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Research Article

ASSESSMENT OF PHYSIOCHEMICAL PARAMETERS OF DRINKING WATER IN DELHI

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A B S T R A C T

Water is a necessary component and valuable natural resource that shapes the central constituent of biological community. It is essential for supporting all human activities hence, it's arrangement in terms of quantity and quality has becomean utmost priority. Contamination of water-sources like streams, lakes and seas influences lives and their regular habitat throughout the globe. This present study is centered on estimating the quality of drinking water in Delhi, India. This study was based onthe analysis of various parameters of drinking water such as physical and chemical. The results of drinking water samples collected from various locations were compared with the standard acceptable limits as per IS: 10500-2012 to check whether the drinking water quality follows the standard, and also to determine its suitability or not for the drinking purpose. 15 drinking water samples were collected from various areas of Central Delhi and examined for different physicochemical parameters. All samples were collected from the diverse Delhi locals. Parameters, such as, pH, Colour, Odour, Taste, Conductivity, Turbidity, Total Hardness, Calcium, Magnesium, Chloride, Nitrate, Phosphorous, etc. were conducted in these samples. As per the resultant of this study, it was concluded that pH level ranges from 6.16 to 7.89 with heavy metals having slight variations between 0.001 to 9.89 including Na, K, and Ni etc. In the study, we found maximum pH value in the Kamla Nagar region that was 7.82 and least in the Karol Bagh region that is 6.66 and both the min and max values lies in between the acceptable limit that is 6.5 to 8.5. pH of the water is the measure of the H^+ ion activity of the water system. It indicates whether the water is acidic, neutral or alkaline in nature.

INTRODUCTION

Water is an exceptional, universal substance that is a noteworthy part of every single living thing. Its tendency and properties have fascinated savants, naturalists and researchers since vestige. Water keeps on connecting with the consideration of researchers today as it remains deficiently comprehended disregarding extreme investigation over numerous years. This is principally in light of the fact that water is anomalous in huge numbers of its physical and substance properties[1].

Water, a prime common asset and valuable national resource, shapes the main constituent of biological community. Water sources might be chiefly as streams, lakes, icy masses, rain water, ground water and so on. Other than the need of water for drinking, water assets assume a key part in different areas of economy, for example, horticulture, domesticated animal's creation, ranger service, modern exercises, hydropower era, fisheries and other innovative exercises. The accessibility and nature of water either surface or ground, have been delayed because of some essential elements like expanding populace, industrialization, urbanization and so on[2].

Drinking water can be characterized as the water conveyed to the buyer that can be securely utilized for drinking, cooking, and washing. The general wellbeing perspectives are of such significance and intricacy that the Health Authority having locale in the group now surveys, examines, tests, screens, and assesses on a proceeding with premise the water provided to the group, utilizing always redesigning drinking water measures. Such water wellbeing control ensures a ceaseless supply of water kept up inside safe points of confinement. Water investigation alone is not adequate to keep up quality but rather should be joined with the occasional survey and acknowledgment of the offices included[3]. Drinking water must meet the physical, concoction, bacteriological, and radionuclide parameters when provided by an affirmed source, conveyed to a treatment and sanitization office of legitimate.

Water quality is a mind-boggling subject, which includes physical, concoction, hydrological and natural attributes of water and their unpredictable and sensitive relations. From the client's perspective, the expression "water quality" is

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characterized as "those physical, synthetic or natural attributes of water by which the client assesses the worthiness of water". For instance, for drinking water ought to be unadulterated, wholesome, and consumable. Essentially, for water system broke up solids and toxicants are vital, for open air showering pathogens are critical and water quality is controlled in like manner. Materials, paper, blending, and many different businesses utilizing water, have their particular water quality needs[4].Each of these assigned uses has distinctive characterized compound, physical and organic norms important to bolster that utilization. For instance, we expect higher measures for water we drink and swim in contrasted with that utilized as a part of farming and industry[5].

Authority of Indian Standards (BIS), has indicated drinking water quality measures in India to give safe drinking water to the general population. It is essential that drinking water sources ought to be tried routinely to know whether water is meeting the endorsed guidelines for drinking or not and, if not, then, the degree of defilement/unsuitability and the subsequent required. Aside from BIS detail for drinking water, there is one more rule for water quality, brought out by Ministry of Water Resources, Government of India in 2005. Tis is known asUniform Protocol for Water Quality Monitoring. A need has emerged to have a different uniform convention for Drinking Water Quality Monitoring in perspective of expanding danger of geogenic and anthropogenic tainting[6].

