

PHYSICO-CHEMICAL ANALYSIS OF DRINKING WATER IN TIHU TOWN WITH SPECIAL REFERENCE TO TUBE-WELL AND WATER-PURIFIER: A COMPARATIVE STUDY

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Abstract

Water from Tube-well and Water-purifier were collected from every wards of Tihu town, Nalbari District, Assam. Physico-chemical properties of every collected sample were analyzed and a comparison was made between tube-well water and purifier water. It has been found that, purifier water comprises all the physico-chemical properties within its permissible level according to WHO Standards than tube-well water. Physico-chemical analysis of different water parameters from tube-well reveal above, near or within permissible level, hence indicate hard and less potable drinking water. Various properties like TDS, Fluoride, Iron etc. were measured by following standard protocols.

Index Terms: Physico-chemical properties, Tihu Town, Potable water.

Introduction

Water is crucial for survival of each and every organism in the world. Water covers almost 75% of the earth. Almost 97% of the earth's water is saline water in oceans and rest 3% is fresh water. But only 1% of the water on earth is fresh water that human and other organisms can actually use (WHO, 2004) ^[1]. Drinking water is inevitable for human. As a major constituent in cell, water has significant role in cellular make-up and various metabolic, physiological and cellular processes in human. Globally 1.69% of water is groundwater which is used by human in different kinds of activities. According to USGS, one-third of the world's population lives in "Water-stressed" countries which was defined as a country's ratio of water consumption to water availability. The quality of water is a vital concern for mankind, since it is directly linked with human welfare. It is matter of history that fiscal pollution of drinking water caused water born diseases which wiped out entire population of a particular area or region. At present, the menace of water born diseases and epidemics still booms large on the horizons of developing countries. Polluted water is the culprit in such cases (Nollet, 2000) ^[2]. For centuries, human have been disposing off waste products by burning, placing them in streams, storing them on ground or putting them on ground. Human induced influences on surface water quality reflect not only waste discharge directly into a stream, but also include contaminated surface runoff (Khalid *et al.*, 2011) ^[3]. Ground water contamination is due to the storage of waste minerals in excavations, such as pits or mines. Water soluble substances that are disrupted, spilled, spread or stored on the land surface may be filled eventually. One cause of water contamination is the disposal of waste materials directly on the land surface. Example includes manure, sludge, garbage and industrial wastes. The waste may occur as individual mounds, or it may be spread over the land. If the waste mineral contains soluble substances, they may infiltrate similar problems that occur in the vicinity of various types of stockpiles (Jaini, 2003) ^[4]. WHO reports that, approximately 36% of urban and 65% of rural Indian was without access to safe drinking water (Akoto & Adiyiah, 2007) ^[5]. Human and ecological use of ground water depends upon ambient water quality. Human alteration of the landscape has an extensive influence on watershed hydrology (Gurunathan, 2006) ^[6]. Ground water plays a vital role in human life. The consequences of urbanization and industrialization lead to spoil the water for agricultural purposes and also for human consumption. During the last decade, this is observed that ground water get polluted drastically

because of increased human activities. Consequently number of cases of water borne diseases has been seen which create health hazards, often directed towards lethality. An understanding of water chemistry is the bases of the knowledge of the multidimensional aspect of aquatic environmental chemistry which involves the source, composition, reactions and transportation of water (Nagamani, 2015) [7]. The quality of water is of vital concern for the mankind, since it is directly linked with human welfare. That is why, various methods are adopted to use and consume water in day-to-day life of human. Modern era comes with plenty of methods, techniques and aids for the pure and safe drinking water which are proved to be boon for human and different health related issues. But the spreading out of these modern aids and techniques is till restricted and confined among a small mass of human. As a country like India, the widespread of these techniques is very much needful which will direct human towards good quality drinking water. Water purifiers are most popular modern instrument which is handled easily by every person and in every household. But the use and proper knowledge regarding these water purifiers are still lacking in both rural and urban societies of Assam as well as India and people still rely on their traditional system of water purification or use water directly from the drinking water sources. The water purifiers are designed in such a way that they will remove the various contaminants from the water. They are designed with cutting-edge technologies that target specific contaminants present in different drinking water sources.

