Elemental Analysis with Physico-Chemical Parameters of Selected Ground Water Samples of Delhi

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Abstract

During the months of April and May, four samples of ground water (bore wells) from various parts of Delhi were subjected to physicochemical and elemental analyses. The water quality boundaries like pH, Absolute disintegrated solids (TDS), Complete alkalinity (TA), All out hardness (TH), Chloride (Cl-), Sulfate (SO42), Nitrate (NO3-), Fluoride (F-), Calcium (Ca2+), Magnesium (Mg2+), Aluminum (Al), Boron (B), Zinc (Zn), Selenium (Se), Manganese (Mn), Iron (Fe), Chromium (Cr), Copper (Cu), Lead (Pb), Cadmium (Cd), Arsenic (As) and Mercury (Hg) were contemplated and result of the outcomes were examined. The natural investigation was completed by utilization of ICPMS. Various boundaries were inspected and contrasted and Indian Principles, BIS 10500 (Greatest Passable Worth) to decide their reasonableness for the purpose of drinking.

Keywords: Physico-Chemical Studies; Elemental Analysis; Ground Water; Delhi; Barapullah; Kalkaji
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1. Introduction

One of India's most important business centers, Delhi is located on the Yamuna River between the latitudes 280 12' -280 53' N and the longitudes 760 50' -770 23'[1]. Its average water consumption is estimated to be 240 liters per capita per day (LPCD), making it the highest in the country[2]. This interest for drinking water is provided by the Delhi Jal Board and is entirely given or to some extent subbed by the accessible ground water of the area. Albeit the water provided is ordinarily tried for its appropriateness for drinking, ground water is acknowledged as such by the occupants without an examination of its true capacity for utilization.

Water can be contaminated by either natural or manufactured foreign matter. Inorganic substances, such as acids, salts, nitrates, and chlorides, which are typically non-toxic at low concentrations, may become concentrated enough to harm biological communities or lower water quality[3]. Leachates, corrosion products from pipe materials, pipe linings, and organic substances that can penetrate plastic pipe materials laid after boring4 are potential sources of water contamination during pumping. The underground water is additionally compromised with contamination from drainage pits, reject dumps, septic tanks, farm excrements, transport mishaps, and with different rural, substance or natural pollutants[5]. In this review, endeavor has been made to explore the nature of water at [4] areas in Delhi to decide its quality. These areas have been chosen arbitrarily.

