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Research Paper

STUDY ON WATER QUALITY OF GROUNDWATER OCCUR AT FOOTHILLS OF HIMALAYA AT TARAI REGION

Zaheen Hasan and D. D. Tewari

Water Analysis Department of Botany,
M.L.K (P.G) College, Balrampur (U.P.) 271201,
India.

Abstract

Alluvial deposits of the sloping plains below the foothills of the Himalaya consist of thick permeable beds of cobbles, pebbles, coarse sands, and minor clay bands in the Bhabar zone, a northwest-southeast-trending belt of relatively arid country whose southern limit is marked by a line of springs. In the flatter swampy terrain of the Tarai belt below the spring line, the deposits are predominantly hard clays and kankar with intercalated sand and gravel lenses and beds in which ground water occurs under artesian conditions. Exploratory drilling has shown that adequate supplies of good- quality water are also available in the Bhabar zone from perched ground- water bodies as well as the deep water-table aquifer.

INTRODUCTION

Life cannot exist without water because it is major component of all living beings. It is important both physiologically and economically as it plays an essential role in temperature control and also is the medium in which organisms exists. The rapid peace of industrialization in India has created problems of water. Therefore, the three types water occur in nature i.e. Surface water, rain water and groundwater. Rain water and surface water are mostly running water and rarely used for commercial purpose. Ground water are the primarily source of potable water. Besides these it is also used for domestic purpose. Further around 68.9% of this fresh water is in the form of ice and snow, 29.9% is present as ground water, 0.3% is in the form of lakes and rivers and 0.9% in soil moisture, swamp water and permafrost atmosphere leaving us with a very small amount of water that may be used for fulfilling the daily needs of the people (Water and related statistics, 2013). It is about 20% of the world resources of

freshwater and used by industries. More than one-sixth of the people living worldwide do not have access to the clean water. If we look closely at the world statistics, India is found to have the highest number of people, i.e., around 76 million without access to clean and safe water followed by China (63 millions), Nigeria (58 millions) and Ethiopia (42 millions) amongst others (Water: At What Cost The State of the World's Water, 2016).

Over the last 150years there has been growing intensification of agricultural activities in the Indo-Gangetic plains (Abrol *et.al.,* 2002). This started with the introduction of large surface water irrigation in the 19th century and was followed by the introduction of agrichemicals in the mid 20th century and rapid growth in groundwater irrigation and urban development in the last 50 years. Groundwater is now heavily exploited for irrigation, industry and drinking water and demands on this resource are increasing rapidly.

Chemical properties of groundwater can be used as environmental tracers and so enable conclusions to be drawn about the water's origin, residence time and hydrogeochemical evolution (Edmunds et.al.,2003). For example, tracers such as major elements and ratios (eg. NO_3, Ca/Mg, NO_3/Cl, Cl, Cl/Br) and trace elements e.g; Sr, Li, Rb, Mo, U, As, Zn, B) are used as tracers in hydrogeochemical investigations characterise anthropogenic and geogenic sources of contamination (Edmunds and Savage, 1991). Systematic approach to the study of groundwater in India has long been overdue. The study unconfined aquifers encountered in dug wells and shallow bores has been investigated in isolated areas but it was not until the Exploratory Tube Wells Organization under the Ministry of Food and Agriculture, Government of India was established in 1953, that the systematic study of the perched groundwater was initiated. The investigation of Tarai zone lying immediately foothills of Himalaya.

With a growing recognition of the importance of groundwater storage in the Middle Hills there is significant potential to further advance the characterisation of groundwater systems and investigate the resilience of groundwater supplies to change. Systematic monitoring of groundwater, as springs flows, groundwater levels and chemistry would give a much better understanding of emerging trends. Likewise, monitoring current yields of springs and comparing to historic values at installation

may allow some conclusions to be drawn about the trajectory of spring flow. There are several groundwater-related initiatives underway within organisations in Nepal.

MATERIAL AND METHOD

Pachperwa is a town and a Nagar Panchayat in Balrampur district in the Indian state of Uttar Pradesh. Pachperwa is situated 54 km far from district headquarter Balrampur and 200 km from state capital Lucknow. The National Highway 730 connected the town to district headquarter as well as other cities**.**

Latitude: 27°30'44.42"N
Longitude: 82° 38' 34.69" E.

We collect groundwater samples from different areas of Pachpedwa which is as follows-

1. Badhiepurwa, Pachpedwa
2. Gurchihhwa
3. Bishunpur vishram
4. Siswa

RESULT AND DISCUSSION

PARAMETER	Unit	Standard limit	Site1	Site2	Site3	Site4
Temperature	˚C	40	27	29	30	25
pH	-	7.0	7.2	7.3	7.5	7.3
Colour	-	-	Transparent	Transparent	Light yellow	Light yellow
Odour	-	-	Odourless	Odourless	Odourless	Odourless
Turbidity	NTU	4	3.8	3.5	3.1	2.7
Salinity	mg/l	70	15	21	28	30
Alkalinity	mg/L	120	60	72	88	44
EC	µS/cm	40	180	240	230	170
Total hardness	mg/L	300	70	90	120	105