Methodology

- (A) **Area of Study:** Study was done in the Tihu town. The town is located $26^{\circ}47'49''\text{N}$ to $91^{\circ}26'89''\text{E}$ in the Nalbari district of Assam, India. The town runs by a town committee and has 4 wards constituting approximately 4021 households (according to 2011 census).
- (B) **Collection of Water:** Drinking water from tube-wells and water-purifiers of different households were collected randomly from all the 4 wards of Tihu Town (Ward No. 01, 02, 03 and 04) in the month of May, 2018. Water was collected in polythene bottles during morning hours in between 9AM-11 AM. Immediately after collection, they were marked well and taken to laboratory of Zoology Department, Tihu College, Tihu for necessary experimentation. A total of 80 samples were collected from all the wards of the town. Among the 80 samples, 40 samples contain tube-well water and rest 40 samples contain water from water-purifier.
- (C) **Analysis of different parameters of water:** In the laboratory, various physico-chemical parameters of water were measured. pH was measured using pH meter, temperature was measured by using thermometer. TDS values were measured by using TDS meter. Whereas, other parameters (Iron, Chloride, Fluoride and Nitrate) were estimated by using standard laboratory methods. In this study, analysis of water quality was done in terms of physico-chemical methods. (Trivedy and Goel, 1986, APHA, 1985) [8][9].

Results

Table1: WHO Standards for various chemical parameters/properties in water [10]

serial number	chemical properties	who standards
01	Iron	1.0 mg/L
02	Chloride	200 mg/L
03	Fluoride	1.5 mg/L
04	Nitrate	45 mg/L
05	TDS	500 PPM

Table 2(A): physico-chemical properties of tube-well water from ward no.01

ward no.	source of water	samples	ph	temperature (°c)	tds (ppm)	iron (mg/l)	chloride (mg/l)	fluoride (mg/l)	nitrate (mg/l)
01	Tube well	01	6.8	28	58	0.75	115	0.30	10
		02	6.8	28	60	0.69	120	0.32	12
		03	6.8	27	70	0.70	123	0.38	20
		04	6.8	27	72	0.85	128	0.34	23
		05	7.1	28	72	0.77	127	0.30	23
		06	7.0	28	66	0.89	123	0.30	14
		07	6.9	28	62	0.87	120	0.32	12
		08	6.9	27	58	0.75	115	0.25	10
		09	7.0	29	75	0.72	132	0.32	28
		10	7.0	28	66	0.78	122	0.35	15

Table 2(B): physico-chemical properties of water-purifier water from ward no. 01

ward no.	source of water	samples	ph	temperature (°c)	tds (ppm)	iron (mg/l)	chloride (mg/l)	fluoride (mg/l)	nitrate (mg/l)
01	Water purifier	01	7.0	28	30	0.18	84	0.04	12
		02	7.01	28	40	0.26	89	0.08	17
		03	7.0	28	35	0.25	86	0.02	14
		04	7.0	28	38	0.28	89	0.06	15
		05	6.8	28	42	0.45	95	0.04	18
		06	6.9	29	40	0.28	90	0.08	16
		07	6.8	29	32	0.22	85	0.10	13
		08	7.2	28	38	0.26	90	0.12	15
		09	7.2	28	42	0.44	97	0.15	18
		10	6.8	28	40	0.28	90	0.20	15

Table 3(A): physico-chemical properties of tube-well water from ward no. 02

ward no.	source of water	samples	ph	temperature (°c)	tds (ppm)	iron (mg/l)	chloride (mg/l)	fluoride (mg/l)	nitrate (mg/l)
02	Tube well	01	7.2	28	145	1.05	139	0.45	35
		02	7.2	28	178	1.12	186	0.48	38
		03	7.2	28	100	0.98	130	0.50	20
		04	6.8	28	122	1.0	134	0.55	25
		05	6.8	28	145	1.08	140	0.56	37
		06	6.8	28	120	1.02	130	0.52	24
		07	6.8	27	134	1.10	138	0.64	30
		08	7.0	27	105	1.01	125	0.55	15
		09	7.2	27	110	1.04	132	0.42	22
		10	7.0	28	186	1.20	190	0.45	40