Water is a finite and irreplaceable resource that is fundamental to human well-being. It is only renewable if well managed. Today, more than 1.7 billion people live in river basins where depletion through use exceeds natural recharge, a trend that will see two-thirds of the world's population living in water-stressed countries by 2025. Water can pose a serious challenge to sustainable development but managed efficiently and equitably, water can play a key enabling role in strengthening the resilience of social, economic and environmental systems in the light of rapid and unpredictable changes[7].

India possesses vast and rich diversity of natural resources, water being one of them. It is universal solvent that has been and is being utilized by mankind since time immemorial. Of the total amount of global water, only 2.4% is dispersed on the main land of which only a small portion can be utilized as fresh water[8].

Today surface water is most at risk to pollution due to its easy accessibility for disposal of pollutants and wastewaters. Worldwide surface water quality is governed by complex anthropogenic activities and natural processes, including weathering, erosion, hydrological features, climate change, precipitation, industrial activities, agricultural land use, sewage discharge, and the human exploitation of water resources [9].

METHODOLOGY

Since a few years, drinking water problem has created havoc in this city. Many questions have been raised regarding the quality of water supplied by the supplying agency[13]. A sample is a part or piece taken from a larger entity and presented as being representative of the whole[14]. In this study, we have collected 15 drinking water samples throughout the city. Different parameters were examined using Indian Standards to find out their suitability for drinking purposes. During this examination, mainly the physio-chemical were taken into consideration. Standard methods of collection, preservation and analysis were adopted. Grab sampling method was used for the collection of 15 drinking water samples throughout the city.

Samples Collection

Delhi is the capital of India and situated on the bank of Yamuna River. It lies between 28° 38' N scopes and 77° 12' E longitudes with the aggregate geological zone 1,483.01 sq. km. In the greater part of the creating nations, metropolitan strong waste (MSW) transfer has been an unending issue, especially in territories with high populace thickness, high generation of can't, and shortage of land satisfactory for landfills.

Water samples were collected in 2-litres plastic cans sealed by screw cap along with the Cello tapeto secure the leakage and labelled properly. The samples were collected from different areas such as R K Puram, Rohini, Patel Nagar, Akshardham, Dwarka, etc. Preservations of samples were done as per the Standard Methods for the Examination of Water and Wastewater.

Analysis of samples

The samples were analyzed by following the methods given in APHA manual and referring to BSI Manual. Measurements of temperature and pH were made with pH electrode. Electrical Conductivity (EC) was determined using digital EC Meter. Total dissolved solid (TDS) was determined by filtering a known volume of water and then drying it at 180^0C. Alkalinity was determined by titration with 0.02 N sulphuric acid. Total, calcium and magnesium hardness were determined by EDTA titration method. Chloride was determined by argentometric titration method.

RESULT AND DISCUSSION

As per the earlier discussion, allthe drinking water samples were collected from various areas of Delhi to examined for different physicochemical parameters. Parameters, such as, pH, Temperature, Color, Odor, Taste, Conductivity, Total Dissolved Solid (TDS), Turbidity, Total Hardness, Calcium, agnesium, Chloride, Total Alkalinity, Acidity, Nitrate, Phosphate, Nitrite, Free Residual Chlorine, Sulphate, Sulphide, Fluoride, Dissolved oxygen, Phenolic Compounds, Silica, were conducted in these samples. The obtained parameters from various parts are given below in table no-1 & 2-

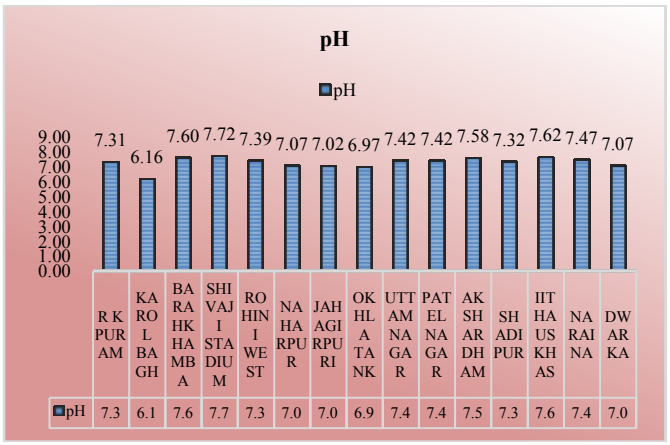
Table 1 obtained parameters from the water samples of various place from Delhi.

