

Ground water quality assessment of different educational institutions in Rajshahi city corporation, Bangladesh

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Abstract: A study to assess the quality of drinking water is very essential for knowing whether the various impurities of water should be within allowable limit. Ground water samples from different educational institutions situated in Rajshahi City Corporation have been analyzed in order to check its quality especially for drinking purposes. The various important qualities of water such as pH, iron, manganese, chlorides, arsenic, total solids, dissolved solids, suspended solids, total acidity, total alkalinity, BOD, COD, DO, color, turbidity, hardness, CO₂ of water, fecal and total coliform were tested. The values of all parameters except pH and total acidity in water samples collected from all locations were found satisfactory. In supply water of these educational institutions contain high concentration of DO, COD, total and fecal coliform, electric conductivity. These qualities of water cause harmful effect on human health. Water qualities of Rajshahi Polytechnique Institute, Rajshahi College and Rajshahi Govt. Degree College were observed satisfactory compared to other institutions.

Keywords: Educational Institutions, Ground Water, Rajshahi City Corporation, Surface Water, Water Quality, BOD, COD

1. Introduction

Water is the most remarkable commodity. It is absolute essential to all lives both animal and plants. It is difficult to imagine any environment without water. Man can live only three or four days without water. Potable and drinking water plays an important role in the development of good health condition of a nation. Water pollution is one of the major problems in Bangladesh. Polluted water is responsible for water borne diseases. Water obtained from different sources is associated with a large number of impurities [1]. The presence of heavy metals also plays toxic roles to human health. Many of them exert cumulative effects. The impurities present in natural water are namely, living impurities, organic impurities and water borne microorganism. The mineral impurities are mainly dissolved gasses and carbonates, sulfates, sulfide etc. On sodium, magnesium, iron etc. Inadequate quantities of water for the maintenance of personal hygiene and environmental sanitation have been shown to be the major contributions factors in the spread of epidemic diseases. The World Health Organization (WHO) states that water containing many types of impurities from various sources causes different types of water borne diseases and each year

millions of people suffer from such diseases due to unsafe drinking water supplies. The aim of the present study was to assess the quality of drinking water uplifted from hand tube wells, shallow tube wells and deep tube wells in different educational institution in Rajshahi City Corporation area.

1.1. Study Area

Rajshahi, the fourth largest city of Bangladesh, lies between 24°21' and 24°25' North latitudes and between 88°32' and 88°40' East longitudes, with an area of about 96.68 sq. km. It is surrounded by two major outfall rivers, namely the Padma and the Barnai. The Padma is situated at the southern border and the Barnai is about 6 km away from the northern edge of the city.

2. Methodology

2.1. Water Sample Collection

To investigate the water quality of different educational institutions samples were collected from selected locations where location A=Rajshahi University (RU), B=Rajshahi University of Engineering & Technology (RUET),

C=Rajshahi Medical College (RMC), D=Rajshahi Govt. Degree College (RGDC), E=Rajshahi Polytechnique Institute (RPI) and F=Rajshahi college (RC). The collected samples were tested in Public Health Engineering Lab, RUET by standard method and analyzed them subsequently.

2.2. Water Sample Technique

22 ground water samples of 2 litres each from the selected locations throughout the area were collected in dry clean

plastic containers. Before collecting the ground water samples, the wells were pumped for 4/5 minutes to obtain the fresh ground water and then after rinsing the containers with pumped fresh water, the containers were filled up. Aeration was avoided as far as possible during sampling. Samples collected from the study area were carefully transported to the laboratory and preserved at a cool place in the dark.

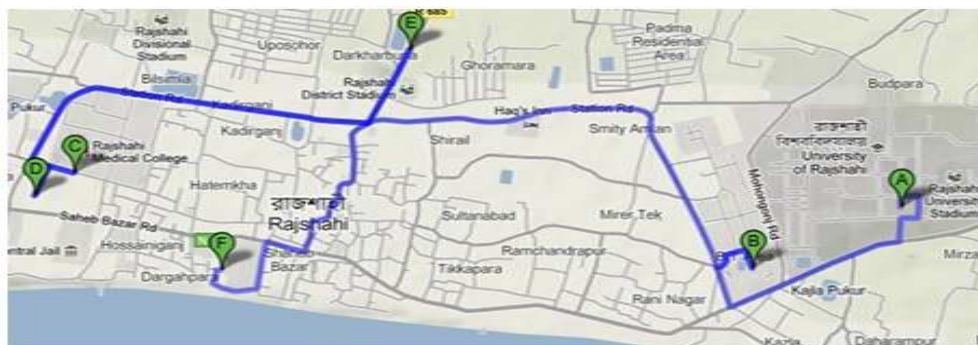


Figure 1. Location map of the study area.

