GROUNDWATER QUALITY OF PURULIA DISTRICT: A MICRO LEVEL STUDY ON PURULIA-I BLOCK, PURULIA DISTRICT, WESTBENGAL

Jayanta Saha

Assistant teacher at Keshargoria Junior High School, Purulia distric

ABSTRACT

The quality of water for drinking purpose is a necessary for good health. The present paper is concern about the study of groundwater quality of Purulia –I block of Purulia district, West Bengal with special reference to four quality parameters i.e. pH, iron, fluoride, total hardness etc..The present study is based on primary survey in the month of December, 2014.The analysis shows that the mean pH value of the block is 6.45.So the groundwater is acidic in nature. The mean iron value is 0.683mg/l and it ranges from 0.5 to 3 mg/l. Fluoride is also higher concentration in number of locations. The fluoride concentration in groundwater of the block varied from 0.084 to 2.23 mg/l. Total hardness of groundwater are found higher than permissible limit at various locations. The average total hardness in groundwater of the block is 399.59 mg/l. Overall groundwater quality is found unsatisfactory for drinking purposes in most of the villages, under the study.

Keywords: groundwater quality, quality parameter, fluoride, pH, total hardness.

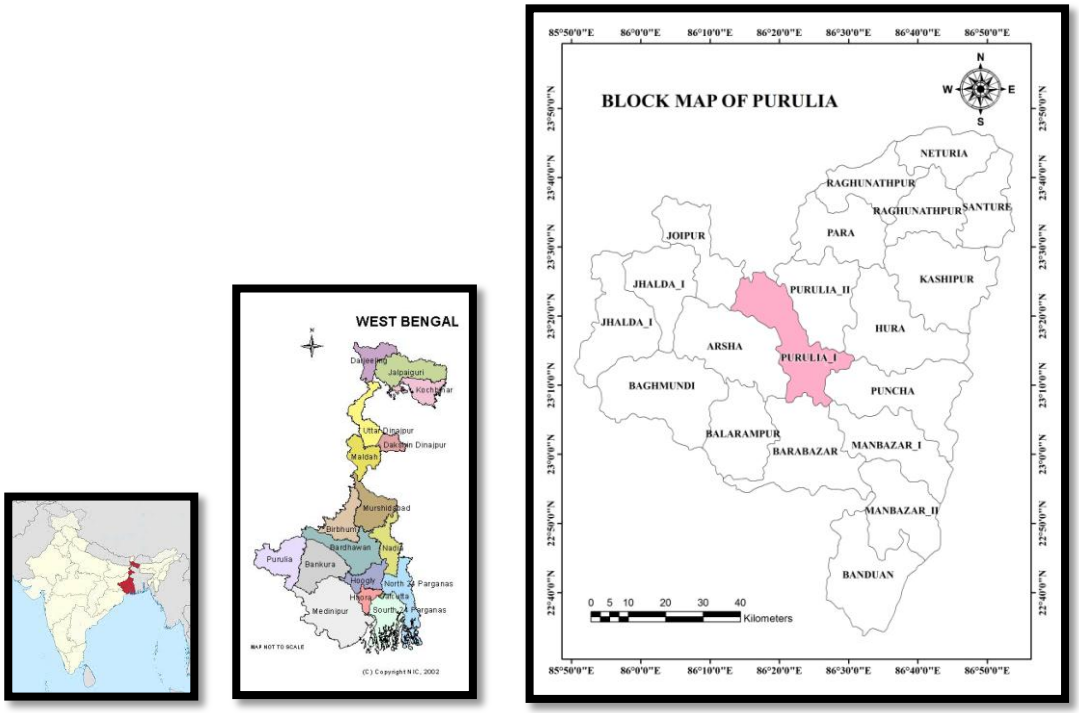
INTRODUCTION:

It may be pointed out that only one percent of total amount of water of the hydrosphere is available to human beings and other biotic communities from various sources such as ground water, rivers lakes soil and atmosphere. But ground water provides the largest amount of water. Increased demand of water due to increasing population, industrial expansion, agricultural stress the quality of water considerably decreased[6]. The quality of water is also an indicator of progress of human civilisation. The water for drinking purpose should be healthy, hygienic and pure. Good quality of water ensures the good health condition. The Purulia district of West Bengal is a drought prone plateau region underlies by pre-cambriam metamorphic rocks where people are mainly dependent on groundwater for drinking water. So the study of ground water quality of Purulia district is very important on the hydro geological, environmental, as well as human health point of view. In this paper, a micro level study on ground water quality on the basis of pH, iron, fluoride (f), Total hardness (TH) has

STUDY AREA:

The study is conducted in Purulia-I block of Purulia district in West Bengal. The eight villages of this block has randomly selected for the purpose of study namely, Gobindpur, Gurpa, Bhul, Ghagarjuri, Pattamputra, Roybaghini, Chakradih, Garafusro.