Calcium	mg/L	75	73	75	80	70
TDS	mg/L	500	92	456	762	520
TSS	mg/L	10	4.4	4.8	5.2	5.9
COD	mg/L	2.72	0.75	1.03	1.05	0.70
DO	mg/L	14.6	11.2	11.8	10.09	11.0
BOD	mg/L	30	16	20	22	46
Nitrate	mg/L	45	28	35	38	34
Sulphate	mg/L	200	74	130	214	160
Phosphate	mg/L	0.3	0.75	0.83	0.85	0.62
Sodium	mg/L	200	30	80	158	120
Chloride	mg/L	250	120	264	175	230

The analytical results of groundwater of the present study are shown in table. All the groundwater samples collected from drinking source were compared with drinking water standard BIS-10500 and WHO Guidelines.The detailed results of the physical and chemical parameters for the collected groundwater samples has been shown in table, where the groundwater variables were compared with prescribed international guidelines for drinking water. There were a large significant differences found in the studied variables observed in the groundwater among various different sites. The pH value of water is an important indicator of the acidic-basic interaction of organic components of water and a number of minerals. The pH value of groundwater samples indicated their alkaline nature pH ranged from 7.2 to 7.5 . It also comes within the desirable limits as prescribed by U.S. Environmental Protection Agency (EPA) (2016).

The salinity behavior of groundwater was investigated by analyzing the total dissolved solids (TDS), where the water with TDS > 500 mg/L is undesirable for drinking water supplies (WHO, 2012). TDS values varied from 92 to 762 mg/L of all the samples.

The electrical conductivity (EC) in water is based on the function of dissolved mineral matter content; if TDS is high then EC will be high as well. Measurable levels of EC with a mean 635 IS were found. The major anions abundance order in groundwater was Cl > SO4 2 > HCO3 , respectively. The concentration of bicarbonate and carbonate in

groundwater was may be due to the dissolution of carbonic acid and carbonate weathering in the aquifers (Kumar et al., 2009; Ramkumar et al., 2013).

Chlorides were common constituents of all natural water. The measurable concentrations of Cl and SO4 2 were in the range of 120–264 mg/L and 74–214 mg/L, respectively. Many samples exceeded the maximum limits as approved by WHO (2010) and EPA (2012). The elevated levels of Cl and SO4 2 in the studied groundwater may be attributed either to groundwater inter-connections. Groundwater with high levels of Cl that is used for irrigation may cause the toxicity of plants, where the Cl is not only absorbed by the soil, and therefore it is moved with the soil water but also taken up by the plants and accumulated in leaves (Kumar et al., 2009). As shown in table, ammonia (NH3 +) are the nitrogen forms present in groundwater in a varied range 28-34 mg/L. The extremely soluble form is NO3 – could reach easily into the drinking water supply through soil. The major sources of nitrogen compounds are fertilizers and domestic wastes which could be converted into nitrates in the soil (Kumar et al., 2009). All measurable nitrate, nitrite and ammonia concentrations were within the limits established by WHO (2008) and EPA (2012).

Agricultural effluents with fertilizers from domestic sewage and industrial wastewater are the main reasons for the differences in ground water phosphate concentration (Mkude, 2015).The major cations' abundance order in Hail groundwater is K+ < Mg2+ < Na+ < Ca2+, where the main composition of groundwater is highly affected by lithology of rocks in addition to human activities (Kumar et al., 2009). The sodium ion concentrations ranged from 30.0 to 158.3 mg/L. The cation exchanges through water–rock interaction in addition to human activities are the main reasons for the increase in Na+ level in groundwater (Mkude, 2015). The most common divalent cations in water are calcium and magnesium. The correlation coefficients between different studied variables in Hail groundwater. A close relationship between the pairs of Cl and SO4 2 with Na+ , K+ , Ca2+ and Mg2+ reflect the occurrence of major cations in groundwater as suphate and chloride, where the groundwater in the Hail region is characterized by calcium sodium-chloride-sulphate type with subsidiary calcium bicarbonate water type. Also, a close relationship between Ca2+, Mg2+, Na+ and K+ concentrations in groundwater states was the probable common source of the major cations. TDS showed highly significant positive correlations among different sites with each of EC, Cl, SO4 2,

Ca2+, Na+ , Mg2+ and K+ which constituted the major cations and anions present in groundwater. The present study will further help to understand the role of natural factors as well as activities related to manmade actions which could affect the quality of ground water.

CONCLUSION

The analysis of water quality is being done by collecting 4 samples from various areas of Pachpedwa Balrampur district (India). The result shows that pH value of groundwater samples indicated their slightly alkaline nature It also fell within the desirable limits cited by U.S. Environmental Protection Agency (EPA) (2012). The salinity behavior of groundwater was indicated by total dissolved solids (TDS), where the water with TDS > 500 mg/L is undesirable for drinking water supplies (WHO, 2010). The electrical conductivity (EC) in From the afore mentioned results, it can be clarified that most of water quality variables exceeded the limits specified by the regional and international standards for drinking water.

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