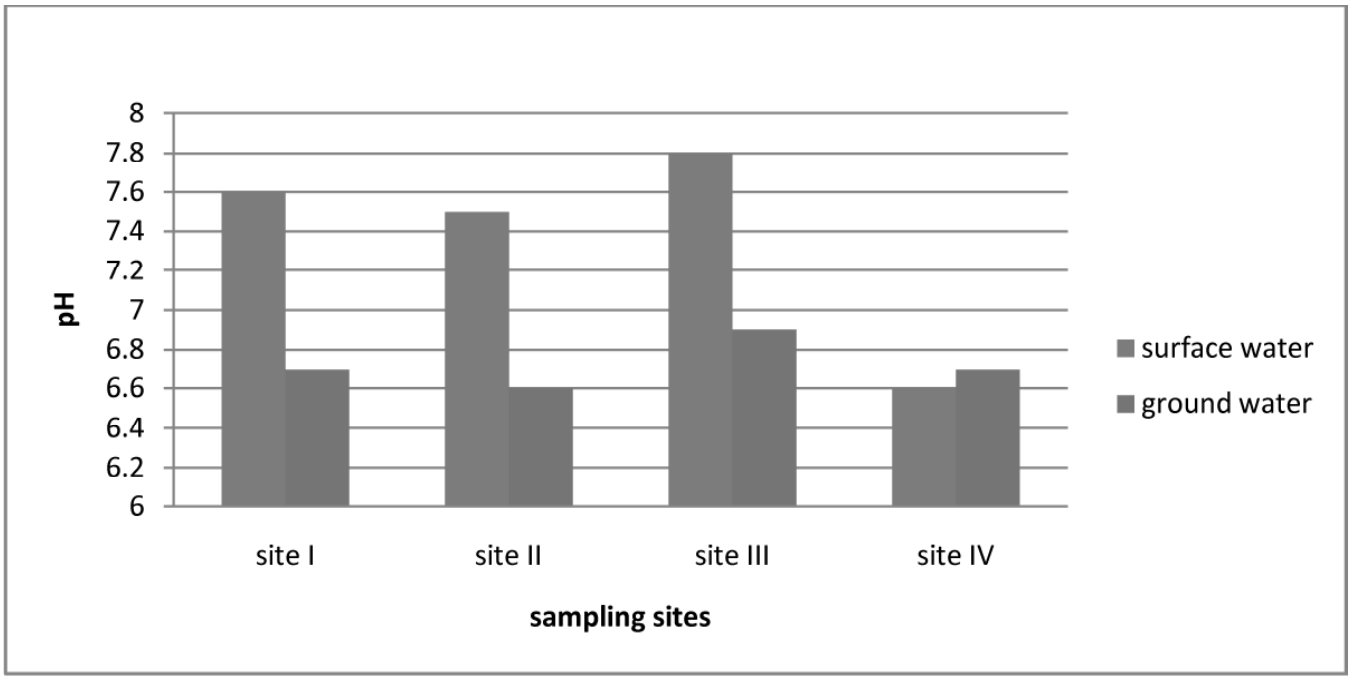

Fig. 1 : Variation of pH

parameters (TDS, TSS, pH, electrical conductivity, turbidity, total hardness, total alkalinity, *etc.*) were analyzed for the water samples by standard procedure[2].

TABLE-1: Physiochemical parameters of surface and ground water in Kota Region (Rajasthan)