Table 1. Sample Location.

Sl. No.	Sample Name	Location
1	S1	Shahid Abdul Hamid Hall, RUET
2	S2	Shahid Shahidul Islam Hall, RUET
3	S3	Tin Shed Hall, RUET
4	S4	Selim Hall, RUET
5	S5	Shahid Ziaur Rahman Hall, RUET
6	S6	Sheikh Hasina Hall, RUET
7	S7	Main Tank, RUET
8	S8	Sere Bangla Hall, RU
9	S9	Bangabandhu Hall, RU
10	S10	Habibur Rahman Hall, RU
11	S11	Mother Bosk's Hall, RU
12	S12	Sohraurdi Hall, RU
13	S13	Taposhi Rabeya Hall, RU
14	S14	Begum Khaleda Zia Hall, RU
15	S15	Main tank, RU
16	S16	Palin Ladies Hall, RMC
17	S17	Pintu Hall, RMC
18	S18	Main tank, RMC
19	S19	Muslim Hall, RC
20	S20	Ladies Hall, RC
21	S21	Samsuddin Hall, RGDC
22	S22	Ladies hall, RPI

2.3. Laboratory Experiment

After collecting, the samples were brought Public Health Engineering Lab, RUET and the concentration of Fe was determined by calorimetric method using dilute hydrochloric acid, potassium permanganate solution, potassium thiocyanate solution and standard iron solution. The pH, electrical conductivity, BOD, COD and DO were measured by a digital meter (Hach Sension™ 156 Multiparameter meter). Total alkalinity and hardness was determined by titration with a standard 0.02 N sulfuric acid solutions and methyl orange as indicator. The concentration of Mn was determined by per sulfate method using standard

manganese solution and ammonium per sulfate. Chloride was determined by titrimetric method using 0.05M AgNO₃ solution in presence of potassium chromate (10%) indicator. Total Acidity and CO₂ was determined by titrimetric method using standard 0.02 N NaOH and phenolphthalein as indicator. The concentration of as was determined by using NIPSOM Kit box is a modified kit of ANN. The color of water was determined by using Hellige color Comparator (Levibond 2000). The turbidity of water was measured by TN-100/T-100 Turbidity Meter.

3. Results and Discussions

The ground water quality was assessed by analysis of some particular parameters and compared with Bangladesh and WHO standard standards [4,5].

It was observed the pH varies from 8.2-8.66 and pH of most samples is within limit. Only some places beyond permissible limit. TS varies from 9.4-565.4 mg/l, TDS varies from 1.01-528 mg/l and TSS varies from 7.2-9.7 mg/l. Most of the samples contain TS and TDS beyond both Bangladesh and WHO standard, but TSS in most samples within these standard limit.

It was observed that color varies from 0-4.8 pt-co unit and electric conductivity varies from 210-900 µs/cm. Both color and electric conductivity are within standard limit. The concentration of iron varies from 0-0.7 mg/l and within Bangladesh standard in the entire sample.

The concentration of dissolved CO₂ varies from 23-240 mg/l and chloride varies from 150-278 mg/l. The total alkalinity, arsenic and manganese are nil in all location. The hardness varies from 190-460 mg/l and turbidity varies from 0.5-9 NTU. The total acidity varies from 1-8 mg/l. DO varies from 0.3-19 mg/l, BOD varies from 0.1-1.5 mg/l and

COD varies from 1.2-5.7 mg/l. The fecal coliform varies from 6-11 cfu/100ml and the total coliform varies from 59-106 cfu/100ml. Total coliform and fecal coliform are excessive in water of Palin Ladies Hall and Pintu Hostel in Rajshahi Medical College.

Table 2. PH, TS, TDS, TSS, color and EC of sample water.

Sample Name	pH	TS (mg/l)	TDS (mg/l)	TSS (mg/l)	Color (pt-co unit)	EC (μs/cm)
S1	8.5	537.6	528	9.6	4.5	399
S2	8.62	463.6	454.4	9.2	3.8	230
S3	8.4	383.6	377.3	9.3	3.8	250
S4	8.52	403.2	393.6	9.4	4.5	280
S5	8.32	565.4	555.8	9.6	2.8	210
S6	8.35	408	398.3	9.7	4.8	495
S7	8.52	483	473.5	9.5	3.5	467
S8	8.5	409.4	401.3	8.1	-	789
S9	8.62	419	409.7	8.62	-	876
S10	8.45	215.4	206.4	9	-	498
S11	8.52	400	390.4	9.2	-	789
S12	8.32	360	351.2	8.8	-	790
S13	8.35	360	351.4	8.6	-	704
S14	8.52	457.8	450.1	8.7	-	756
S15	8.2	332.4	324.4	8	-	876
S16	8.66	259.6	252	7.6	-	789
S17	8.49	367.6	360.1	7.5	-	698
S18	8.49	253.6	246.4	7.2	-	790
S19	8.24	217.2	208.9	8.6	-	900
S20	8.24	537.6	528	8.54	-	400
S21	8.52	71.2	62.9	8.3	-	456
S22	8.24	9.4	1.01	8.4	-	867
Bangladesh Standard	6.5-8.5	10	1000	500	15	1200
WHO Standard	6.5-8.5	-	1000	80	15	1200

