

## Physico-Chemical Characterization of Tube-Well Water at Hura, Purulia, West Bengal (India)

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**Abstract** People of Purulia district in West Bengal (India) suffer from severe water scarcity. Extreme situation generally arises in summer season when ground water level decreased down and people endure from lack of drinking water. This circumstance will be harsher if this valuable resource becomes contaminated anyway. Keeping in mind this condition, recent survey was undertaken to examine the physico-chemical qualities of drinking water of a part of Hura of Purulia. Quantitative characterization of drinking water samples collected from five different tube-wells of Hura, Purulia illustrated that all the tube-well water contains hardness far standard limit provided by WHO, BIS and ICMR except the water collected from Hospital Area tube-well. TSS in all five tube-well water was recorded as increased level than that of desirable limit. Undesirable concentration of iron was observed only in Hospital Road tube-well water and Coliform bacteria were also found in the water of Hospital Road.

**Keywords** Drinking water quality, Water hardness, TSS, Tube well water, Water iron.

### Introduction

Blemish of water especially drinking water contamination is a global problem in recent days. Water is

indispensable for sustaining life on earth, but now-a-days major sorts of fresh water is getting infected with different types of pollutants. Impurities like heavy metals, organic and inorganic chemicals, disease causing pathogens, Arsenic, Fluoride, Nitrate are continuously enter in to the water system and are causing redundant modification of the quality of water. Human is often not getting least amount of fresh water. The mentioned pollutants often construct serious human health problems. Keeping these incidences in my mind, I undertook a study to observed the drinking water quality of Hura of Purulia. It is well known that Purulia district is in the water paucity sector. People of this district are the worst target of water scarcity ; this trouble persists throughout the year and becomes severe during summer. The situation will surely be more critical if this diminutive amount also becomes contaminated or polluted, especially the drinking water, as we know life without water is simply impossible. Tube-well water broadly used in the villages of Purulia district as source of drinking water. A tube-well is a small diameter set up well fitted with a cast iron suction hand pump (Briscoe 1978). These tube wells are usually installed at various depths, depending upon the accessibility and level of ground water. During the possession of my investigation, I had estimated and observed the physico-chemical quality of water collected from tube-wells of Hura of Purulia (WB). Liu et al. (2003) reported high level of salinity and Arsenic in the water samples collected from well of coastal black foot diseases area of Yun-Lin, Taiwan. Agusa et al. (2006) mentioned that the residents of Gia Lam and Thanh Tri district of Hanoi, Vietnam were exposed to As, Mn and Ba from ground water

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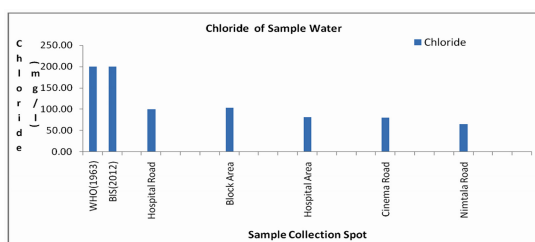


Fig. 1. Graph of chloride.

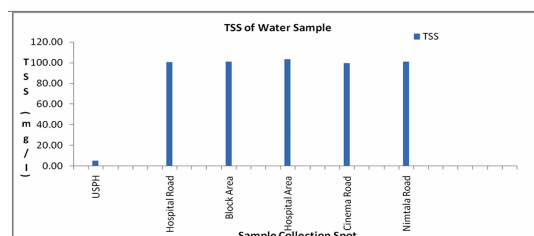


Fig. 2. Graph of fluoride.

in the Red River Delta.

## Materials and Methods

Representative water samples were collected from five tube-wells of Hura in the month of November, 2016. People extensively use water from these tube-wells for drinking purpose. The tube-wells were at Hospital Road, Block Area, Hospital Area, Cinema Road and Nimtala Road. Hura is located in Purulia

District of West Bengal and it is 27 km far towards East from Purulia Town. It is in 167 meters above sea level. Latitude and Longitude of Hura are 23°18'0.00'' N and 86°39'0.00'' E respectively. Three successive water samples were collected from each tube-well. Water samples were stored separately into clean plastic bottles. Before collection, bottles were rinsed with the respective sample water. After collection, bottles were brought into laboratory and

Table 1. Analytical results of water parameters [\*Unit-(mg/l)].

