Chemical Analysis of Ground Water of Purnia District town, Bihar, India – A case study

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Abstract: Water pollution is a serious problem as nearly 80% of India surface water and a considerable number of growing groundwater sources have been contaminated by inorganic an d biological pollutants . Pollution of water resources occurs mainly through point and nonpoint (diffusion) sources. The major source of water pollution can be categorised as Municipal agricultural and industrial Municipal water consist of water from houses and commercial establishment, which run-off leached up to groundwater table to contaminate the source . Agriculture including commercial livestock and animal farm waste and lots are the main source of many organic and inorganic pollutants. These contaminants include both sediments from erosion of cropland and compounds of phosphorus and nitrogen that partly originated from animal wastes,fertilizers and common Agro- biocides. Animal wastes and domestic wastes are high oxygen demanding materials such as nitrogen and phosphorus often they harbour pathogenic microbes. In India, raw level of major ions (notably phosphates, nitrate fluorides and chlorides), metals(notably iron and arsenic) and liable and non liable DOC vary significantly across the region and with Season. However ,in india particularly rural sector groundwater (major source of potable water) resources are polluted through the poor septic systems,small disposal pits, landfills, animal lots, fertilizers and application of sledge's. Keeping this view a laboratory study was conducted to monitor the groundwater quality of selected sites are Purnea, sub-urban town by examining the various for physicochemical parameterssuch as temperature ,pH, T.D.S., D.O. and COD etc comparison with ICMR,WHO and other Agencies standard,shows that the groundwater is nearly suitable for drinking purposes and for other useful anthropogenic activities.

Keywords: contamination, septic system, water characteristics, potable water

1.Introduction

Groundwater is ultimate and most suitable fresh water resource having nearly balanced concentrations of the required salt of human use. Rapid urbanizationsand population explosion have led to a great demand of an increasingly smaller potable water supply in the country .Problem with water qualities are as severe as problems with water sustainability, but less attention has been paid towards this issue in our country.The high rate of exploration than its charging in appropriate dumping of waste (liquid / solid), lack of enforcement of law and unhealthy governance are the factors of deterioration of ground water quality.Purnea municipality almost does not facilitates the treated water supply. In alternate to this,the inhabitants keep options as hand pumps and motor pumps. The objective of this work is to access the groundwater quality and an idea about to hypothise some new chemical formulation for water management in Purnea town,a sector of Kosi region, Bihar.

1.1.Source of pollution

Groundwater and surface water resources are mainly polluted through point and nonpoint (diffusion) sources.Nonpoint sources of pollution occur when harmful substances are directly discharge into water bodies such as Industrial effluents, sewage discharge in domestic untreated sewage and nonpoint source delivers ground water resources while fluoride ions and dissolved solids are for anthropogenic activities such as application of fertilizers and crop plants, iron and dissolved solids are dealt with by suitable treatment methods of extracted water.

1.2.Pollution from domestic activities

About 14% of rural and 70% of urban inhabitants have access to adequate sanitation facilities .Hence, water contaminated by domestic waste as it is directly discharged into water bodies are seats into the groundwater table due to improper location of septic tanks / pit latrines, inadequate facilities for treatment of human and animal wastes contribute the high intensity of water borne diseases in the North Eastern parts of Purnea, Bihar, (Kosi region), India such as renal problems, hypertension, skin diseases,fluorosis etc. are commonly seen in this region hence called as "Kala Pani."

1.3.Pollution from Geochemical Activities

Groundwater of certain geographical regions may not be of desired qualities for potable use due to geochemical conditions. Groundwater with high fluoride contact period between groundwater and fluoides bearing rocks such as fluorospars ,phosphatic rocks and phosphates. The fluoride contents in India aquifer vary from <1ppm- 25 ppm. The other factors contributing to excess of fluorides in groundwater are overexploitation of groundwater reservoirs,high level of fluorides in potable water or drinking water. They lead to dental and skeletal fluorosis.In India ,about seventeen States have been identified as endemic to fluorosis in drinking water and Bihar is one of them. Arsenic compounds with Ores and Minerals such as in combination with iron and manganese oxides and under some natural conditions it can be soluble and released into groundwater table.