Table 3(B): Physico-chemical properties of water-purifier water from ward no. 02

Ward No.	Source of water	Samples	pH	Temperature (°C)	TDS (PPM)	Iron (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)
02	Water purifier	01	7.1	27	45	0.55	68	0.12	18
		02	7.0	27	50	0.56	72	0.10	20
		03	6.9	27	55	0.60	75	0.16	22
		04	6.9	27	68	0.70	82	0.16	28
		05	6.9	28	45	0.52	67	0.18	18
		06	7.0	28	60	0.68	78	0.25	25
		07	7.0	28	54	0.58	75	0.20	22
		08	6.8	28	52	0.54	72	0.30	20
		09	6.7	29	55	0.58	76	0.20	22
		10	6.9	29	80	0.78	87	0.18	30

Table 4(A): Physico-chemical properties of tube-well water from ward no. 03

Ward No.	Source of water	Samples	pH	Temperature (°C)	TDS (PPM)	Iron (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)
03	Tube well	01	6.9	28	80	0.50	95	0.35	25
		02	6.9	28	85	0.56	100	0.42	29
		03	6.9	28	80	0.48	96	0.55	26
		04	7.0	28	87	0.58	98	0.58	28
		05	7.0	28	90	0.65	105	0.68	32
		06	7.1	28	95	0.68	110	0.57	35
		07	7.2	29	89	0.77	100	0.35	32
		08	7.3	29	85	0.57	102	0.44	30
		09	7.3	29	85	0.58	102	0.65	30
		10	7.3	29	80	0.52	95	0.72	25

Table 4(B): Physico-chemical properties of water-purifier water from ward no. 03

Ward No.	Source of water	Samples	pH	Temperature (°C)	TDS (PPM)	Iron (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)
03	Water purifier	01	7.0	28	45	0.40	56	0.18	15
		02	7.0	28	48	0.42	58	0.20	18
		03	7.0	28	52	0.52	62	0.15	22
		04	7.0	28	50	0.50	60	0.20	20
		05	7.0	28	58	0.60	68	0.15	28
		06	7.1	28	68	0.65	75	0.18	38
		07	7.1	28	65	0.62	72	0.22	34
		08	7.1	28	58	0.59	68	0.35	26
		09	7.0	28	50	0.45	60	0.30	18
		10	7.0	28	48	0.40	56	0.24	16

Table 5(A): Physico-chemical properties of tube-well water from ward no. 04

Ward No.	Source of water	Samples	pH	Temperature (°C)	TDS (PPM)	Iron (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)
		01	6.8	28	186	1.20	140	0.45	35
		02	6.8	28	178	1.18	130	0.52	20
		03	6.8	28	187	1.22	140	0.46	35

04	Tube well	04	6.8	28	160	1.10	120	0.43	10
		05	6.9	29	166	1.12	125	0.64	12
		06	6.9	29	170	1.08	120	0.53	14
		07	6.9	29	175	1.08	125	0.40	15
		08	6.7	29	177	1.09	128	0.40	20
		09	7.1	29	175	1.15	125	0.84	20
		10	7.1	29	180	1.18	135	0.38	30

Table 5(B): Physico-chemical properties of water purifier water from ward no. 04

Ward No.	Source of water	Samples	pH	Temperature (°C)	TDS (PPM)	Iron (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)
04	Water purifier	01	7.1	28	80	0.24	60	0.20	07
		02	7.1	28	86	0.30	65	0.34	12
		03	7.1	28	86	0.30	65	0.35	12
		04	7.0	29	90	0.35	68	0.40	18
		05	7.0	28	85	0.30	64	0.32	10
		06	7.0	29	85	0.32	62	0.30	10
		07	7.0	28	85	0.28	63	0.30	12
		08	7.0	29	86	0.35	66	0.32	15
		09	7.1	29	80	0.22	58	0.18	08
		10	6.9	28	80	0.24	60	0.17	10