Sample collection point ↓	Result type ↓	Chloride*	Coli-form 100ml	Fluoride*	Hardness*	Iron*	TDS*	TSS*	pH
Hospital Road	Mean±SD	99.97 ±0.15	12±1	0.29 ± 0.01	761.67 ± 1.53	0.36 ± 0.01	189.67 ± 1.53	100.33 ± 0.58	7.17 ± 0.21
	Min	99.70	11	0.28	760	0.35	188	100	7.00
	Max	100.00	13	0.30	763	0.37	191	101	7.40
	Range	0.30	2	0.02	3	0.02	3	1	0.40
Block Area	Mean±SD	103.23 ± 0.02	–	0.28 ± 0.01	740.33 ± 1.53	0.01 ± 0.01	132.33 ± 8.74	100.667 ± 2.082	7.33 ± 0.15
	Min	103.21	–	0.27	739	0.00	125	99	7.2
	Max	103.25	–	0.29	742	0.02	142	103	7.5
	Range	0.04	–	0.02	3	0.02	17	4	0.3
Hospital Area	Mean±SD	81.39 ± 0.01	–	0.25 ± 0.02	279.67 ± 1.52	–	140.00 ± 5.00	103.33 ± 2.08	7.60 ± 0.20
	Min	81.38	–	0.25	2.78	–	135	101	7.40
	Max	81.41	–	0.27	281	–	145	105	7.80
	Range	0.02	–	0.03	3	–	10	4	0.40
Cinema Road	Mean±SD	80.30 ± 0.02	–	0.28 ± 0.02	351.67 ± 1.52	0.01 ± 0.01	135.00 ± 3.00	99.67 ± 2.08	7.47 ± 0.15
	Min	80.29	–	0.26	350	0.00	132	98	7.30
	Max	80.32	–	0.31	353	0.01	138	102	7.60
	Range	0.03	–	0.04	3	0.01	6	4	0.30
Nimtala Road	Mean±SD	65.51 ± 0.01	–	0.17 ± 0.01	380.00 ± 1.00	0.01 ± 0.01	120.00 ± 4.00	100.67 ± 2.08	7.37 ± 0.15
	Min	65.50	–	0.16	379	0.00	116	99	7.20
	Max	65.52	–	0.18	381	0.02	124	103	7.50
	Range	0.02	–	0.02	2	0.02	8	4	0.30

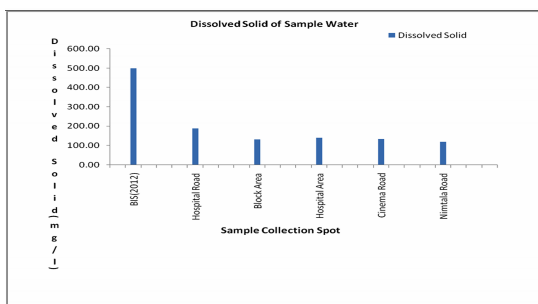


Fig. 3. Graph of hardness.

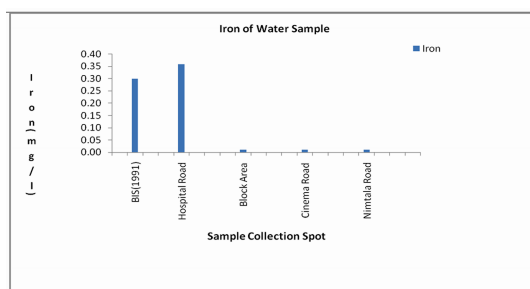


Fig. 5. Graph of TDS.

pH was immediately measured (Clesceri et al. 1998). Then taking required portion of sample water TDS, TSS, Hardness, Chloride, Iron were measured in the laboratory following criterion methods and MPN, fluoride were estimated in the laboratory of P.H.E., Department of Purulia.

**Results and Discussion**

Mean analytical results of water parameters including standard deviation are represented in the Table 1 and then these results are compared with the standard values prescribed by WHO (Godghate et al. 2013) BIS, ICMR and USPH. From Table 1, it is observed that drinking water samples collected from Block Area tube-well have highest level of chloride in comparison to other four and it is  $103.23 \pm 0.02$  mg/l and minimum chloride concentration was found in water samples collected from Nimtala Road tube-well. The concentration of chloride in water samples collected from all five tube-wells were in the enviable range (Fig. 1). Coliform was found only in the water of Hospital Road area but according to the guideline provided by BIS, Coliform bacteria should not be detected in any 100