This north-eastern region of Bihar ie.Kosi region has existing concentration of iron in groundwater in the form of ferrous ions in anaerobic conditions, but when after extraction comes in aerobic conditions ferrouss converted into ferric state to make water as “Red Water” with offensive smell. The long uses of this water impart reddish colour in the inner wall of container and even platform of the hand pump gets red in colour.Though iron content in drinking water may not affect the human health as a simply dietary load. But in the long run, prolonged use causes bioaccumulation which may result in damages of tissues ie.”Homochromatosis”

1.4.Pollution from Agricultural Activities

The excess use of fertilizers, pesticides,herbicides,fungicides, rodenticides etc. to improve soil fertility and protection of crops emerging as an environmental menace . These chemical products find their way to accumulate into the lung tissues through foodc-hains resulting,implication on human health . Biocide and fertilizers entered the water resources through run-off and become hazardous to human animal and plant lives.

2.materials and methods

2.1.study area

Purnia is a sub-urban area and district town of north -eastern region of Bihar(Kosi region),which consists of 46 wards under its own municipal corporation, located in India at 25^0 47’N latitude and $87^0$28’E longitude and 40.61 metre above the sea level. The hottest month are July -August and coolest months are December- January. The temperature varies from 8^0C-16^0C in winter and 29^0C-39^0C in summer In winter,the temperature sometimes varies from 3^0C-5^0C and shoots up in summer about 40^0C – 42.5^0C. The relative humidity in and around this area is about >75% during the month of July- September.The average rainfall is in between 141 mm -145mm.About 80% of the total rainfall Is normally received during the monsoon month of June to September.Besideshaving itself a municipal corporation with some extension areas,it lacks proper planning and managements .In total five sites are selected for the study and boring depths of hand pump vary in between 18-25feet (Table 1).

Table-1

Sampling Location and Corresponding habitats

SL.No.	Sampling Location	Habitats	Source of Water Sample	Depth of HAND Pumps (feet)
1	Madhubani (S1)	Residential Area	Hand Pump	20-22
2	Line Bazar (S2)	Residential Area	Hand Pump	19-21
3	Rambagh (S3)	Residential Area	Hand Pump	19-21
4	Khuski Bagh(S4)	Residential Area	Hand Pump	18-20
5	Gulabbagh(S5)	Residential Area	Hand Pump	18-21

2.2.Sampling and sampling sites (station)

The samples were collected in clean polythene bottles of capacity two litres having no air bubbles. Before sampling evacuation of the stored water in hand pump head has been made to take fresh groundwater sample .The selected sites are urban residential areas of the

town detected in figure 1 (a map view of the Purnea district town assite S_1 –S_2). Groundwater is particularly important for about 80%-88% safe drinking water in rural areas where population is widely dispersed and the minimum possible infrastructure needed for treatment of water doesn't exist. The sampling has been carried out in post monsoon session October to May 2011. The temperatures are the samples were measured in the field itself at the time of collection. The samples were kept in refrigerator at 4^0C.

2.3.Methodology

The ware quality parameter analysed were pH with the help of pH meter standardized wuth pH buffer 4 and 7 .TDS were estimated by evaporation method at 1800C .Calcium content bt EDTA titrimetric method , hloride content by argentometric method , total hardness (TH) by EDTA methods ,alkalinity and chemical oxygen demand (COD) by open reflux methods.Table.2.

Table.2

Comparision Of Water Quality Parameters Of Ground water,Purnea Town(in/mg/L) with Standard Values Of ICMR,WHO&BIS

Parameters	S1	S2	S3	S4	S5	Mean	ICMR	WHO	BIS
Temp.^{0}c	22	21	20	21.5	22	21.3	_	_	_
Ph	7.9	6.8	7.3	7.3	6.9		7-8.5	7-8.5	7-8.3
TdS	800	1100	980	1020	1100		500	500	500
t.h	121	130	125	150	201		300	200	200
COD	164	170	160	162	235		_	255	255
CL	70	80	80.8	100	113		200	250	250
Aik	90	112	90	95	102	97.8	200	120	200
Ca-Hardness	79	80	80	82	110			75	75
Turbidity (NTU)	10	10	12	18	20				
Conductance Mmho/cm	450	500	500	550	660				

3.Results and Discussions.

