ISSN Print: 2664-6781
ISSN Online: 2664-679X
Impact Factor: RJIF 5.32
IJACR 2024; 6(1): 91-94
www.chemistryjournals.net
Received: 04-01-2024
Accepted: 12-02-2024

Neelesh Kumar Pandey
Department of Chemistry, B.S.A. College, Mathura, Uttar Pradesh, India

Ravi Prakash
Department of Chemistry, B.S.A. College, Mathura, Uttar Pradesh, India

RB Singh
Department of Zoology, School of Life Sciences, Dr. Bhimrao Ambedkar University, Khandari Campus, Agra, Uttar Pradesh, India

Corresponding Author:
Neelesh Kumar Pandey
Department of Chemistry, B.S.A. College, Mathura, Uttar Pradesh, India

Physico-chemical studies on rural areas of ground water of Mathura district of Uttar Pradesh (India)

Neelesh Kumar Pandey, Ravi Prakash and RB Singh

DOI: https://doi.org/10.33545/26646781.2024.v6.i1b.171

Abstract
The most important natural resource for life is water. In order to meet life's necessities, ground water is crucial. The examination of the physico-chemical parameters of the numerous ground water bodies in the Mathura district area, where the marble and cement industries are the dominant businesses. It is necessary since ground water is the primary source of drinking water for the municipality. The quality of drinking water will be improved by the current analysis. The promotion of human health standards is significantly aided by water quality. The current study aims to evaluate the physio-chemical parameters of ground water in order to determine its quality. Samples of the ground water were taken from the several communities in the district of Mathura rural areas. On the basis of 25 distinct villages in the Mathura district, they recorded and compared their physio-chemical parameters, including electrical conductivity, pH, total alkalinity, TDS, chloride, fluoride, nitrate, and total hardness. The Scott-Sanchis (visual) method, the SPADNS method, the tritimetric, titration and colorimetry methods were all used to study the analysis. The results of the water quality testing in these particular areas were compared to BIS and WHO criteria. Some of the analysis areas were found to have excessive levels of EC, TDS, and fluoride. The study indicates the present state of the water quality in that location and integrating them is crucial to determining and maintaining the quality of the groundwater of rural area of Mathuro district (UP), India.

Keywords: Drinking water, ground water quality, physio chemical analysis, Mathura district, spadns method, tritimetric, titration and colorimetry method)

Introduction
The primary resource needed to support all human endeavours is water, It is one among the most significant chemicals that has a significant impact on life [1]. In Uttar Pradesh, the primary source of drinking water is groundwater. Considering that Uttar Pradesh receives little rainfall, around 95% of the population relies on ground water. Surface water is thought to be somewhat more dirty and pollutant-free than ground water [2]. The quality of ground water supplies varies significantly and naturally depending on the climate, season, bedrock geology, and human activity [3]. It is becoming contaminated as a result of sewage from homes and businesses, industrial waste, agricultural waste, runoff from cities, and soluble effluents [4-6]. To determine and maintain the quality of the groundwater, it is crucial to monitor it using a variety of physiochemical parameters and by combining them [7]. The goal of the of the current study is to determine the current ground water quality conditions in the rural area of Mathura district. The most important natural resource for life is water. The necessity for life is largely satisfied by groundwater, which is one of the different types of water. The demand for water resources is rising as a result of urbanisation, industry and population growth. The terrible thing is that human activities are contaminating any available resources. This is also putting this priceless resource under stress.
The present need is to manage the avoidable water resources. Mathura district where marble and cement industries are the dominating industries is one such district. So there is an urgent need of the Physico- chemical study of various ground water bodies belonging to Mathura district as the ground water is the major source of supplying drinking water by the municipality. The present study will help in improving drinking water quality.
After being rinsed with the same water, 25 samples of 500 ml each were obtained from 25 different villages in the Mathura district and placed in clean PET bottles. Hand pumps, open wells, and tube wells were used as sample locations.

