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Hydrochemical Monitoring of Ground Water Quality With Reference To Town Deeg, District Bharatpur, Rajasthan

Abstract

Ground water has become indispensable to full fill the requirement of water for agriculture and domestic uses.The assessment and management of groundwater resources has become a prerequisite to satisfy the need of water for domestic and agriculture purposes.

The present study deals with the evaluation of quality of ground water (well and hand pump) of four areas in town Deeg (Bharatpur), Rajasthan during postmonsoon season (October-2008 to January-2014) to find out pH, T.D.S., T.H., CaH., Total Alkalinity, F, Cl, Dissolved Oxygen (DO), Phosphorus, Nitrate, Salinity and E coli. A comparison with ISI standards shows that TDS, TH, salinity, chloride, nitrate, and fluoride (all water) and CaH (hand pump) exceeded permissible limits. DO and phosphorus are within the limits. The *E coli* in well water has been recorded very high than the limits. Water borne diseases such as of heart, respiratory, gastric, skeletal deformities, diarrhea, jaundice, amoebiosis, arthritis etc. are prevalent in the area.

The groundwater (well and hand pump) of Deeg (Bharatpur) is not fit for drinking purpose.Management strategies such as recharging ground water, registration and regulation of groundwater extraction, collection and disposal of waste water,adoption of traditional conservation methods,de-fluoridation(food rich in calcium and phosphorus, adoption of an activated alumina adsorption technique), nitrate removal (use of yellow mustard and food with vitamin-C) and awareness of public about the water quality importance and hygienic conditions may be employed.

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Keyword: Groundwater Quality, Water Borne Diseases, Hydrochemical .

Introduction

Water can undoubtedly be referred to as the sine qua non life. Although water is found abundantly on planet earth, a majority of its population does not have access to clean drinking water. Water is not only the most important essential constituent of all animals, plants, and other organism but also is pivotal for survival of the mankind in biosphere.The ground water resources are being utilized for drinking, irrigation,and industrial purposes(Sampat,2000).Gupta and Kumar (2002),Kannan et al.200

Many wetlands and most lakes depend on ground water for base flow and are directly connected to ground water (Brown et al. 2007). However, due to rapid growth of population, urbanization, industrialization and agricultural activities ground water resources are under stress. Ground water contamination and extraction have been recognized as a crucial danger to the environment and biodiversity around the world (Eamus et al.2006). There is growing concern on the deterioration of ground water quality due to geogenic and anthropogenic activities. Groundwater is also often withdrawn for agricultural, municipal and industrial use by constructing and operating extraction wells.

In many parts, the demand for ground water already exceeds supply. In addition surface water supplies is fully allocated for use, thus water users are turning to ground water to meet further water need (Gannett et al. 2007). Ground water contains variety of dissolved inorganic chemical components in various concentrations resulting from chemical and biochemical interactions between water and geological material.

Inorganic contaminants including salinity, chloride, fluoride, nitrate, iron, TDS, and arsenic are important in determining the suitability of ground water for drinking purpose. Furthermore, ground water fails to meet drinking water standards.Ground water contamination by nutrients or chemicals from agriculture,waste disposal and industrial operation is prevalent. Waste materials which are subjected to reaction with percolating rain water and reach the aquifer system hence degrade the ground water quality Reza and Singh (2009), Kumar et al.2008)Consequently, ground water depletion and contamination pose a looming and widespread threat to aquatic ecosystem and suitability for agricultural, industrial and domestic uses. The transmission of water borne disease has been a matter of concern for many years (Roy, 2007).

The Town Deeg in district Bharatpur situated at the eastern gateway of Rajasthan was founded by Maharaja Suraj Mal in 1733 AD.Deegtown is the main historical and tourist place of Rajasthan. The places include Deeg fort and Jal mahal of Deeg. The ground water of Town Deeg contains very high TDS, salinity and hardness (Garg et al. 2008). Residents of Town Deeg do not totally depend on ground water but they use it only for bathing and washing of clothes. Water quality studies were carried out by several workers ie. Gupta and Verma (2007), Devi Prasad *et al.* (2009), Shivakar *et al.*(2009), Gupta and Sharma (2009), Gupta and Singh (2009), Gupta and Jatav (2009), Reza and Singh (2009) and recently by Gupta and Singh2009,2010,2011),Sunder Singh 2013,2014).