Parameters	Rk puram	Karol bagh	Barahkhamba	Shivaji stadium	Rohini west	Naharpur
Ph	7.31	6.16	7.60	7.72	7.39	7.07
Temperature	21.00	22.00	22.00	22.00	23.00	22.00
Conductivity	386.37	663.68	663.68	901.55	967.30	370.02
Turbidity	<0.1	0.20	<0.1	<0.1	0.03	<0.1
Color	C.l.	C.l.	C.l.	C.l.	C.l.	C.l.
Odor	Agree	Agree	Agree	Agree	Agree	Agree
Taste	Agree	Agree	Agree	Agree	Agree	Agree

During the analysis of all the water samples were also measured. The measured pH has a lot of variation in the supplied water samples of all the places. The obtained pH is given below in form of graph no.-1

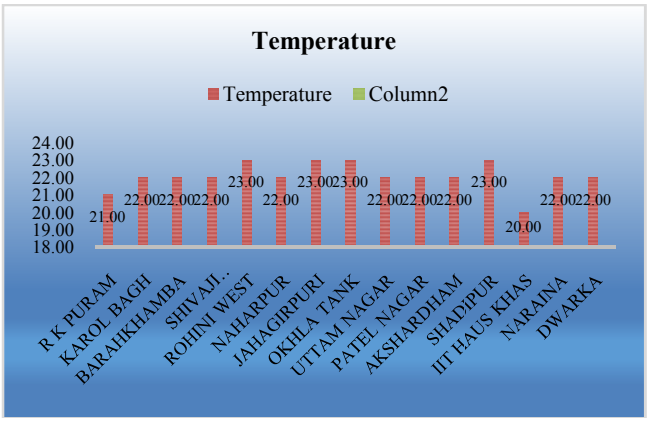
Table 2 obtained parameters from the water samples of various place from Delhi (continuation of table no-1).

Parameters	Okhla tank	Uttam nagar	Patel nagar	Aksha Rdham	Shadipur	Iit haus khas	Naraina	Dwarka
Ph	6.97	7.42	7.42	7.58	7.32	7.62	7.47	7.07
Temperature	23.00	22.00	22.00	22.00	23.00	20.00	22.00	22.00
Conductivity	564.10	362.19	917.21	254.51	2135.72	1504.20	638.23	424.83
Turbidity	<0.1	0.40	0.20	0.20	0.20	0.30	<0.1	0.20
Color	C.l.	C.l.	C.l.	C.l.	C.l.	C.l.	C.l.	C.l.
Odor	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree
Taste	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree

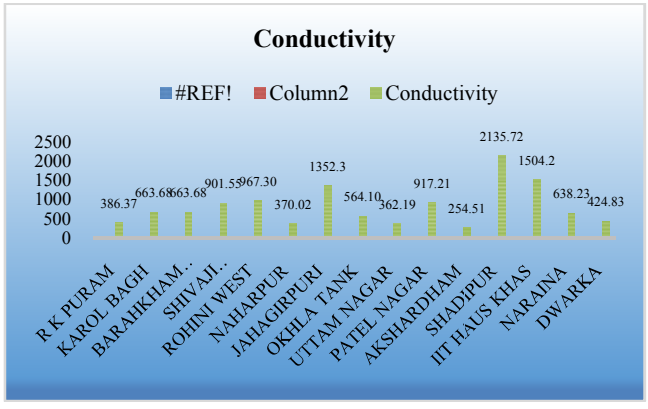


Graph 1 Obtained pH of the samples collected from various places of Delhi.

During the samples collection, temperature of all the various places was also recorded. The temperature was recorded to examine the effect over the physical parameters of drinking water. The recorded temperature is given below in graph no.2, similar like of it; the conductivity of all the water samples were also recorded. The conductivity of the samples are given below in graph no.3-



Graph 2 the recorded temperature during the samples collection of all the places of Delhi.



Graph 3 the recorded conductivity of the water samples of all the places of Delhi.

After examination of all the physical parameters in the drinking water, Now, all the samples were subjected to the analysis of chemical parameters. As a resultant of the study, obtained chemical parameters are given below in table no-3 &4-

After examining the concentration of all the physical and chemical parameters, the presence of few dissolve solids was noticed. The concentration of those dissolve solids are given below in graph no-4.

The test results concluded that pH level ranges from 6.16 to 7.62. In the study, we have found maximum pH value in the IIT Haus Khas region that is 7.62 and least in the Karol Bagh region that is 6.66 and both the min and max values lies in between the acceptable limit that is 6.5 to 8.5 as per IS: 10500-2012. pH of the water is the measure of the H^+ ion activity of the water system. It indicates whether the water is acidic, neutral or alkaline in nature. Odour, taste and color of every sample was found to be acceptable as per the test performed and turbidity was also found to be acceptable as per the standards.