Zirconyl-SPADNS method [8] and colourless complex anion ZrF-2, Fluoride concentration increases result in gradually lighter colouring. After eliminating any remaining chlorine, the Scott-Sanchis approach calls for the preparation of a series of standard fluoride solutions with varying ppms. After one hour, the colour developed in the 100 ml samples after the addition of 5 ml of the Acid-Zirconyl- Alizarine Reagent. This colour was then compared to standards samples. Fluoride levels rose along with the increase in lemon colour. In addition, evaluated the parameters for calcium, chloride, TDS, nitrate, pH, hardness, and alkalinity. These 25 villages' attributes were recorded throughout each of the four seasons of the year and contrasted with other villages and seasons. The villages with high levels of fluoride, TDS, hardness, etc. were recognised by us, and we compared their values to those set by NEERI, ICMR, WHO, and APHA.

The most important component of water quality in a water delivery system is fluoride. Human health has been demonstrated to be significantly impacted by fluoride. Fluoride plays a positive effect in the development of teeth in the right proportion. According to [9], a concentration of F- intake that is too low (0.5ppm) may not be sufficient to prevent dental cavities in young children. In Kdabakshupally, Sarampet, and Sivannagudem, dental moulting was reported in 76% of children aged 5 to 10 and 84% of children aged 10-15 [10]. Check the prevalence of dental fluorosis in water with reduced fluoride levels. Humans have been seen to be unable to walk due to painful and tight joints [11]. In Uttar Pradesh, adults exposed to mean fluoride levels of 1.4 and 6 mg/l were examined to determine the prevalence of skeletal fluorosis. Dental caries as a result of high F- concentrations that are greater than 1.5 ppm include teeth molting [12].

Chronic skeletal fluorosis is caused by excess F- in drinking water above 4 ppm and results in stiff joints, an increase in bone mass and osteoporosis in older people.Paralysis and rapid ageing may occur in extreme circumstances. Recent studies have indicated that prolonged F- poisoning can have harmful effects on the body, including an increase in peroxidation and cardiac damage. If the mother consumes water and food that have high concentrations of F while she is pregnant, the foetus may also suffer harm [13]. Climate, rock type, and hydrogeology all affect the amount of F- in water [16]. Fluorspar, topaz, and cryolite minerals are the cause of the F- buildup in ground water. F- is more prevalent in alkaline volcanic, hydrothermal, and sedimentary rocks.

Materials and Methods

Mathura district is a district of the Uttar Pradesh in North Central India. Mathura geography has a major influence on its elimate and topography. Mathura lies between the coordinates 27°41` in North latitude and 77° 41` East longitude. Mathura is located at 27.28°N 77.41°E /27 28°N 77.41°E. Mathura district has many important sites associate with Goddess Radha and Krishna. The total area of Mathura district is 3.340 square kilometres. There are five tehsils in the Mathura district i.e. Mathura, Govardhan, Chhata, Mant and Mahavan. Mathura district is bounded by Aligarh district to the North East, Hathras district to the South East, Agra district to the South, Rajasthan to the west and Haryana to the North west. This city in Uttar Pradesh is located on the beautiful banks of the river Yamuna. Mathura is popularly known as Brajbhoomi is 145 km South of the New Delhi. The holicity is just 50 km from Agra where the beautiful Taj Mahal is located. I have study 25 of the village of the Mathura district of Uttar Pradesh (India) The majority of the techniques followed APHA guidelines Both the APHA method and the SPADNS approach. The phenol disulphonic acid technique was employed to detect nitrate, and nitrate was found at a wavelength of 410 nm.TDS was calculated using the Combo by Hanna HI9812 equipment model.

In this study, 25 samples of underground water were collected from various Mathura district locations for physio-chemical investigation. From various locations, water samples were collected in sterilised plastic bottles and labelled S-1 to S-25 as shown in Table 1. Between the months of February 2022 and April 2022, samples were collected. Electrical conductivity, pH, total alkalinity, TDS, chloride, fluoride, nitrate, and total hardness were all measured in the samples. As instructed in the standard manual of water analysis [15], these parameters were examined. All of the obtained water sample's parameters were compared to Indian drinking water standards established by BIS 10500:2012 [16] and WHO [17].

