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GROUNDWATER QUALITY STATUS VIS-À-VIS HEALTH RISK OF THE SIPRI AREA IN JHANSI CITY, BUNDELKHAND, (INDIA)

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ABSTRACT

Water is the precious gift of nature to human beings. The drinking groundwater of the Sipri area in Jhansi city is going to be polluted day-by-day with increasing urbanization and small industries development. Although three-fourth part of earth is being surrounded by surface water but a little portion of it can be used for drinking purpose. Virtually almost all the surface water in India is unfit for direct consumption. In spite of the fact the Jhnasi municipal water supply in most part of the Jhansi city is not thoroughly treated of surface water, where presence of over contamination by natural and anthropogenic activities. The more stringent treatments would be required to make surface water for potable. The prominent source of groundwater pollution is mainly due to domestic sewage, industrial waste water and agricultural runoff, which affect the quality of water containing bacteria, viruses and pathogens for health risks. The degree of pollution is assessed by studying physico- chemical characteristics of the groundwater available in aquifer. The study was conducted during January 2012 to July 2012 for evaluate the physico-chemical parameters (pH, temperature, turbidity, chloride, total Hardness, fluoride, iron and nitrate) of groundwater of Jhansi city. Water Quality Index (WQI) was calculated from these analytical results and to find the range of all quality of water samples of the Sipri area in the Jhansi city which come under the slightly polluted in characteristics.

INTRODUCTION

Water is extremely essential for survival of all living organisms. The quality of water is vital concern for mankind since it is directly linked with human welfare. In India, most of population is depend on groundwater as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems (Raja *et al.*, 2010). The rapid growth of urban areas has further affected groundwater quality due to over exploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of groundwater quality (Sekar, *et al.*, 2008). The quality of groundwater is generally under a considerable potential of contamination especially in agriculture dominated area with intense activities that involve the use of fertilizers and pesticides. The issue of protection of groundwater against pollution is of crucial significance (Buseli and LU, 2001). Groundwater can also become contaminated by disposal of fluid through wells and in limestone terrains through sink holes directly aquifers. Likewise, infiltration of contaminated through surface water caused groundwater contamination in several places. Pumping is another cause of groundwater quality deterioration which may precipitate the migration of more mineralized water from surrounding strata to the well (Bujung, *et al.*, 2011). Land use practices geological formation, rainfall patterns and infiltration rate are reported to affect the quality of ground water in an area (Suresh and Kottureshwara, 2009). Jhansi is situated in central part of India of Bundelk hand region of Uttar Pradesh. The municipal corporation of Jhansi have facilitate the drinking water in limited area but most of the people keeps option using hand pumps and jet pumps for water requirement in large scale from last few years. It has been seen that water quality of hand pumps and wells is deteriorating and its responses are noticed in form of yellowish and uncommon odor of water. People in these Sipri areas in Jhansi city are using chlorine tablets and

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other treatment methods for disinfected the drinking water. In Jhansi city, there is no significant work on groundwater quality of residential and commercial area of Jhansi city. In view of the above, it is clear that water quality assessment studies in Jhansi is inadequate. Therefore, the present study has been undertaken to assess the groundwater quality of Sipri areas in Jhansi city.

Study Area

Jhansi is well known district of Bundelk hand region of Uttar Pradesh with a geographical area of 502.75 thousand hectare. The district is situated in the South West corner of the region at $24^0$11'N - $25^0$57' N latitudes and $78^0$10'E - $79^0$23' E longitudes. Population of Jhansi is near about 4, 79,612.The western area of the district is covered with hillocks. Jhansi is located in the plateau of central Indian area dominated by rocky reliefs and minerals underneath the soil. The city has a natural slope in the north as it lies on the south western border of the vast *Tarai* plains of Uttar Pradesh. The elevation rises on the south. The region relies and dependent heavily on monsoon rains for irrigation purposes. Under an ambitious canal project (Rajghat canal), the government is constructing a network of canals for irrigation in Jhansi and Lalitpur and also some areas of Madhya Pradesh. Being on a rocky plateau, Jhansi experiences extreme temperatures. Winter begins in October with the retreat of the SW monsoon.

Analytical Methodologies

Physical and chemical properties of groundwater have been done according to standard methods (APHA,2005) and Hi-Media (WT-023) kit and their specific range for water analysis.

RESULTS AND DISCUSSION

The average results of the Physico-chemical parameters for groundwater samples are presented in Table-1. Status of water quality index is obtained by analytical results of various physic-chemical parameters of all the samples. Water quality index (WQI) from the analytical results of the groundwater specially Sipri area in Jhansi city comes within the range 50 indicate the slightly polluted in nature.