S. No.	Parameter	Indian Standard	WHO Standard	Surface Water				Ground Water			
				Site I	Site II	Site III	Site IV	Site I	Site II	Site III	Site IV
I	pH	6.5 – 8.5	7 – 8	7.6	7.5	7.8	6.6	6.7	6.6	6.9	6.7
2	Conductance		300 µmho/cm	317	315	1068	767	917	495	1197	774
3	Turbidity	5 – 10	5	1.2	1.5	5.3	12.6	8.2	3.4	0.9	14.1
4	Total solids	500– 2000	500	247	246	833	598	715	386	934	604
5	Total Hardness	187 – 500	(Calcium) 100	80	90	130	130	180	110	170	130
			(Magnesium) 100	70	40	130	140	200	60	270	160
6	Total Alkalinity	200 – 600	100-200	110	110	530	270	540	210	530	280
7	Cl^-	250– 1000	250	20	30	120	110	40	60	150	110
8	SO_4^{2-}	200 – 400	250	4	2	7	6	5	2	8	6
9	F-	1 – 1.5	1	0.30	0.26	0.33	0.34	0.33	0.37	0.22	0.33

(Except pH and conductivity all results are in mg/l.)

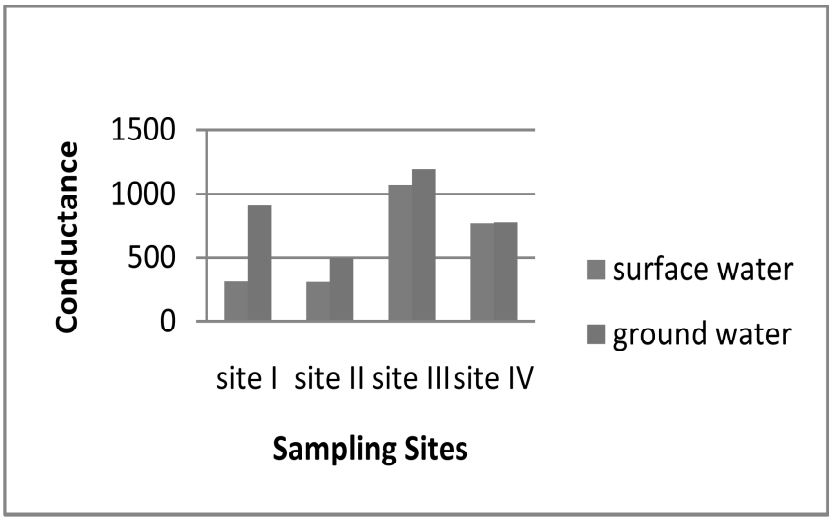

Fig. 2 : Variation of Condutance

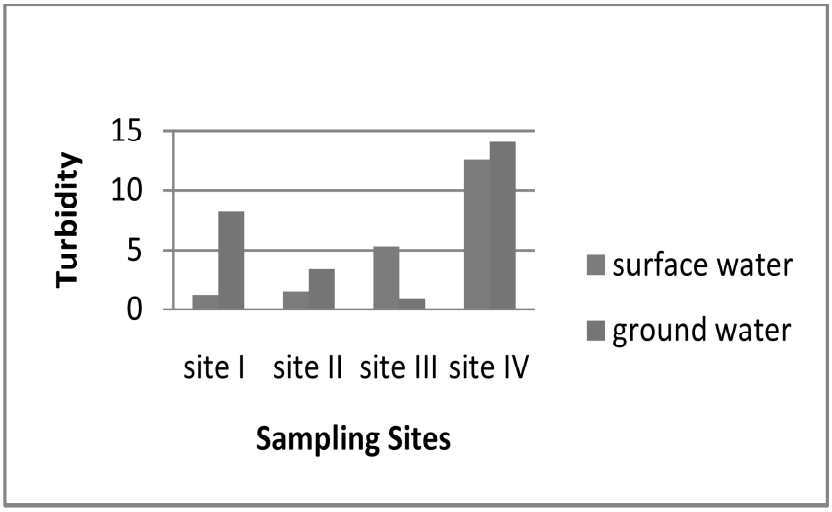

Fig. 3 : Variation of Turbidity

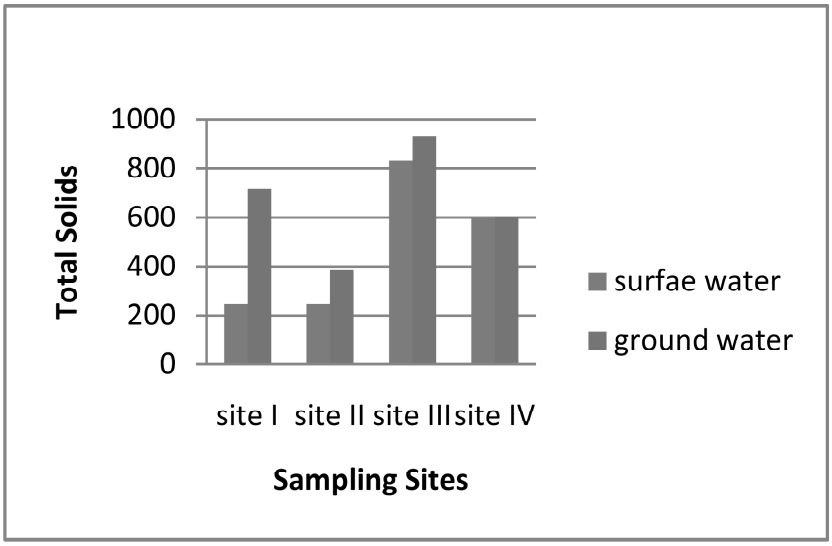

Fig. 4 : Variation of Total Solids

The ground water samples were collected and analyzed in areas lying within 1-2 km radius of respective sampling sites. Total four areas were chosen for the sample collection. Water quality parameters were selected, which were considered to be important as per the drinking water standard[2,5,12,13].

The assessment of groundwater quality was made through calculating the water quality indices. The understanding of the various parameters that cause the groundwater pollution is important in evaluating the water quality index. Existing bore well of the study area were considered as the points to draw the samples. Four bore wells were selected as the sampling point to collect the ground water samples. The points selected were distributed in the entire area to represent true representative about the quality of the groundwater.

Result and Discussion

pH –- pH shows the acidic or alkaline nature of water[10]. pH in surface water at site III, had highest pH (7.8) among all the study sites and lowest pH (6.6) was found at site IV. However, in case of ground water, the highest pH[4,7] was also found at site III and lowest (6.6) at site II (Fig.1). In the present investigation pH was found to be in the range of 6.6 to 6.9 and 6.6 to 7.8 in ground water and surface water respectively which is within desirable limit. It was observed that ground water had lower pH as compared to surface water which might be due to dilution effect of rain water[7].

1) Conductance – Conductance is the measure of water's capacity to pass electric flow[14]. This is measured in terms of the amount of ions in a solution. The more the ions in the solution the higher is the conductivity[1]. After the laboratory analysis electrical conductivity in surface water and ground water were found to be varied among all four sites (Fig. 2). It was recorded that highest conductivity (1068 µmho/cm) was at site III and lowest (315µmho/cm) was at site II in surface water. However, in case of ground water conductivity was recorded highest at site III (1197µmho/cm) and lowest at site II