Table 3. Concentration of arsenic, iron, manganese, chloride and dissolved CO₂ in sample water.

Sample Name	As (mg/l)	Fe (mg/l)	Mn (mg/l)	Chloride (mg/l)	Dissolved CO ₂ (mg/l)
S1	-	0.3	-	150	28
S2	-	-	-	165	32
S3	-	0.4	-	171	23
S4	-	-	-	189	35
S5	-	0.3	-	185	32
S6	-	0.6	-	180	31
S7	-	0.3	-	170	32
S8	-	0.1	-	210	28
S9	-	0.3	-	220	32
S10	-	-	-	205	23
S11	-	0.4	-	208	35
S12	-	0.7	-	230	32
S13	-	0.2	-	230	28
S14	-	0.3	-	204	40
S15	-	-	-	206	40
S16	-	-	-	160	240
S17	-	-	-	156	220
S18	-	-	-	178	210
S19	-	-	-	212	87
S20	-	-	-	218	88
S21	-	-	-	230	18
S22	-	-	-	278	18
Bangladesh Standard	0.05	0.3-1.0	0.1	150-600	25-50
WHO Standard	0.01	0.3	0.1	25	30

Table 4. Hardness, total alkalinity, total acidity and turbidity of sample water.

Sample Name	Hardness (mg/l)	Total Alkalinity (mg/l)	Total Acidity (mg/l)	Turbidity (NTU)
S1	270	-	3	6.5
S2	273	-	6	8.5
S3	271	-	3	9
S4	280	-	4	7.5
S5	260	-	1	6.5
S6	268	-	5	7
S7	270	-	2	9
S8	200	-	3	2
S9	202	-	2	3.5
S10	198	-	3	1.3
S11	212	-	-	0.7
S12	212	-	1	0.9
S13	208	-	2	0.5
S14	212	-	4	2.6
S15	204	-	-	1.5
S16	305	-	5	6.5
S17	408	-	8	8.6
S18	460	-	3	8.8
S19	205	-	5	4
S20	240	-	8	2
S21	190	-	3	1.5
S22	230	-	1	0.9
Bangladesh Standard	200-500	-	-	10
WHO Standard	200	-	-	5

Table 5. DO, BOD, COD, fecal coliform and total coliform of sample water.

Sample Name	DO (mg/l)	BOD (mg/l)	COD (mg/l)	Fecal Coliform (cfu/100ml)	Total Coliform (cfu/100ml)
S1	0.5	0.2	3.4	7	70
S2	0.7	0.1	5.7	9	67
S3	0.4	0.4	2.1	15	89
S4	0.8	0.1	2.3	10	65
S5	0.3	0.3	4.8	9	78
S6	0.8	0.3	2.3	11	59
S7	0.5	0.7	2.1	8	87
S8	0.5	0.3	3.5	7	60
S9	1.2	0.5	2.5	9	65
S10	0.6	0.8	5.6	11	67
S11	0.8	0.5	2.9	8	75
S12	0.2	0.2	3.1	9	71
S13	0.7	0.1	4.8	6	72
S14	0.7	0.8	2.7	7	67
S15	0.1	1.5	1.2	11	65
S16	0.1	0.2	2.1	10	87
S17	0.2	0.3	1.2	12	106
S18	0.6	0.1	1.6	13	112
S19	0.5	0.4	1.4	8	95
S20	0.8	0.8	1.8	9	69
S21	1.5	0.3	3.6	7	80
S22	1.9	0.6	3.8	11	89
Bangladesh Standard	6	0.2	4	0	0
WHO Standard	-	-	-	-	-

4. Conclusion

It may be concluded from the study that the quality of ground water in these educational institutions is in general good for utilization in drinking, agriculture, industrial and domestic purposes. However a few water samples are found unsuitable especially due to high contents of total coliform and fecal coliform. The present status should not let continue unconcerned for the situation may get critical in near future. Measures should be taken to regulate the water quality determining parameters as well as to minimize total coliform and fecal coliform contents at best in drinking water. Government and Public Health Departments may play a vital role in these educational institutions.

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