Therefore, the present study is aimed to evaluate the suitability of ground water for domestic uses.

Materials And Methods

The urban agglomeration of Town Deeg is located at the foot hills of the aravali mountains between the most eastern part of the Rajasthan state. Town Deeg lies between the east longitude $77^0 15'$ and north latitudes $27^0 20'$ at 100 meters above MSL. Ground water such as hand pumps and open wells from five different areas the nagar road Goverdhan road ,Jal mahal and kaman road and their near by places of Town Deeg were selected for sampling of water. The approximate distance between the four areas was one and a half kilometer. Samples were taken from all the four areas including four samples each from hand pump and well water every fortnightly during postmonsoon season from October,2010 to January 2011.

Samples were taken in clean sterilized polythene bags. Water samples were analysed to find out pH,Total alkalinity, Total hardness (TH), Calcium hardness (CaH), Nitrate (NO_3), Total dissolved solids (TDS),Fluoride (F),Salinity,Chloride,and Dissolved Oxygen (DO)by using methods as given by APHA,BIS (1991)(2005) and Trivedi and Goya l(1986) AOAC (1990). pH of the samples was analysed at the spot and compared with BIS (1991).

Results And Discussion

The pH of all water samples of all areas is within the permissible limits.The TDS,chloride, salinity and TH of all the hand pump and well water of all as are very higher to the permissible limits in the present studies.The population of Town Deeg (Bharatpur) is 120500.(2011census) with a density of 3644.22 person per Km. The high TDS,salinity and chloride may be due to ground water pollution by waste waters which is discharged into pits and deposition of large heaps of cattles and human wastes around the well of Town Deeg in the present studies.The total waste generation of the city is about 116.74 metric tones per day (MTD). No initiative has been taken till now in terms of door to door collection of solid waste. Most of the waste is dumped without any treatment in depressions, ditches or by the sides of the road flank in an unscientific manner singh and gupta 2010,2011.2012.

Town Deeg does not have under ground sewerage system. Out of the occupied residential houses only 41.88% population have some kind of individual facility and about 28.78% with low cost sanitation (LCS). Most of the houses have adopted the practice of onsite disposal by constructing water seal or bore hole latrines or septic tanks with effluent discharge in to soak pit or open surface drains.The present findings are in agreement to Binu Kumari *et al*. [2006] and Gupta and Verma (2007)Brown et al.2007.

The higher values of CaH in the water of hand pump has been noted in the present studies which may be due to the addition of calcium ions to a natural water system as it passes through soils and rocks containing large amounts of calcium in mineral deposits as has been reported by sarkar (2004), arnon (1958) adoni,etal.(1985) The total alkalinity in hand pump water exceeds the permissible limits.

The dissolved oxygen is within the prescribed limits. Very high salinity in the ground water may be due to a combination of low rainfall and high evaporation. The values of chloride in well and hand pump water of all five areas exceeds permissible limits.

The fluoride and nitrate content of all areas is within the prescribed limits.

Conclusion

From the present study it is evident that ground water quality is gradually getting deteriorated and it may deteriorate further with time.The water quality of well and handpump of all areas are polluted and unfit for human consumption for any use.

Suggestive Remedies and Management Strategies

1. For the conservation and management of water resources the traditional methods such as recharging water system by ponds, pokhars and reservoirs and rain water harvesting must be employed
2. Groundwater extraction structures (tube well, handpump, deepbore, and well) should be registered and regulated. to decrease over-abstraction and degradation of ground water quality.