Dissolved oxygen concentration is a remarkable Indicator of water pollution. Fish and other aquatic animals depend upon DO, which dependent on the water temperature. The maximum DO in water was found to be 9.6 in the Dwarka and minimum was 5.50 in the Shadipur region.Total Dissolved Solid (TDS) ranging from 157.80 mg/L (Akshardham Region) to 911.14 mg/L (Shadipur Region) in all the samples and the acceptable limit is 500 mg/L. Similarly, with the other parameters varies within the range but some parameters found to be beyond the acceptable limit (as per IS: 10500-2012).

Acidity is almost common in all the sampling areas having the range in between 9.02 to 45.10, and alkalinity, hardness, calcium and other parameters varies randomly such as in some of the areas it is beyond the range of acceptable limit where it is not permissible for the drinking purpose. We should also have to consider the Delhi in our project also to be safe and secure from the diseases and other toxic substances that can cause harm to the population. The accepted concentration of various parameters in the drinking water as per the IS; 10500-2012 are given below in table no.5-

Dissolved oxygen concentration is a remarkable Indicator of water pollution. Fish and other aquatic animals depend upon DO, which dependent on the water temperature. The maximum DO in water was found to be 9.6 in the Dwarka and minimum was 6.0 in the Okhla region. Similarly, with the other parameters varies within the range but some parameters found to be beyond the acceptable limit (as per IS: 10500-2012).

Table 3 Obtained chemical parameters in the water samples of distinct places of Delhi.

Parameters	R k puram	Karol bagh	Barahkhamba	Shivaji stadium	Rohini west	Naharpur	Jahagirpuri
Ttotal dissolved solids	204.24	223.98	360.38	379.57	550.14	250.48	645.46
Total hardness	180.25	195.70	206.00	216.30	484.10	231.75	370.80
Calcium	41.28	39.22	45.41	45.41	76.37	37.15	76.37
Magnesium	18.78	23.78	22.53	25.03	71.35	33.80	43.81
Chloride	21.70	67.50	96.42	106.07	50.62	21.70	156.69
Total alkalinity	107.10	107.10	102.00	112.20	402.90	153.00	290.70
Acidity	9.02	45.10	13.53	13.53	13.53	9.02	18.04
Free residual chlorine	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Sulphate	49.94	13.39	74.17	71.33	63.83	48.83	70.17
Nitrate	0.67	0.84	0.94	0.83	0.72	0.64	0.83
Nitrite	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Phosphate	0.19	4.00	0.22	3.59	0.13	0.00	0.18
Fluoride	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Silica	4.05	5.18	2.65	2.16	26.40	8.17	10.69
Dissolved oxygen	8.20	7.30	7.50	7.60	8.00	7.20	7.30
Phenolic compounds	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Sulphide	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl

Table 4 Obtained chemical parameters in the water samples of distinct places of Delhi.

Parameters	Okhla tank	Uttam nagar	Patel nagar	Akshardham	Shadipur	Iit haus khas	Naraina	Dwarka
Total dissovled solids	292.54	274.38	470.68	157.80	911.14	512.61	230.70	249.64
Total hardness	195.70	247.20	211.15	133.90	571.65	345.05	206.00	216.30
Calcium	41.28	41.28	47.47	26.83	154.81	86.69	43.35	43.35
Magnesium	22.53	35.05	22.53	16.27	45.06	31.29	23.78	26.29
Chloride	45.80	28.93	154.28	19.28	233.83	103.66	16.87	24.11
Total alkalinity	107.10	183.60	122.40	102.00	484.50	234.60	158.10	147.90
Acidity	13.53	9.02	13.53	13.53	36.08	13.53	22.55	18.04
Free residual chlorine	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Sulphate	72.78	42.44	71.89	13.33	60.56	84.44	42.22	57.78
Nitrate	0.96	0.63	0.71	0.92	0.70	0.69	0.71	0.72
Nitrite	0.00	0.00	0.00	0.00	0.20	0.01	0.00	0.01
Phosphate	0.24	0.00	0.26	0.05	0.08	0.07	0.06	0.21
Fluoride	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Silica	10.04	2.57	2.92	2.11	4.69	5.51	0.38	1.12
Dissolved oxygen	6.00	6.10	7.60	8.00	5.50	7.90	8.30	9.60
Phenolic compounds	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Sulphide	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl

Table 5 the accepted concentration of various parameters in the drinking water as per the IS; 10500-2012.