Table 1: Sample numbr assigned to sampling Area selected for ground water analysis from Mathura district

S. No.	Sample Number	Sampling Area
1.	S-1	Adula
2.	S-2	Aurangabad
3.	S-3	Bajna
4.	S-4	Barari
5.	S-5	Balrai Bangar
6.	S-6	Daulatpur Farah
7.	S-7	Madaura
8.	S-8	Mahuan
9.	S-9	Makhdum
10.	S-10	Nagla Bohra
11.	S-11	Parkham
12.	S-12	Rasulpur
13.	S-13	Marholi
14.	S-14	Neemgao
15.	S-15	Pali Dungara
16.	S-16	Rahimpur
17.	S-17	Rampur
18.	S-18	Salampur Farah
19.	S-19	Sanaura
20.	S-20	Umari
21.	S-21	Uspar
22.	S-22	Shah Pur Jaran
23.	S-23	Sanaura
24.	S-24	Begampur
25.	S-25	Chharaura

Results and Discussion

Samples of ground water were taken in the rural areas of Mathura district of Uttar Pradesh area, as shown in Table -1. In Table-2, the measured values for various physical and chemical parameters, including TDS, pH, Ca- and Mg-hardness, total hardness, chloride, sulphate, nitrate, fluoride, and conductivity, are shown. All results are contrasted with the desired and allowable limits suggested by the bureau of Indian standard BIS 10500:2012, which are shown in Table-3.

Table 2: Physico chemical analysis of ground water sample from Mathura district U.P., (India)

Sample No.	TDS mg/L	pH	Ca^{++} mg/L	Alkalinity	Total Hardness mg/L	Cl^- mg/L	NO_3^- mg/L	F^-mg/L
S-1	3524	7.2	230	480	840	1180	26	7.3
S-2	1176	7.5	200	300	350	170	37	5.4
S-3	3332	6.8	110	250	390	118	9	2.9
S-4	637	7.4	220	370	320	170	9	5.1
S-5	3185	7.5	120	520	720	980	26	2.7
S-6	3381	6.6	320	400	550	860	26	0.8
S-7	735	7.09	260	450	390	100	37	5.5
S-8	2156	7.2	690	440	1160	370	231	2.8
S-9	3871	6.9	180	640	890	1440	4	0.72
S-10	784	7.5	270	450	390	130	13	9.44
S-11	2254	7.3	360	400	600	760	4	7.98
S-12	328	7.4	70	90	100	40	9	3.06
S-13	348	7.6	70	100	110	13	13	0.18
S-14	2352	7.3	330	350	450	780	62	0.3
S-15	686	7.2	200	400	390	60	13	3
S-16	1029	7.9	110	270	180	230	4	5.92
S-17	3920	7.7	180	260	290	1240	22	0.6
S-18	5880	7.6	450	690	1370	1160	13	11
S-19	2254	7.8	180	300	280	410	9	12
S-20	1813	7.6	90	420	450	300	264	3.4
S-21	770	7.5	620	550	360	80	88	9
S-22	328	7.1	420	360	600	40	4	1.4
S-23	13000	7.3	80	110	140	2100	9	13
S-24	584	7.6	300	330	420	90	4	1
S-25	2352	7.0	700	550	1100	500	4	6.5

Table 3: Drinking water standards of BSI (IS: 10500:1991)

S. No.	Parameters	Desirable limit	Permissible limit
1.	Total Dissolve Solids (TDS)	500	2000
2.	pH	6.5-8.5	6.5-8.5
3.	Calcium Hardness(Ca^{++})	75	200
4.	Magnesium Hardness (Mg^{++})	30	100
5.	Total Hardness	300	600
6.	Chlorides(Cl^-)	2500	1000
7.	Sulphate($SO4^-$)	200	400
8.	$NO3^-$	45	100
9.	Fluorides (F^-)	1.0	1.5
10.	Electrical-Conductivity(EC)	1500 µs/cm	2000 µS/cm