Fig.1: LOCATION MAP OF THE STUDY AREA



OBJECTIVES:

The main objective of the study is to examine the groundwater quality of Purulia-I block of Purulia district of West Bengal on the basis of four key groundwater parameters i.e. pH, iron, hardness, fluoride.

METHODOLOGY:

In order to assess the groundwater quality 18 tube well water samples have been collected from 8 villages of this blocks during post monsoon season in the month of December 2014. Then samples

were tested in the water testing laboratory using standard methods given by American Public Health Association. The results are evaluated in accordance with the drinking water quality standards given by WHO and BIS.

PHYSICAL SETTINGS:

Purulia district is a part of Chotanagpur plateau region. The district is characterized by undulating topography with rugged hilly terrain in the western and southern part. General elevation ranges from 100 to 300 meters. Master slope ranges between 10 to 20 m/ km. climatologically, Purulia district falls under semi arid and drought-prone region. The monthly temperature varies between 7.8^0C to 46.8^0C from winter to summer. Average rainfall recorded during last fifty years is 1375.2mm. The main rivers are Kangsabati and Kumari and their tributaries and they are flowing from northwest to south east direction. From geological point of view, the district is underlain by rocks of Precambrian and Archean ages represented by granite, gneiss, calgranulite, ultrabasic and metamorphic rocks, including crystalline lime stone, hornblend schist, biotic gneiss, pegmatite vein. The ground water in the district occurs in the weathered zone within 10 mbgl and or shallow fracture zones forming unconfined to semi confined aquifers. The depth of the water level varies from 3.63- 9.76 mbgl in pre monsoon and 1.32 – 7.3 mbgl in post monsoon period.

RESULT AND DICUSSION:

The four key water quality parameters namely pH, fluoride, iron, total hardness were studied. In table 1 the summarised mean values of these parameters have given. The data showed significant variations in the water samples.

Table.1: summarised mean and maximum value of groundwater parameters

Name of the villages	Total sample analysed	pH		Fluoride(mg/l)		Iron (mg/l)		Total hardness (mg/l)	
		Maximum value	Mean value	Maximum value	Mean value	Maximum value	Mean value	Maximum value	Mean value
Gobindpur	3	6.99	6.77	2.00	1.136	1.2	0.85	340	266.66
Gurpa	2	6.51	6.375	0.175	0.13	0.8	0.65	760	590
Bhul	2	6.74	6.375	1.77	1.73	0.5	0.25	420	330
Ghagarjhuri	2	6.96	6.82	1.33	1.33	0.5	0.3	360	290
Pattamputra	3	6.78	6.70	2.23	1.73	1.2	0.48	480	360

Roybaghini	3	6.58	6.38	1.61	1.215	0.5	0.33	360	300
Chakradih	2	6.24	6.14	0.443	0.423	3	2.1	780	550
garafusro	1	6.01	6.01	0.5	0.5	0.5	0.5	800	800
Total	18		6.45		0.941		0.683		399.59

Source: primary field survey, December, 2014 and calculated by author

Table- 2: Guideline for water quality for drinking purpose

Guideline according to		pH	Iron mg/l	Fluoride mg/l	Hardness mg/l
WHO	Highest desirable limit	7.00 – 8.5	0.3	0.6 – 0.9	100
	Highest permissible limit	6.5 - 9.2	1.0	0.8 -1.7	500
BIS Standard	Highest desirable limit	6.5 - 8.5	0.3	1.0	300
	Highest permissible limit	No relaxation	1.0	1.5	600

pH:

A test of the acidity of water is pH, which is a measure of the hydrogen-ion concentration. The pH scale ranges from 0 to 14. A pH of 7 indicates neutral water; greater than 7, the water is basic; less than 7, it is acidic. A one unit change in pH represents a 10-fold difference in hydrogen-ion concentration. For example, water with a pH of 6 has 10 times more hydrogen-ions than water with a pH of 7. Water that is basic can form scale; acidic water can corrode[9].

Groundwater of Purulia-I block is acidic in nature. The mean value of pH of groundwater in Purulia-I block is 6.45 which is below than the WHO (World Health Organization) and BIS

(Bureau of Indian Standards) highest desirable limit (7.00 -8.5 and6.5 – 9.2 respectively) and it ranges from 6.01 to 6.99. Maximum pH value found in Gobindpur village and lowest pH value found in Garafushro village. The groundwater at the villages like as Garafushro, Chakradih, Gurpa is highly acidic in nature, while at the villages of Ghagarjhuri, Pattamputra, Gobindpur acidic nature of groundwater is reduced.