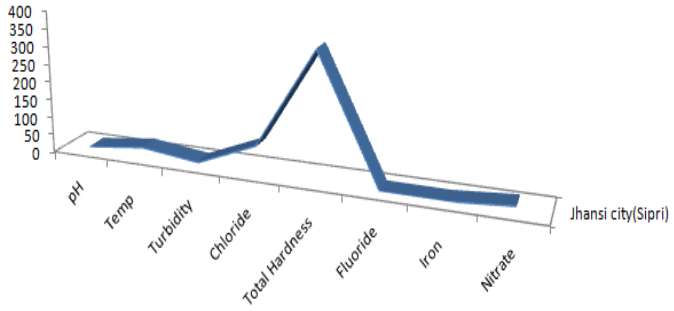

Fig. 1: Shows the physico-chemical characteristic of groundwater in Sipri area in Jhansi city, Bundelk hand

Calculation of Water Quality Index

Eight water parameters were considered for calculation of water quality index (Harkins, 1974; Tiwari, *et al*., 1986; Tiwari and Manzor, 1988; Mohanta and Patra, 2000, Kesharwani *et al*., 2004; Padmanabha and Belagalli, 2005).

Water Quality Index (WQI) = $\sum$QiWi
Where Q_i (water quality rating)= 100 x (Va- Vi) / (Vs-Vi),
When V_a= actual value present in the water sample
V_i= ideal value (0 for all parameters except pH and DO which are 7.0 and 14.6 mg l^{-1} respectively).
V_s= standard value.
If quality rating Q_i = 0 means complete absence of pollutants,
While 0< Qi <100 implies that, the pollutants are within the prescribed standard
When Qi > 100 implies that, the pollutants are above the standards .
W_i (unit weight) = K / S_n

Table 1. calculate the WQI from different analytical result of groundwater quality of different sites of Sipri area in Jhansi City, Bundelk hand

Parameters	pH	Temp (^{o}C)	Turbidity (NTU)	Chloride (mg/l)	Total Hardness (mg/l)	Fluoride (mg/l)	Iron (mg/l)	Nitrate (mg/l)	∑WiQi
WHO Standard	--------	---------	5	200	500	1.5	0.1	45	
Site No.									
S1	7.2	26	5	70	375	1	0.05	10	
S2	7.4	28	5	30	400	0.5	0.03	10	
S3	7.1	30	5	70	375	0.5	0.05	10	
S4	7.3	27	25	100	450	0.5	0.03	45	
S5	7.1	26	10	80	425	0.5	0.05	10	
S6	7.5	24	5	80	350	0.5	0.03	10	
S7	6.5	25	5	80	350	0.5	0.03	10	
S8	7.7	25	5	40	325	0.5	0.05	10	
S9	6.6	26.5	5	80	350	0.5	0.04	10	
S10	7	25.5	5	80	375	0.5	0.02	10	
S11	7.2	25	5	70	375	0.5	0	10	
S12	6.8	25	0	80	300	0.5	0.03	10	
S13	8	30	10	160	250	0.5	0	45	
S14	7.1	26	0	40	325	0.5	0.03	0	
S15	7	28	10	70	250	1	0	0	
Average	7.16	26.466	6.666	75.3333	351.666	0.566	0.029333	13.33333	
Wi	------	----------	0.018354	0.00045	0.00018	0.06118	0.9177	0.002039	
Qi	-------	---------	133.33	37.666	70.33	37.77	29.33333	29.62963	
QiWi	----------	----------	2.4472	0.0172	0.0129	2.311	26.9192	0.060425	31.76

Qi- water quality rating, Wi- Unit weight
S1-Prem Ganj, S2-Sipri Bajar, S3-Tandon Garden, S4- Goverenment Colony, S5-German Hospital, S6- Rai Ganj, S7- Prem Ganj, S8- Massiha Ganj, S9-Church, S10-Prem Ganj-1, S11- Sabji Mandi, S12- Nayak Ganj, S13-chamam Ganj, S14- Railway Kachha Pul, S15-Arya K. I. College.

$$\text{Where K (constant)} = \frac{1}{1/Vs1 + 1/Vs2 + 1/Vs3 + 1/Vs4 \ldots\ldots\ldots\ldots\ldots\ldots + 1/ VS_n}$$

S_n = 'n' number of standard values.
According to Sinha *et al. (*2004)

Table 2. Categories the water quality index (WQI) with range of pollution

Category	WQI with range of Pollution
I	If, water quality index (WQI) is less than 50 such water is slightly polluted and fit for human consumption
II	WQI between 51-80- moderately polluted
III-IV	WQI between 50-100- excessively polluted and WQI above the 100 indicate the severely polluted.