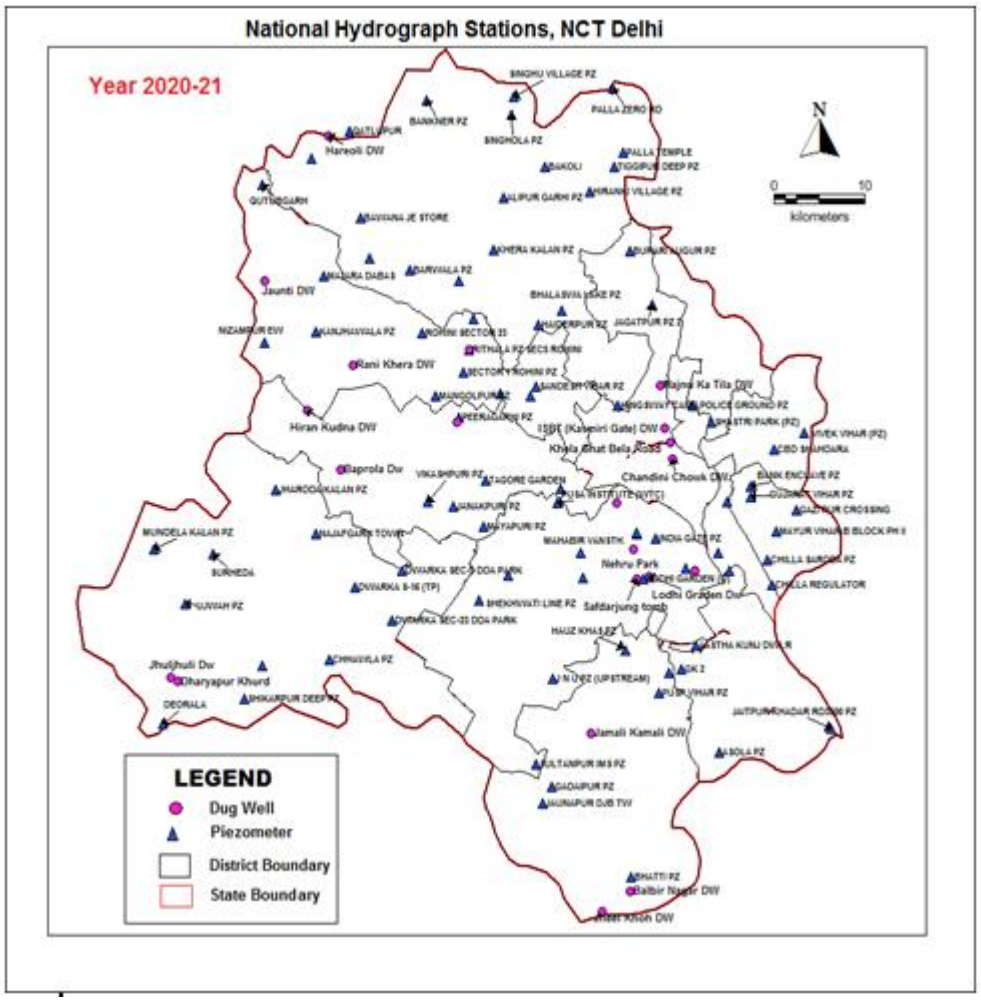

Fig. 1: Hydrograph of New Delhi *(Source-Ground Water Year Book)*

2. Material and Methods

The adoption of standard techniques for collection, preservation, and analysis occurred6. The grab sampling method was used to collect four ground water samples from the city that were used for drinking (Figure 1). The following standard procedure was used to analyze the physiochemical parameters: APHA[7] and the basic examination were finished utilizing ICPMS (Inductively Coupled Plasma Mass Spectrometer, PERKIN ELMER, Energy DRCe).

Table 1: List of the methods used for Physico-chemical analysis and the instruments used for elemental analysis.

S. No.	Parameter	Method used
1.	pH	pH meter
2.	Total Dissolved Solids	Total Dissolved Solids dried at 100°C
3.	Chloride	Argentometric method
4.	Hardness	EDTA Titrimetric method
5.	Fluoride	SPADNS method
6.	Sulphate	Turbidity method
7.	Nitrate	Ultraviolet Spectrophotometric Screening method
8.	Alkalinity	Titration method
9.	Calcium	Detection by AAS
10.	Magnesium	Detection by AAS
11.	Elemental analysis (Al, B, Cd, Cr, Cu, Mn, Pb, Zn, As, Hg, Se, Fe)	Detection by ICPMS, Perkin Elmer, Elan DRCe

3. Results and Discussion

3.1 Groundwater from Barapullah

According to IS 10500 standards, all of the physiochemical parameters were within the acceptable range. Comparatively essential boundaries portrayed similarity with the IS 10500 endorsed norms. The water can subsequently be utilized for drinking afterchlorination.

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3.2 Groundwater from Kalkaji

With the exception of nitrate, hardness, and fluoride, the pH of the Kalkaji water sample was 7.41. On analysis, the Kalkaji water sample showed that all physicochemical parameters were below the IS 10500 drinking limit. It has been discovered that each of them exceeds the IS-recommended limits of 100 ppm, 600 ppm, and 1 ppm. A high level of hardness means that there are salts in the water, which makes it taste different and makes it less acceptable to drink. Scale can form in boilers and water supply structures at high hardness levels (above 300 ppm), while pipeline corrosion can occur at very low hardness levels. Mineral leaching from the soils could be the cause of the high hardness.[9] On the other hand, all of the parameters looked at

had elemental characteristics that were within the IS drinking guidelines. After being treated for fluoride, nitrate, and hardness, this water may therefore be considered safe for drinking.