ml sample. The presence of Coliform bacteria in water sample collected from Hospital Road indicates that the tube-well water any how became contaminated with fecal matter and intake of this water may trigger diseases among people. Analytical results confirmed that all tube-well water carries the desirable load of fluoride (Fig. 2). Hardness was also maximum in Hospital Road tube-well water and lowest hardness was found in Hospital Area tube-well water. As per the guideline provided by BIS (IS: 10500–2012), the hardness in all sample water was higher than the desirable limit, apart from the case of Hospital Area (Fig. 3). Water of Cinema Road and Nimtala Road were reasonably hard whereas Hospital Road and Block Area tube-well water were very hard (Das 2010). Regular consumption of water containing hardness beyond limit may pose serious health hazards. As per ICMR (1975) guideline, higher amount of hardness cause gastro-intestinal irritation. Besides Jain et al. (1997) also reported about problems caused due to ingestion of hard water. Iron concentration also exceeds the desirable limit in the water sample from Hospital Road tube-well (Fig. 4). Water with high iron level comparing to the desirable level has a metallic

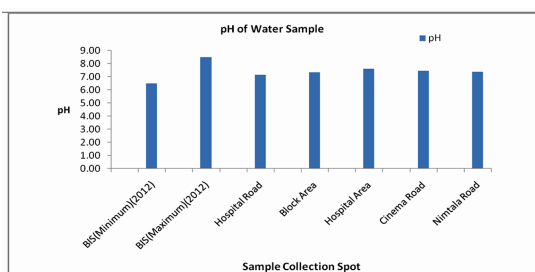


Fig. 4. Graph of iron.

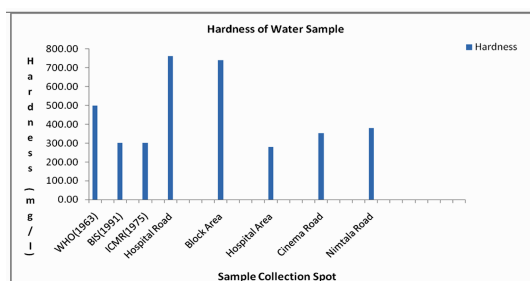


Fig. 6. Graph of TSS.

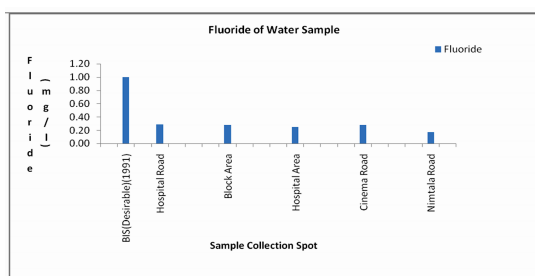


Fig. 7. Graph of pH.

taste, it causes the problem of constipation, hair fall. When iron exists along with certain kind of bacteria, a smelly bio-film can be formed—reddish brown or yellow slime will be formed producing offensive smell. According to the data given in the Table 1, Hospital Road sampling point showed maximum unit of TDS in comparison to other four tube-well water; however the TDS level in all the five tube-well water were within the desirable range (Fig. 5). TSS values were also around 100 mg/l in all the tube-well water and the concentration was excess (Fig. 6) than the desirable amount given by USPH standards (De 2001). Maximum TSS value were experienced in the water samples collected from both Block Area and Nimtala Road tube-well whereas water from Cinema Road tube-well indicated lowest presence of TSS among the five tube-well water. Enhancement of suspended solid level in drinking water may responsible for health impacts among human. pH level in the drinking water samples were recorded within the safe limit (Fig. 7). Coliform bacteria were also detected in the water of Hospital Road. The results and discussions suggest to follow proper safety measures before consumption of water from the said tube-well because of high level of hardness, TSS, iron as well as Coliform bacteria. These Coliform bacteria may increase diseases among the human society based on those tube-wells for drinking water. Regular taking of or bathing with hard water increase risk of cardio-vascular disease, high

blood pressure, risk of reproductive failure, growth retardation among children, increases risk of gastric, colon, ovarian, esophageal cancer, skin irritation, eczema, dry skin, hard or bumpy patches on skin. Enhancement of suspended solid level in drinking water may responsible for health impacts among human. Before taking or using water collected from the said sources people of that area have to follow suitable treatments to remove the excess burden of hardness, TSS, iron and Coliform from drinking water to overcome ill health effects.

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