TDS: The TDS ranged from 300 to 13,000 mg/lt in each sample. The BIS states that the TDS maximum acceptable limit for drinking water is between 500 and 2000 mg/lt. Contaminants present in the water cause high levels of TDS. A high TDS in water used for drinking causes a number of diseases that are not water-borne but rather result from too much salt. [18]

pH: The water in the research region has a pH value that falls within the BIS-permitted range of

Chloride: All of the water samples had chloride levels that ranged from 100 to 2100 mg/lt, which is within acceptable limits. However, the majority of the samples had a value that was discovered to be higher than the desired level (250 mg/l).

Nitrates: According to the findings, the tested area's nitrate concentration ranged from 26 to 264 mg/lt. 50 mg/lt is the highest allowable limit (ICMR). Infants under 6 months old frequently experience methemoglobinemia, sometimes known as the "blue baby" condition, because of the greater quantity of nitrate in their drinking water.

Hardness: Hardness is a crucial factor in deciding whether water is suitable for residential use, drinking, and many industrial applications. Results show that the hardness was within the acceptable range (1000 mg/lt). Some samples had levels that are higher than the acceptable limit (350 mg/lt). Scaling and incrustation in parameters are caused by harder materials.

Fluoride: It was noted that the fluoride concentration in the chosen study area ranged from 0.3 to 12 mg/lt. The majority of the sample had fluoride concentrations that are far higher than the allowed limit (1.5 mg/lt). Teeth moulting, skeletal fluorosis, knee joint deformation, etc. may occur as a result of the high fluoride concentration in ground water.

Conclusion

The analysis above leads to the conclusion that some of the study areas of groundwater of Mathura district of Uttar Pradesh (India) is suitable for drinking purpose. While certain water samples from a particular area have excessive amounts of fluoride and TDS, rendering them unfit for human consumption. Therefore, water must undergo thorough purification before being used for drinking.

References

1. Grode SP, Jadhav MV. Journal of Engineering Research and Applications. 2013;3(6):2029-2035.
2. Patil VT, Patil PRE. Journal of Chemistry. 2010;7(1):111-116.
3. Ramesh K, Soorya V. International Journal of Research in Chemistry and Environment. 2012;2(3):112-122.
4. Karunakaran T. Indian Journal of Environment Protection. 2005;25:510-514.
5. Inirabai WPS, George S. Pollution Research. 2005;21:209-212.
6. Shukla DK, Srivastava AK. Indian Journal of Environments. 1995;37:205-208.
7. Srivastava RK, Kumariya M. International Research Journal of Environmental Science. 2018;7(5):69-71.
8. APHA. Standard Methods for Chemical Examination of Water and Waste Water. 21st edition. Washington, D.C.: American Public Health Association; c2005.
9. Ruan JP. Acta Odontologica Scandinavica. 2007;65(2):65-711.
10. Kodali VRR, Krishnamachari KAVR, Gowrinathsastry. Tropical Doctor. 1994;24:136-137.
11. Short HB, Pandit CG, Taghavachari TN. Indian Medical Gazette. 1937;72:396-398.
12. Choubisa SL, Choubisa DK, Joshiand SC. Fluoride. 1997;30(4):223-228.
13. Pasha PM, Sujitha NS. Toxicology International. 2011;18(2):99-104.
14. Fawell J, Baile K, Chilton J, Dahi E, Fewtrell L, Magara Y, *et al*. Fluoride in drinking water. World Health Organization; c2006.
15. Manual of Standards of Drinking Water Supply. New Delhi: ICMR. 2nd special report series No. 44; c1975.
16. Indian standard drinking water specification (First revision) (IS-10500); c1991.
17. WHO guidelines for drinking water quality Recommendations. Geneva: WHO, 1984, 1.
18. Sabata BC, Nayar MP. River pollution in India: A case study of Ganga River; c1995. p. 33.