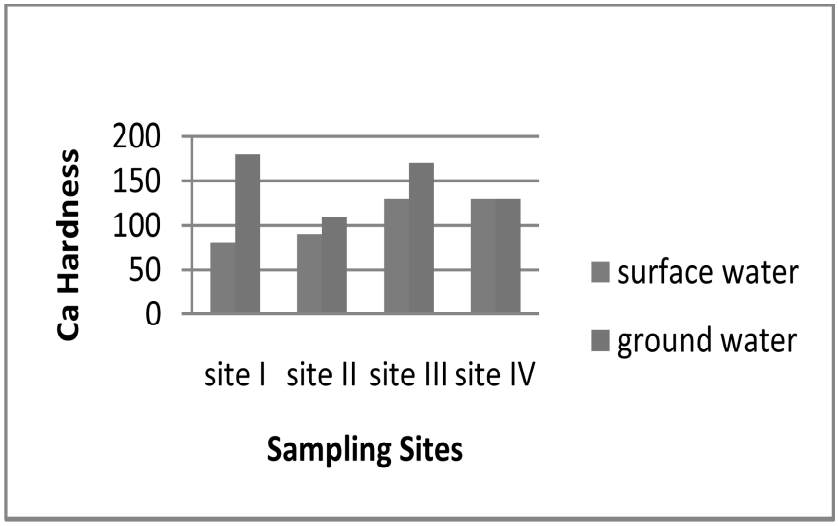

Fig. 5 : Variation of Ca Hardness

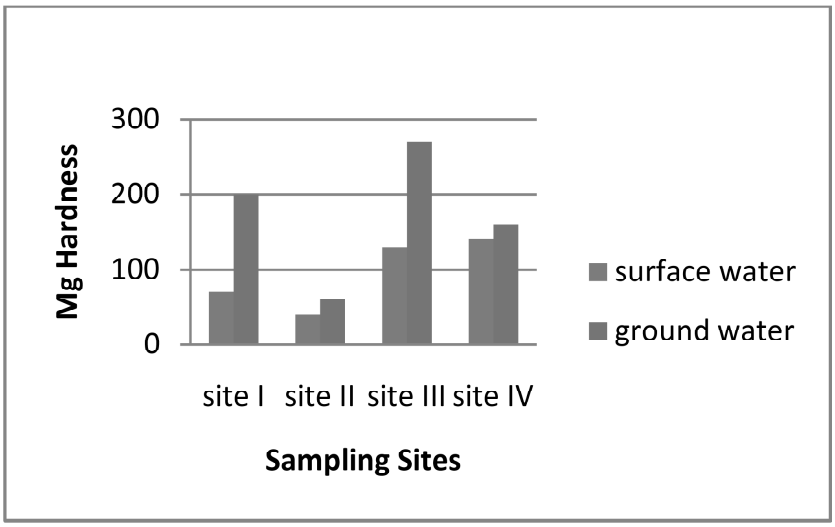

Fig. 6 : Variation of Mg Hardness

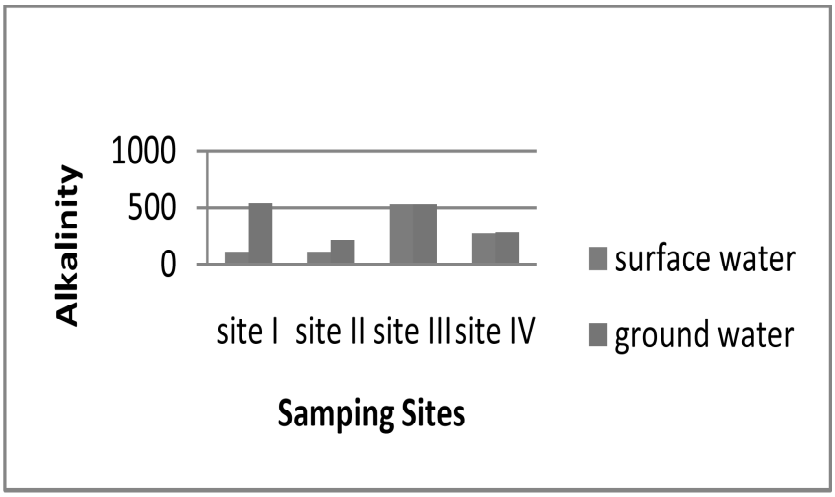

Fig. 7 : Variation of Alkalinity

(495µmho/cm). Conductivity was found in the range of 317 to 1068 and 495 to 1197 in surface water and ground water respectively which was higher as compared to standard limit. Overall, ground water had higher conductivity than surface water in all the selected sites. It might be a consequence of pollution caused by anthropogenic activities.