S.NO.	Parameters	UNITS	Acceptable Limit (As Per Is: 10500-2012) [Max.]
01.	**PH**	NA	6.5 TO 8.5
02.	Temperature	^{0}C	NA
03.	Conductivity	µS/CM	NA
04.	Turbidity	NTU	**1**
05.	Color	NA	Agreeable
06.	Odor	NA	Agreeable
07.	Taste	NA	Agreeable
08.	Total Dissovled Solid	MG/L	500
09.	Total Hardness (as $caco_3$)	MG/L	200
10.	Calcium (as ca)	MG/L	75
11.	Magnesium (as mg)	MG/L	30
12.	Chloride (as ci)	MG/L	250
13.	total alkalinity (as $caco_3$)	MG/L	200
14.	Acidity	MG/L	NA
15.	Free Residual Chlorine (as ci_2)	MG/L	0.2
16.	Sulphate (as so_4)	MG/L	200
17.	Nitrate (as no_3)	MG/L	45
18.	Nitrite (as no_2)	MG/L	1
19.	Phosphate (as po_4)	MG/L	NA
20.	Fluoride (as f)	MG/L	1.0
21.	Silica (as sio_2)	MG/L	NA
22.	Dissolved Oxygen (as o_2)	MG/L	NA
23.	Phenolic Compounds (as c_6h_5oh)	MG/L	0.001
24.	Sulphide (as h_2s)	MG/L	0.05

In India, ground water is the fundamental wellspring of drinking water furthermore vital hotspot for living creatures. The ground water quality issue has turned out to be intense these days. In urban zones of the nation, uncontrolled development of populace has left a few urban areas lacking in infrastructural administrations viz., water supply, sewerage and strong waste administration. To develop methodologies for the change of water supply and sanitation, different techniques have been received. Amid the most recent two decades, groundwater quality has developed as a standout amongst the most vital ecological issues going up against a significant part of the total populace [10].

In 1990, the aggregate water withdrawal was assessed at 552 bcm i.e. 30 for each penny of the nation's renewable water assets. The commitment from surface water was 362 bcm, while the groundwater withdrawal was evaluated at 190 bcm. Roughly 460 bcm was utilized for water system while 25 bcm was utilized for household needs. Around 19 bcm and 15 bcm were utilized for vitality and mechanical purposes separately. Presently, more than 80 for every penny of the 750 bcm water utilized as a part of India is for water system. The adjust 20 for every penny is utilized to meet residential, vitality, modern and different prerequisites. With the quickly developing populace, alongside modern and urbanization exercises, the interest for water is relied upon to increment significantly quicker[11].

Nearly 2.2 billion people lack access to a safely managed water system, and 4.5 billion lack access to safely managed sanitation. The Sustainable Development Goals aim to achieve

universal and equitable access to drinking water, sanitation and hygiene for all, and to end open defecation. The water goal (Sustainable Development Goal Number 6) further sets out to improve water quality, increasing water-use efficiency, and restoring water-related ecosystems. Around 80 percent of global fish stocks are fully or overexploited; nutrient and plastics pollution continue to increase, and only around four percent of the ocean is protected. Through Sustainable Development Goal Number 14, the world has committed to sustainably use of the oceans, seas and marine resources. United Nations Development Programme supports Sustainable Development Goal Number 14 by promoting sustainable and inclusive fishing, applying area-based ocean and coastal management, reducing marine pollution and increasing and strengthening marine protected areas. Through a coordinated portfolio operating in over 100 countries, United Nations Development Programme's Water and Ocean Governance Programme applies such approaches at local, national, regional and global levels12.

CONCLUSION

Drinking water is of very serious concern because it leads to various diseases that cause harm to the people where it is used for various drinking purposes used in the food preparations, drinking and other purposes also and it is not mandatory that all the people have the purifier facility to purify the water and use it for purposes thus water should have to have clean to drink.In this way, to shield the way of water from unsafe pollutions for the quality of individuals and the earth, two techniques are overall associated in the field of sustainable management to predict the effects of toxic substances and to screen the harmful toxins in water.Acidity is almost common in all the sampling areas having the range in between 9.02 to 45.10, and alkalinity, hardness, calcium and other parameters varies randomly such as in some of the areas it is beyond the range of acceptable limit where it is not permissible for the drinking purpose. In this manner, to shield the nature of water from dangerous contaminations for the strength of people and the earth, two methodologies are by and large connected in the field of sustainable management to foresee the impacts of poisons and to screen the harmful toxins in water.

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