3. The groundwater must be assessed before use to ensure suitability of the quality for human consumption.
4. The ground water sources and their surroundings should be maintained to ensure hygienic conditions and no sewage or polluted water should be allowed to percolate directly to ground water aquifer. (Batheja et al.2009)
5. The hand pumps, of very poor water quality should be painted red to indicate and warn the public that the water drawn from the source is not fit for human consumption.
6. The ground water drawn from hand pumps should be properly chlorinated to eradicate the presence of bacterial contamination.
7. The untreated sewage and sewerage flowing in various open drains are one of the causes of ground water quality deterioration. Proper under ground sewerage system must be laid in all inhabited areas and the untreated sewage and industrial wastes should not be allowed to flow in open drains.
8. Monitoring of Groundwater quality should be done in the areas where water was found contaminated.
9. Collection & treatment of wastewater and collection & disposal of municipal solid waste must be executed.
10. Industries should not be allowed in residential areas. There should be no stagnation of wastewater to prevent percolation of pollutants in groundwater Emmanel et al.2008).
11. Disposal of hazardous waste or biomedical waste should be prohibited in the city limit to avoid any leaching process in to the groundwater. (Bush and Mayer1982).
12. The drinking water quality in an emergency situation at household-level can be monitored by the rolling boil than cooling and alum or bleaching treatment before use to minimize the concentration of TDS (Garg *et al.*2008 and WHO, 2008).
13. Environmental awareness through education is highly recommended as this is very important to conserve water resources and equally to maintain health.

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Table 1: Physicochemical and Microbiological Parameter of Ground Water During Postmonsoon Seasonin Deeg (Bharatpur)Rajasthan.

Area	Type of water	pH	TDS(ppm)	Total alkalinity (ppm)	TH(ppm)	CaH (ppm)	Chloride (ppm)	DO (ppm)	Salinity μs/cm	P (ppm)	Nitrate (ppm)	F (ppm)	*E coli*/ 100ml
NagarRoad	Hand pump	7.07 ±.007	6769 ±8.27	388 ±4.79	4820 ±8.16	612 ±2.8	3337 ±28.98	4.79 ±0.03	9942 ±26.68	.06 ±0.002	125.50 ±0.98	3.56 ±0.05	00.00 ±0.00
	Well	7.58 ±.015	3529 ±4.27	119 ±1.25	2828 ±12.83	629 ±2.51	1906 ±16.96	6.53 ±0.02	4673 ±18.12	0.00 ±0.00	142.65 ±0.07	6.96 ±0.04	2500 ±13.46
Goverdhan Road	Hand pump	7.17 ±.018	3576 ±2.23	545 ±2.04	1845 ±15.54	1222 ±5.08	1665 ±22.69	4.75 ±0.06	4952 ±18.44	.03 ±0.00	115.25 ±0.38	1.20 ±0.018	8.00 ±0.06
	Well	7.15 ±.015	4673 ±2.38	746 ±2.39	2040 ±10.80	229 ±2.51	1984 ±4.33	3.95 ±0.03	6444 ±34.44	.10 ±.007	82.67 ±0.07	7.69 ±0.01	2220 ±24.32
Jal Mahal	Hand pump	7.05 ±.064	2589 ±4.27	216 ±2.39	2555 ±12.50	470 ±3.82	995 ±14.52	3.88 ±0.01	4060 ±14.46	0.00 ±0.00	115.25 ±0.38	0.76 ±0.04	00.00 ±0.00
	Well	7.40 ±.019	2176 ±2.39	390 ±4.08	2063 ±21.59	172 ±9.52	614 ±6.02	5.39 ±0.13	3141 ±13.24	.17 ±0.004	125.25 ±0.38	7.96 ±0.035	2000 ±19.83
Kaman Road	Hand pump	6.91 ±.016	8618 ±12.09	478 ±4.79	4470 ±28.86	455 ±5.08	3284 ±54.11	3.55 ±0.01	12645 ±34.44	.10 ±0.004	325.75 ±0.48	2.60 ±0.043	14.00 ±0.25
	Well	7.50 ±.017	8246 ±2.39	520 ±4.08	2375 ±47.87	235 ±6.65	4580 ±45.83	4.40 ±0.00	12110 ±43.48	0.00 ±0.00	142.65 ±0.07	8.61 ±0.054	2420 ±22.64
Permissible Limits (BIS Standards)		6.5 To 8.5	500 To 2000	200 To 600	300 To 600	75 To 200	250 To 1000	3-7	0-1500	0.1 – No Relaxation	45 – No Relaxation	1.00 To 1.5	Less than 10.00

Values are Mean ± Standard Error