Turbidity – Turbidity is the cloudiness of the fluid caused by large numbers of individual particles that are generally invisible to naked eyes. In drinking water, higher the turbidity level, the higher is the risk that people may develop gastrointestinal diseases[8]. According to analysis, the turbidity of surface water in site I (1.2) and site II (1.5) was within desirable limit and in site III (5.3) and site IV (12.6) was beyond desirable limit. In case of ground water the turbidity of site II (3.4) and site III (0.9) was within desirable limit. Whereas in site I (8.2) and site IV (14.1) was beyond desirable limit (Fig. 3). The higher values of turbidity might be the adverse impact of encroachment and extensive construction sites nearby these water resources.

Total Solids – Total Dissolved Solids and Total Suspended Solids together constitute the Total Solids in water[13]. Consumption of water with higher value of Total Solids may cause gastrointestinal irritation, constipation and is aesthetically unsatisfactory for bathing and washing[6]. As per the analysis of the surface water, value of Total Solids in site III was highest and lowest in site II (246 mg/l). In case of ground water site III (934 mg/l) had highest value of total solids and site II (386 mg/l) had lowest value of it (Fig. 4). The higher values of this parameter might be attributed to the human activities like, overexploitation of resources, rapid urbanization *etc.*

Total Hardness – Total Hardness is measure of Poly valent cations in water. It generally represents the concentration of Calcium and Magnesium ions. Hardness affects the amount of soap that is needed to produce foam or lather. Hard water can also leave a film on hair, fabrics and glassware[13]. Following the comparative analysis, the surface water of every site