Bio-statistical Representation Physico-Chemical Properties

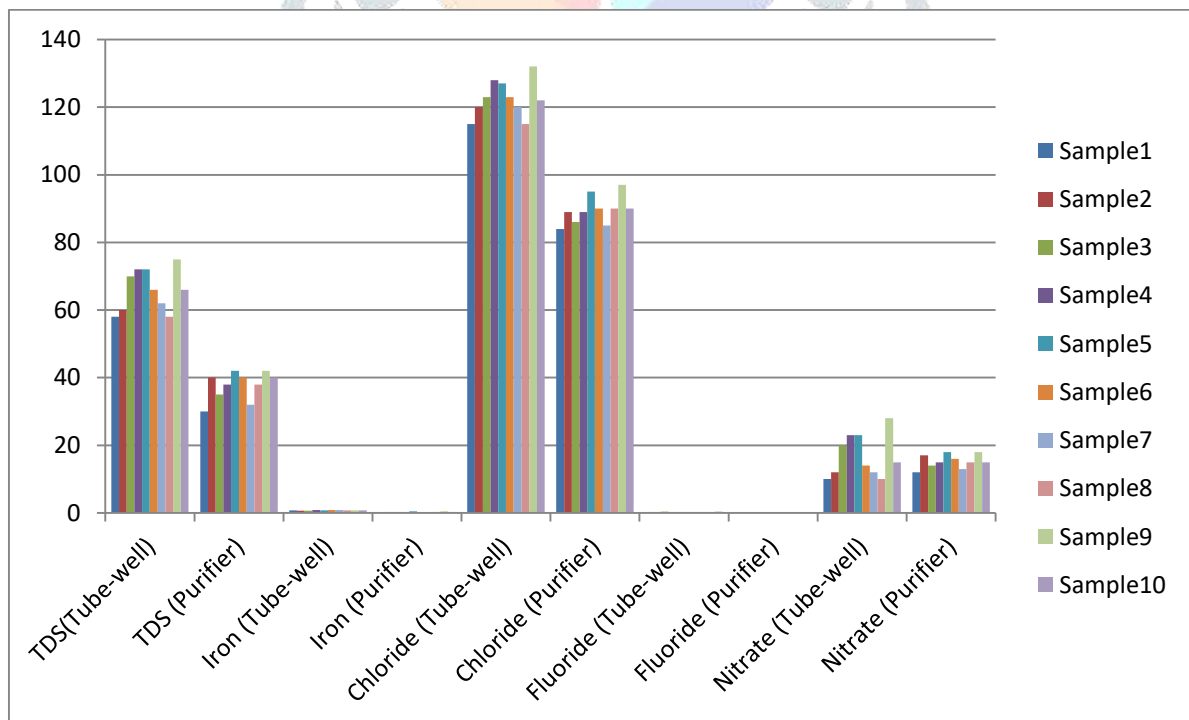


Figure1: physico-chemical properties of water samples (tube-well & purifier) from ward no.01