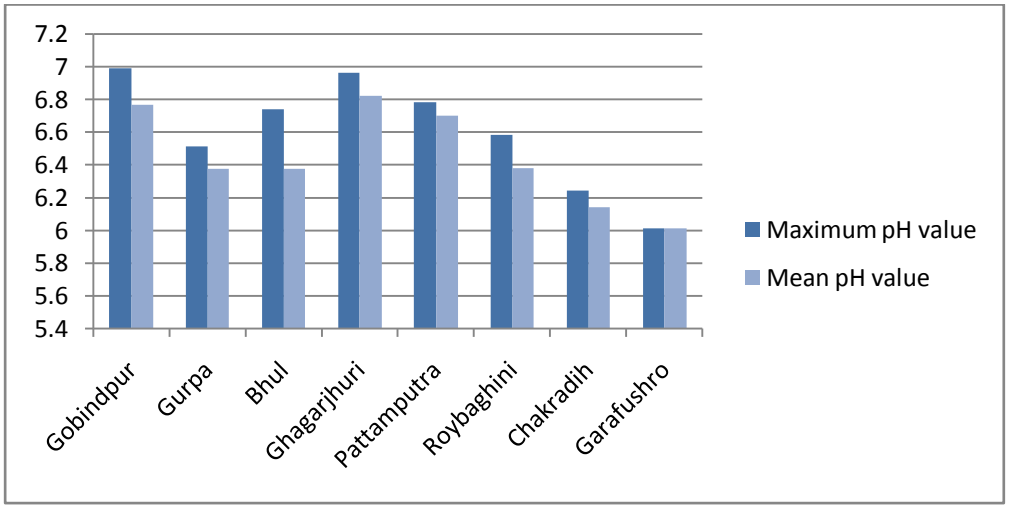


Fig.2: village wise maximum and mean pH value of ground water samples of Purulia-I block

Hardness:

Water that contains a lot of calcium and magnesium is said to hard. The hardness of water is expressed in terms of the amount of calcium carbonate. Water is considered soft if it contains 0 to 60 mg/l of hardness. Moderately hard from 61 to 120 mg/l, hard between 121 and 180 mg/l and very hard if more than 180mg/l. Very hard water is not desirable for many domestic uses; it will leave a scaly deposition inside the pipes, boiler and tanks[9].

From fig.3 it has seen that groundwater of Garafushro and Gurpa villages are very hard in nature and maximum total hardness of these villages have found 800mg/l and 760 mg/l respectively which are above the maximum permissible limit of WHO's and BIS's guidelines for drinking water i.e. 500 mg/l and 600 mg/l respectively (table-2). The average hardness of groundwater in Purulia-I block has found 399.59 mg/l (table- 1)

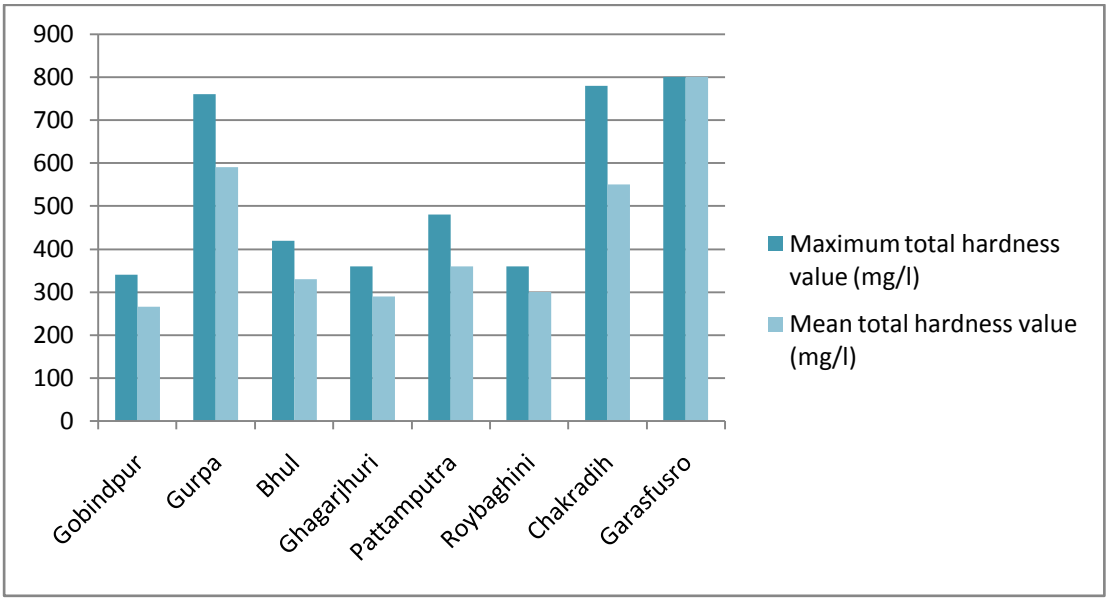


Fig .3: Village wise total hardness value of ground water samples

Source: primary survey and calculated by author

Iron:

Iron in rural groundwater supplies is a common problem: its concentration level ranges from 0 to 50 mg/l, while WHO recommended level is ‹ 0.3 mg/l. The iron occurs naturally in the aquifer but levels in groundwater can be increased by dissolution of ferrous borehole and hand pump components. Iron-bearing groundwater is often noticeably orange in colour, causing discoloration of laundry, and has an unpleasant taste, which is apparent in drinking and food preparation.

The iron concentration in ground water of Purulia-I block is ranges from 0.1 to 3 mg/l. Mean iron concentration in groundwater is 0.685 mg/l which is greater than the maximum desirable limit as per WHO's (World Health Organisation) guideline i.e. 0.3 mg/l. Highest iron concentration in groundwater has found at Chakradih village i.e.3 mg/l (fig.4& table.1).

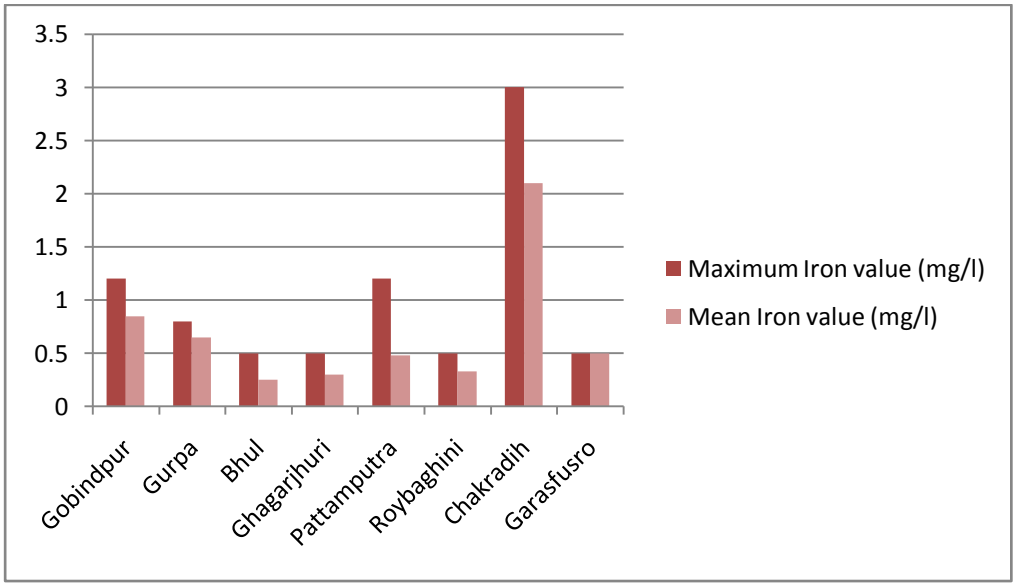


Fig .4: Village wise iron value of ground water samples

Source: primary survey and calculated by author

Fluoride:

Fluoride in minute quantity is an essential for mineralisation of bones, formation of teeth enamel and helps to prevent dental caries. In excessive doses, however it leads to a chronic fluoride poisoning called fluorosis. According to BIS standard highest desirable limit of fluoride is 1.0 mg/l and maximum permissible limit is 1.5 mg/l [1,2].

The fluoride concentration in Purulia-I block varies from 0.084 to2.23 mg/l and highest fluoride concentration in groundwater has found at Pattamputra village i.e.2.23 mg/l whereas the average fluoride concentration in groundwater of Purulia-I block is 0.941 mg/l (table.1 & fig.5). High concentration of fluoride id often above 1.5 mg/l, results in severe problems over large part of India. A number of villages namely, Gobindpur, Bhul, Ghagarjhuri,Pattamputra have high concentration of fluoride in groundwater which is above 1.5 mg/l.

In Purulia-I block of Purulia district fluoride contamination is mainly by a natural process, i.e. leaching of fluorine minerals. In semi-arid climate, high temperature, low rainfall, great ground water fluctuations, rocks of precambrium metamorphic age high physical and chemical weathering process etc. leads the fluoride enrichment procss in groundwater.