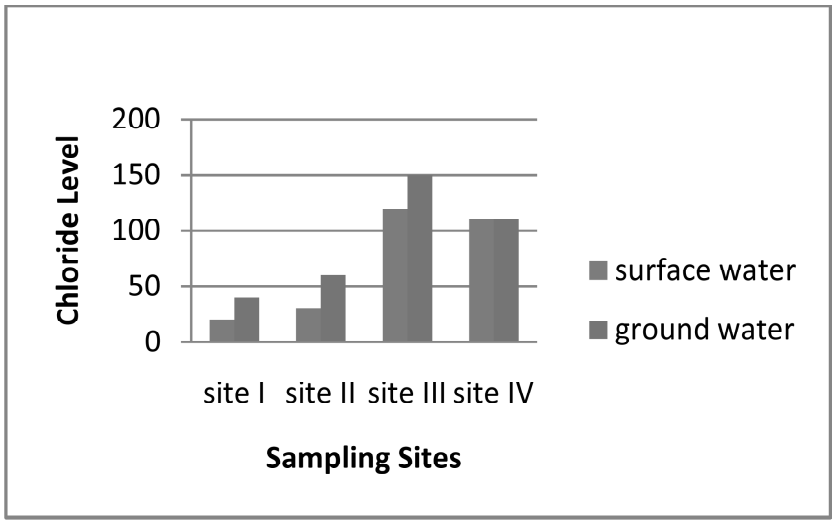

Fig. 8 : Variation of Chloride

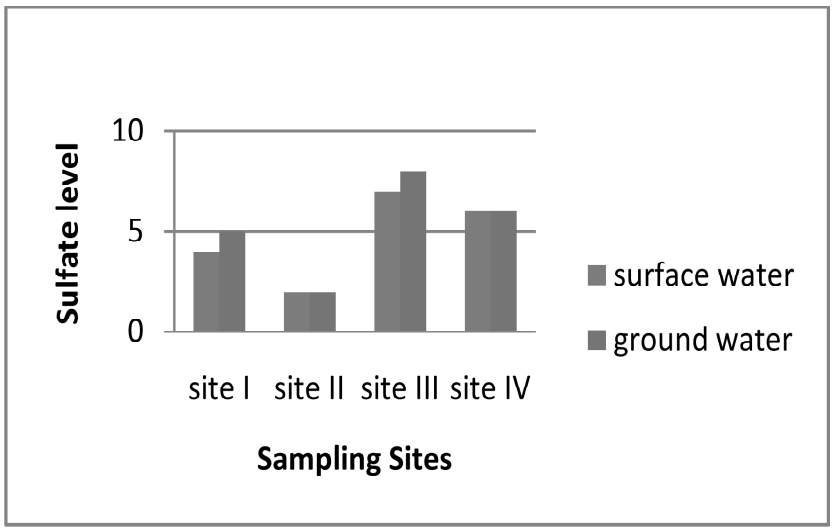

Fig. 9 : Variation ofSulphate

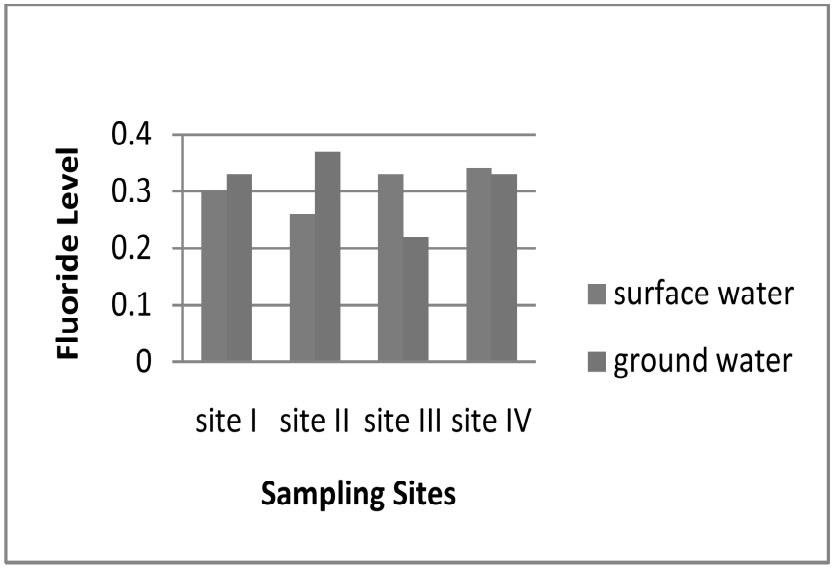

Fig. 10 : Variation of Fluoride

was within permissible limit as per Indian Standards. In case of ground water, site I (180 mg/l) (Fig. 5) had the maximum Calcium hardness and site III (270 mg/l) (Fig. 6) had highest Magnesium hardness of all the selected sites. The hardness is primarily a function of the geology of the area with which the surface water is associated. Water underlain by limestone are prone to hard water because rainfall, which is naturally acidic because it contains carbon dioxide gas, continually dissolves the rock and carries the dissolved cations to the water system[13].

Total Alkalinity – Alkalinity is a measure of the buffering capacity of water. Alkalinity not only helps regulate the pH of a water body, but also the metal content. Bicarbonate and Carbonate ions in water can remove toxic metals (such as lead, arsenic and cadmium) by removing the metal out of solution[13]. Alkalinity was analyzed in surface and ground water at all four selected sites. The highest alkalinity was recorded in surface water site III (530 mg/l) and lowest at site I and site II (110 mg/l). In case of ground water highest value of alkalinity was observed in site I (540 mg/l) and lowest in site II (210 mg/l) (Fig. 7). The observed values of alkalinity were found higher which might be a reason of industrial activities and improper disposal of wastes.

Chloride – Chloride is an important quality parameter that affects the aesthetic property of water including taste[5]. The concentration of chloride is the indicator of sewage pollution and also imparts laxative effect[12]. Following the analysis Chloride content was highest in site III for both ground water (150 mg/l) and surface water (120 mg/l) (Fig. 8) which showed the improper sewage disposal and impact of encroachment in the vicinity of these resources of water.