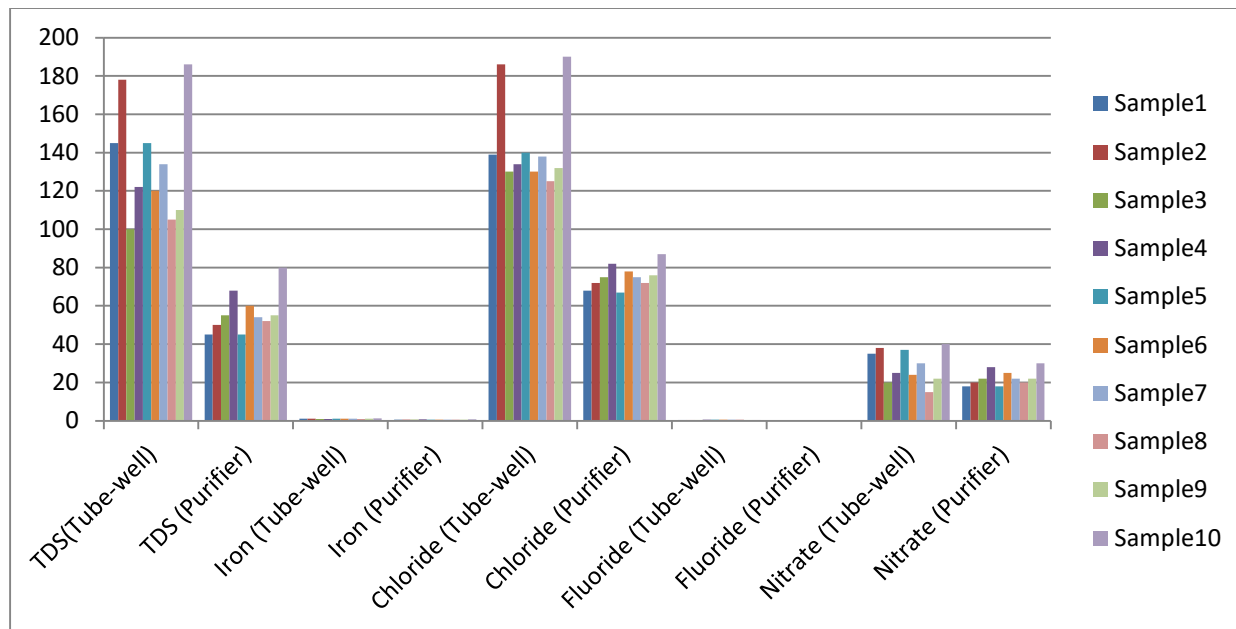


figure2: physico-chemical properties of water samples (tube-well & purifier) from ward no.02

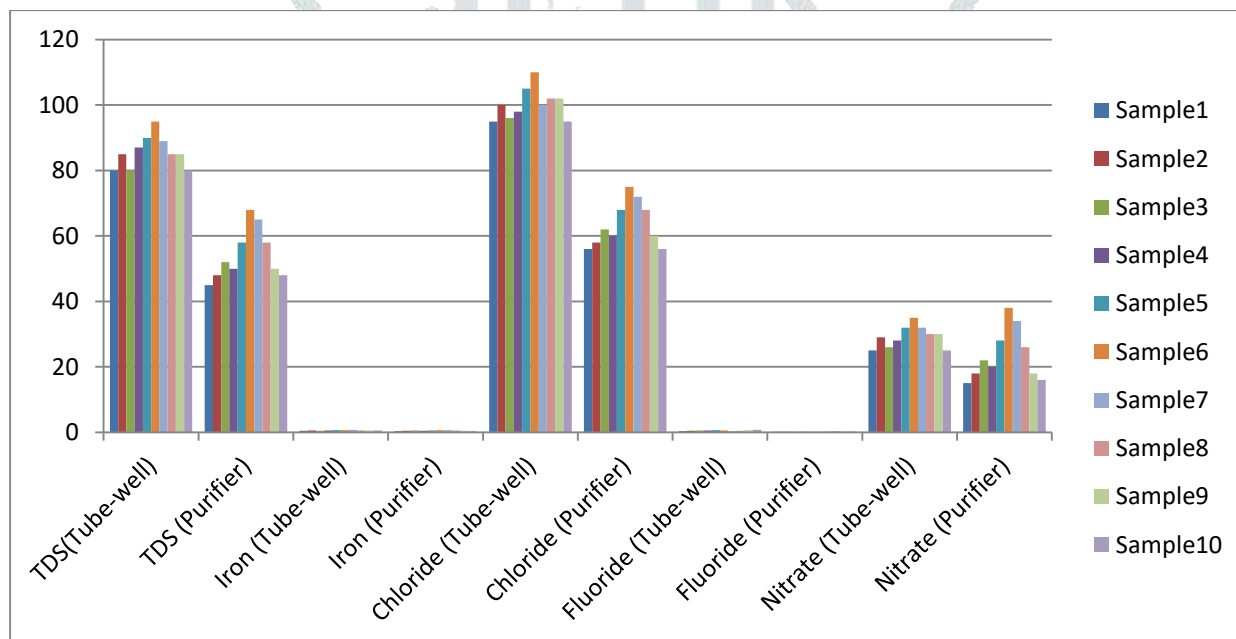


figure3: physico-chemical properties of water samples (tube-well & purifier) from ward no.03