3.1.Result

The results of the physico chemical analysis (2010-2011) of the ground water samples as S_1-S_2 of five different Sites of Purina are summarized in table 2. The value of pH range among 6.8 to 7.9 is well within the prescribed limit of ICMR and other Agencies (WHO/BIS). A little bit increases in the pH may depress the effectiveness of the used disinfectants such as chlorination thereby additional chlorine is required. The value of TDS varies in between 800- 1100 mg/l where as the average of TDS in the groundwater is 1000 mg/L, the maximum permissible level in is 2000 mg/L as per IMCR(Table 3).

Table.3.

Parameter		**ISI**		**WHO**		**ICMR**		**BIS**	
		HDL	**MPL**	**HDL**	**MPL**	**HDL**	**MPL**	**HDL**	**MPL**
Ph		**6.5-8.5**	**--**	**7.0-8.5**	**6.5-9.5**	**7.0-8.5**	**6.5-9.2**	**7.0-8.3**	**8.5-9.0**
TDS		**500**	**2000**	**.**		**500**	**1500**	**500**	**2000**
Ca			**75**		**75**				**75**
Cl			**250**		**250**		**250**		**250**
TH		**300**	**600**	**200**	**600**	**300**	**600**	**200**	**600**
Alkalinity		**200**	**600**		**120**			**200**	**600**
COD		**150**	**255**		**225**			**150**	**255**

High TDS in groundwater may be due to groundwater pollution when wastewaters from residential areas are discharged into pits,ponds and other water bodies leached tothe water table .Total hardness from 164-235mg/L chloride content is 7-1 12 mg per liter. And it is also in the limit of standard IAMCR / W H O oblique b I a s. COD ranges from 90 to 120 to MG per liter indicating the nearly pure symptoms. The standard desirable limit of alkalinity in drinking water is 120 mg per litre. The maximum permissible level is 600 mg per litre. The mean value of alkalinity is the ground water sample is 97.8 MG per litre. The value of alkalinity in the water provides an idea of natural salt present in what search water research has various ionic species that contribute to alkalinity includes bicarbonate Hydroxide phosphate borate and organic acids on the other hand one more possibility is here that is the degradation of dissolved organic matter as disinfectants / USA of use of Agro biocide in the crop land main causes some disinfection by-products black adbp bracket close as the use T H M (try hello Methane) close, h a a bracket hello Acetic Acid (close etc. Some of them are of potential threat to carcinogenic activities, and Reena problem and a short period exposure can associated with headache X, dizziness as well as some problems related to nervous system problems at Sector this is more prevalent in those factors where Hai contamination of dissolved oxygen organic matter exist due to Excess application of disinfectants.(table.2.)

Conclusion

Quality of groundwater understudy area is nearly suitable for drinking and other domestic uses.Hence, it is recommended that the water analysis should be carried out from time to time to monitor the rate and kind of contamination in context to the human health. The groundwater of this Kosi region has existing concentration of iron which requires specific analysis cum treatment. Hence, it is good to set-up common Commission for water and sanitation on state and national level to enforce in rural population in particular as water and sanitation of course related. Improper and poor sanitation is the cause of many diseases and it also results in poor quality of water.For example,a toilet or pit latrines within a distance of 18- 20 metres from a male hand pump / Bore well will contaminate groundwater table. There is less increasing awareness among the people to maintain the groundwater at their highest quality and purity level and the present study May prove to be useful in achieving the same.

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Abbreviations:

HDL- Highest Desirable Level
MPL- Maximum Permissible Level
BIS- Bureau of Indian Standard
ICMR- Indian Council Of Medical Rresearch
WHO- World Health Organization
ISI – Indian Standard Institute
TDS- Total Dissolved solid
TH- Total Hardness
COD- Chemical Oxygen Demand

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