Sulfate – Sulfate is an ion that occurs naturally in drinking water at various concentrations[14]. Sulfate ion if present in excess amount produces cathartic effect upon human beings[15]. According to the analysis, the Sulfate content in the collected samples from the selected sites was almost negligible, (Fig. 9) which may be attributed to the geological characteristics of Kota City region (Rajasthan).

Fluoride – Water Fluoridation is the controlled addition if Fluoride in water supplies to maintain public health[9]. Defluoridation is needed when naturally occurring fluoride level exceeds recommended limits[11]. The Fluoride level in the collected samples is found to be within desirable limits which might be the result of geographical makeup of Kota City region of Rajasthan State (India). This region lacks fluoride bearing rocks, hence, the available water resources had low fluoride content (Fig. 10)

Summary and Conclusion

From the above observations and analysis it can be concluded that consequences of urbanization like, encroachment, overexploitation of resources, lack of sanitation, improper sewage disposal *etc.* adversely affects the water quality of the ground water and surface water in Kota City of Rajasthan State in India.

References

1. ABEGAZ, S.M. (2005) 'Investigation of Input and Distribution of Polluting Elements in Rinishu Akaki River, Ethopia, Based on the determination by ICP- MS. Ph.D Thesis, Ghent University.
2. APHA (1992) AWWA. WFCW in Standard Method for the examination of water and waste water. American Public Health Association, New York.
3. CHAKRABORTY, R.N., SAXENA, K.L. AND KHAN, A.Q. (1965) 'Stream pollution and Its Effects on Water Supply' A report of survey, *Proc. Symp. Problems in Water treatment.* Oct. 29-30, Nagpur. 211-219.
4. EHLERS, E. AND KRAFFT, T. (2001) 'Integrated Management of Water Resources, Understanding the Earth System.' Springer 116-117.
5. ISI (1991) Indian Standard Drinking Water Specificatio New Delhi, **5** : 6.
6. JAIN C.K., KUMAR S. AND RAO Y.R. (2004) 'Trace Element Contamination in a Coastal Aquifer of Andhra Pradesh.' *Pollution Research* **23** : 299-312.
7. KUMAR, R., CHAUHAN, A. AND RAWAT, L. (2017) 'Physicochemical Analysis of Surface and Ground Water in Selected Sites of Dehradun, Uttrakhand, India.' *J. Environ Anal. Toxicol.* **6** : 420.
8. MANN, A.G., TAM, C.C., HIGGINS, C.D. AND LODRIGUES, L.C. (2007) 'The Association Between Drinking Water Turbidity and Gastrointestinal Illness, A Systematic Review'. *BMC Public Health:* **7**(256); 1-7.
9. PIZZO, G., PISCOPO, M.R. AND GIULIANA, G. (2007) 'Community Water Fluoridation and Caries Prevention, A critical Review.' *Clin, Oral, Investing:* **11** (3); 189-193.
10. RAJAWAT, AJAY KUMAR AND KUMAR, PRAVEEN (2017) 'Physicochemical Aspects of Yamuna River at Gokul Barrage, Mathura (UP) India'. *Flora and Fauna:* **23** (2); 359-362.
11. TARICSKA J.R., WANG L.K., HUNG Y.T. AND LI K.H. (2006) 'Fluoridation and Defluoridation, Advance Physicochemical Treatment Process.' Human Press: (Handbook of Environmental Engineering 4).
12. TRIPATHI, R.B., SHUKLA, A. AND SINGH INDU (2016) Water quality of seetadwar lake of Shravasti district (U.P.) in relation to physicochemical characteristics of Zooplankton. *Flora and Fauna* **22**(2) : 257-262.
13. VENKATESWARA, B.R. (2011) 'Physicochemical Analysis of Selected Ground water Samples of Vjayawada rural and Urban in Krishna District, Andhra Pradesh, India.' *International Journal of Environmental Science* **2**: 710-714.
14. WHO (2011) Guidelines for Drinking Water Quality, 4th edition.
15. www.cwejournal.org.
16. www.iitk.ac.in.