Table 2: Values for physio chemical parameters estimated by chemical analysis

Sm. No.	pH	TDS (%) mg/L	Sulphate mg/L	Nitrate mg/L	Chloride mg/L	Hardness mg/L	Fluoride mg/L	Alkalinity mg/L
1	7.27	0.06	44	3	112.94	243.04	ND	99.6
2	7.41	0.17	177	109.7	526.43	803.6	24.96	179.3
3	8.04	0.17	165.63	37.3	550.36	472.32	101.7	69
4	7.28	0.08	130.63	193.2	157.93	407.04	ND	73.9
IS 10500 Value	7.5-8.5	0.2%	400	100	1000	600	1	600

ND-Not detected.

3.3 Groundwater from Okhla

The pH of the water test gathered from Okhla was somewhat soluble (8.04).The water test gathered from Kalkaji portrayed on examination all Physico-synthetic boundaries to be under the IS 10500 endorsed limit for the purpose of drinking except for fluoride. The degree of fluoride was viewed as most elevated among every one of the examples tried and was found to surpass the IS endorsed restriction of 1 ppm. Hydrogen fluoride, which is highly corrosive, is produced when fluoride and stomach hydrochloric acid combine9. Fluoride is delivered into the ground water through enduring of essential silicates and related extra minerals[10].The elemental characteristics depicted conformity with the IS standards with the exception of selenium (20.59 ppb) and calcium (215.17 ppm). They exceeded the prescribed standards of 10 ppb and 200 ppm respectively.

Table 3: Values for elemental parameters estimated by Atomic Absorption Spectrophotometer and Inductively Coupled Plasma Mass Specrometer.

Sm. No.	Al ppb	B ppb	Zn ppb	Se ppb	Ca ppm	Mn ppb	Fe ppb	Mg ppm	Cr ppb	Cu ppb	Pb ppb	Cd ppb	As ppb	Hg ppb
1	2.1	101.82	39.47	0.33	5.23	290.2	337.18	26.27	3.15	1.41	0.34	ND	0.85	0.34
2	19.21	115.64	0.70	ND	2.83	64.26	412.81	55.31	ND	5.46	22.18	ND	1.29	ND
3	35.35	274.40	81.14	20.59	215.17	64.08	541.94	62.49	6.55	28.6	14.86	ND	2.13	0.21
4	93.9	324.27	180.03	51.62	4.11	104.84	839.48	97.91	6.21	1.98	0.40	ND	0.77	ND
IS 10500 Value	200	5000	15000	10	200	300	1000	100	50	1500	50	10	50	1

ND-Not detected.

3.4 Groundwater from Shahdara

On analysis, the water sample taken from Shahdara showed the highest concentration of nitrate among all samples tested, 193.2 ppm. All other physical and chemical parameters were found to be below the IS 10500 drinking-safe limit. Nitrate has long been linked to infantile methaemoglobinaemia, or blue baby disease, which occurs when nitrate is broken down by bacteria in the stomach into nitrite[11]. The biodegradation products of organic materials may have leached into the water sources, resulting in such a high concentration of nitrate in drinking water. On the other hand, the elemental analysis revealed a higher level of selenium. This water needs to be treated because selenium is an element that humans and other animals need in small amounts. However, excessive amounts can cause damage to the nervous system, fatigue, and irritability[2].

4. Conclusion

For millions of people, groundwater is an extremely important resource for drinking and irrigation. The nature of groundwater is essentially as significant as its amount since it is the main consideration in deciding its appropriateness for drinking, domestic, irrigation and industrial purposes. The

quality of groundwater is determined by the concentration of chemical components, which is greatly influenced by geological formations and human activities. Both the rural and anthropogenic exercises have brought about decay of water quality delivering serious dangers to individuals. Once contaminated, groundwater cannot be restored to its original quality. Groundwater naturally contains fluoride, which prevents dental caries, particularly in children. In the majority of the city, the overall condition of the groundwater demonstrates a decline in groundwater levels and deteriorating groundwater quality. Disintegration of groundwater quality because of anthropogenic exercises is expanding at a disturbing rate in many pieces of the Delhi, yet restricted work has been done on groundwater quality and checking. This study examines groundwater quality, comparing its suitability for drinking and irrigation, and the health status of individuals in various Delhi regions. The requirements of Delhi's steadily expanding populace have prompted overexploitation of springs.

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