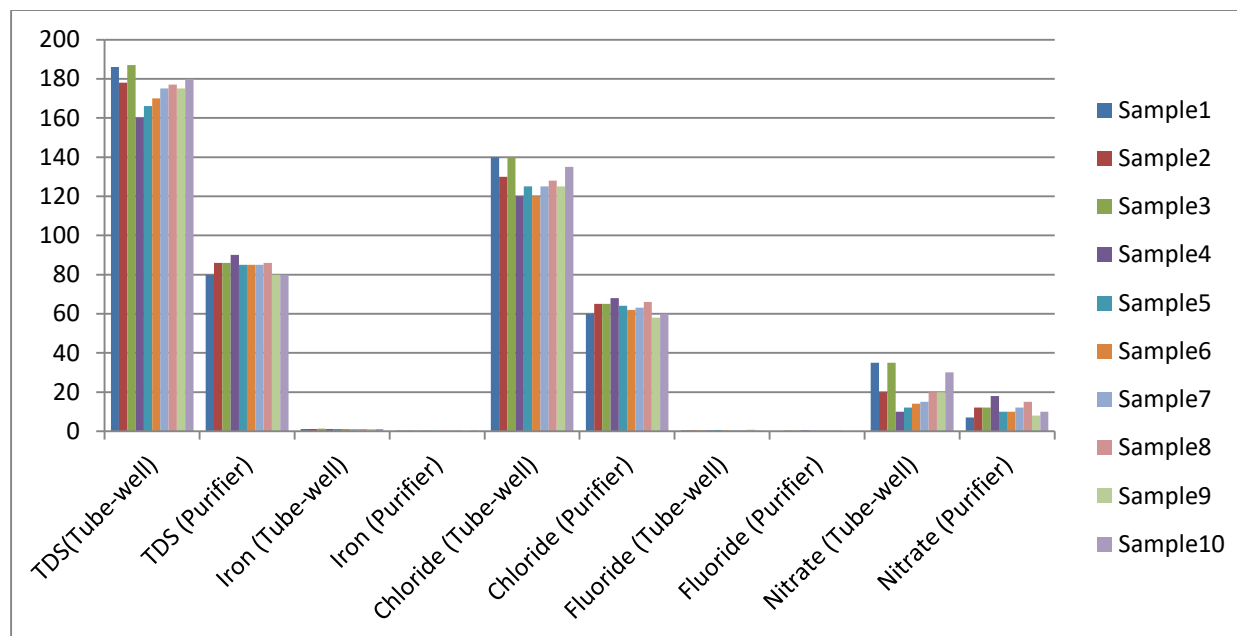


figure4: physico-chemical properties of water samples (tube-well & purifier) from ward no.04

Discussion

There is no significant change in the pH value in all the water samples. pH lies in between 6.7-7.3. Average temperature lies in between 27 °C – 29 °C. TDS, Fluoride, Chloride, Nitrate levels are within below the Standard Level according to WHO. Iron level in some cases is found to above the permissible level. Level of iron is above in the tube-well water of Ward No. 2 and 4 mainly. The level of chloride is not above the permissible level but near the permissible level. Other parameters like TDS, Nitrate and Fluoride are within permissible. In case of water samples collected from water-purifier, all the physico-chemical parameters of water are within permissible level hence is safe for drinking. Compared to this, tube-well water of all the four wards (except Ward No. 01) is hard and less potable; therefore needs suitable treatment before use. The use of this kind of water may be the cause of various water-borne diseases. The occurrence of various diseases by drinking water has been reported by Saravanakumar and Kumar in 2011 [11]. Their studies revealed occurrence of many diseases like stomach diseases, gastric troubles etc. due to drinking of less potable water.

Conclusion

Quality water is very necessary for human health and livelihood. In this present study, a comparative analysis of different physico-chemical properties of water between the tube-well and water purifier from the different households of the wards of Tihu town was made. The results from the analysis revealed that water from water purifiers are good and safe for human consumption compared to water collected from tube well. During the study it has been noticed that people are not much aware of using good quality water and most of the household uses water directly from the drinking water sources instead of using a water purifier. That is why, a proper widespread knowledge and awareness for using water purifier among households is very important. All the physico-chemical parameters of water from the water purifier are within permissible level but tube-well water of all the wards are hard except Ward No. 01. That is why, a proper treatment is very much important. However, our study is the first of its kind from this area; but it needs further investigation.

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