Temperature

Water temperature is an important factor determining the water quality in term of its Physico-chemical properties and it directly regulates the characteristic like patterns of mixing and stratification water column. In present study, average temperature was recorded 14-29 ^{0}C.

pH

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the water is slightly alkaline due to presence of carbonates and bicarbonate. The pH value of sample varied between 6.5 to 8.0 and were found within the prescribed limit by WHO.

Turbidity

In most water, turbidity is due to colloidal and extremely fine dispersions. The turbidity value varied between 5 to 25 NTU.

Total Hardness (TH)

Hardness is the property of water which presents the soap and increase the boiling point of water. Hardness of water mainly depends upon the amount of calcium or magnesium salt or both. The hardness value of these groundwater was shown from the range of 250 to 450 mg/L.

Chloride

The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects. In the present analysis chloride concentration was found in the range of 40 to160 mg/L.

Nitrate

In the study area groundwater contains nitrate due to leaching of nitrate by the percolating water. Ground water can also be contaminated by sewage and other waste which rich in nitrate. The nitrate content in the study area varied in the range 10 to 45 mg/L.

Fluoride and Iron

In the present investigation, both parameters such as fluoride and iron are found in very concentration which are within limits.

Health Risk

In the study area, the groundwater reserves in the aquifer availability depletes day-a-day due to excess consumption relative to the recharging of groundwater where contaminants mixing from the existence wall rock in the aquifer. This area is found underneath granitic rocks containing excess quartz minerals and it infiltrate in to the highly rechargeable groundwater as a SiO_2 forms (Abhimanyu, *et al.*, 2013).The higher the concentration of silica content as a silicon ion percolate in groundwater producing the greater health hazard as a silicosis problems to human beings as Silicotuberculocis which occur in large scale in investigated area of Jhansi city in Bundelk hand region.

Conclusion

Present study shows that the groundwater quality of Sipri areas in Jhansi city is poor for drinking purpose as per water quality index. So this water can be used for drinking purpose after purification treatment. Results also shows that the quality of groundwater used specially for irrigation will be good but not in drinking purpose.

REFERENCES

Abhimanyu, S., J, Zaidi., S. Ganesh., Beenu Raj , Swati G., and Imtiyaz A., (2013); Monitoring of the Ground Water Around the Heidelberg Diamond Cement Factory, Jhansi District, Bundelk hand. *International Journal of Advanced Scientific and Technical Research* Issue 3.pp.107-114.

APHA (2005), Standard methods for examination of water and wastewater, *21st ed. American Public Health Association, Washington*.

Bujung B. K. Haut. Hossen, Moyadi., Fatemen, Moyadi., Afshin, asadi and Thamer Ahmad Mohammad Ali., (2011). Groundwater quality of assessment of Labuan Island Using GIS, *EJGE*,., Vol. 16., 463-475.

Burelli, G., and Lu. K. (2001); Groundwater Contamination monitoring with multichannel electrical and electromagnetic methods. *Journal of applied geophysics*, 48 91), 11-23.

Duran, M. and Sucienz, Mendres (2007): Utilization of both benthic maer invertebrates and physic-chemical parameter for evaluating water quality of the stream cekekc(tokat, Turky).*J. Environ.Bio.*28. 231-236.

Harkins, R. D. (1974): An objective water quality index. *J. water pollut. Contr. Fedr*., 46, 589.

Mohanta, B. K. and Patra, A. K. (2000). Studies in the water Quality index of river Sanamachha Kananda at Keonjargarh at, Orissa, India. *Pollut. Rex*., 19, 377-385.

Padmanabha, B. Belagali, S. L. (2005).Comparative study on the water quality index of fur lakes in the mysore city. *IJEP*, 25, 873-876.

Raja, G and Venkatesan, (2009): Assessment of ground water pollution and its impact in and around Punnam Area of Karur District, Tamilnadu, India. *J. of chemistry*, 473-478.

Sekar P. G., Hariprasad S and Deccaraman M., J.(2008) *Appl. Sci. Res*. 4(11). 1526.

Sinha, A. K., Saxena, S. and Sexena, R. (2004). Water quality Index for Ram Ganga river water at Muradabad. *Pollut. Res*., 23, 527-531.

Suresh, T. and kottureshwara, N. M. (2009): assessment of ground water quality of bore wells water of hospet Taluka Region Karnataka, India *Rasuyan J. Chem.* 221-233.

Tiwari, T. N. and Manzor, A. (1988).Water quality index for Indian Rivers. In ecology and pollution in Indian rivers (Ed: R. K. Trivedy) *Ashish Publishing House*, New Delhi, 271-286.

Tiwari, T. N., Das, S. C. and Bose, P.K. (1986). Water quality index for the river Jhelum in Kashmir and its seasonal variations. *Pollut. Res*., 5, 1-5.

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