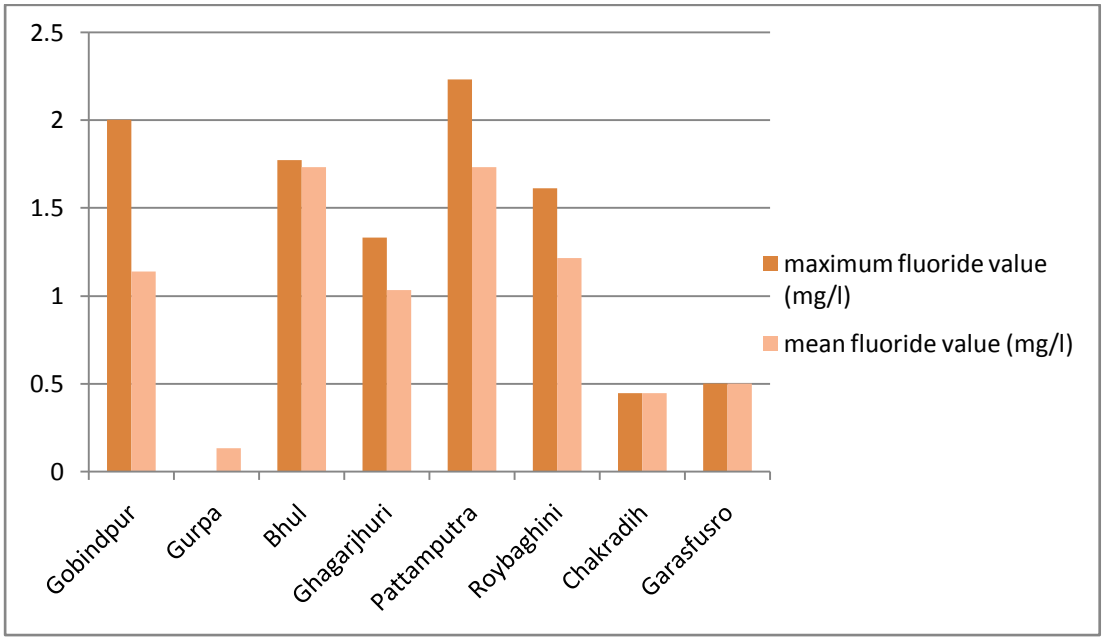


Fig .5: Village wise fluoride value of ground water samples

Source: primary survey and calculated by author

CONCLUDING REMARKS:

The groundwater of Purulia – I block is acidic in nature. There is wide range of variation in the groundwater quality parameters. Overall quality is found unsatisfactory for drinking purposes without proper treatment in most of the villages of the block.In many villages of Purulia –I block groundwater found to be contaminated by fluoride and iron contents. The excess fluoride, iron concentration in groundwater may occurs due to geological formation of the Purulia –I as well as Purulia district. Weathering of hard rocks like granite, gneiss etc. and high groundwater fluctuations are may be responsible for the contamination process. The poor people of these villages where fluoride and iron contamination occurs, are suffer from water related diseases like dental and skeletal fluorosis.

ACKNOWLEDGEMENT:

The author would like to extend his heartiest gratitude to Prof. S.C. Mukhopadhyay, former Head, Department Of Geography, Calcutta University, for his guidance and supervision and

encouragement.The author expresses his sincerest thanks to chemist of water testing Laboratory, Sister Nivedita Oldage Home, Purulia.

REFERENCES:

1. BIS (1991) Bureau of Indian Standards, Drinking water specification (first revision) IS 10500.
2. BIS (2003) drinking water specifications, IS10500. Bureau of Indian Standards, New Delhi.
3. Chakrabarti S. And Bhattacharya H.N. (2013), Inferring the Hydro-Chemistry of Fluoride Contamination In Bankura District, west Bengal: A Case Study, Journal Geological Society Of India, vol.82, pp. 379-391.
4. Ramesh K.and Soorya V. (2012) Fluoride Contamination in Drinking Water in Palcode Region, Tamil Nadu, International Journal of Research in Chemistry and Envionment, Vol.2 Issue 1, pp.116 -123.
5. Saha J. (2012),Fluoride Contamination of Groundwater in Purulia district, West Bengal,India, Indian Journal of Landscape Systems and Ecological Studies, vol.35, No.2, pp.136.
6. Sing S. (2009), Environmental Pollution, Environmental Geography,Chapter.21.6, pp.485
7. WHO (2006) Guidelines for drinking water quality, third edition, incorporating first and second addenda.
8. Quality of Groundwaterhttp://www.lenntech.com/groundwater/iron.htm#ixzz3ehcpyzW2