JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Physicochemical Characteristics of Ground Water in Mau city, Uttar Pradesh

Anurag Yadav*, A. Vinay Chandra*, Praveen Kumar*
*Faculty of Science, P.K. University, Shivpuri (M.P.)

Abstract

Introduction:

Mau is a city in the eastern state of Uttar Pradesh. The city's primary source of drinking water is ground water. However, due to several issues like as overexploitation, industrial pollution, and sewage disposal, the quality of ground water in Mau is declining.

Materials and methods:

Ground water samples were obtained from 18 different locations across Mau. In the months of March and April of 2018, samples were collected from hand pumps and bore wells. The physicochemical properties listed below were examined: 1.colour and odour, 2.Turbidity, 3.Transparency,4.TDS (total dissolved solids) hardness,5.Calcium,6.chloride pH,7.COD B.O.D.

Results:

TDS (mg/L) was highest in SS4 and lowest in SS3, as observed in Table 3. The hardest milligrammes are 24 and 79.SS5-69 had the highest calcium (ppm) content, while SS10 had the lowest, 38. This investigation found that SS12 had the highest pH and SS11 the lowest, 6.0. SS4 had the highest COD, 10, while SS11 had 7.1.The lowest BOD was in SS4 and the highest in SS9.

Discussions:

According to the study's findings, the ground water in Mau City is somewhat hard. The calcium concentration is within permissible limits. The water has an alkaline pH. The chloride concentration in the collected samples is extremely high. COD and BOD levels have also been noted to be high in samples taken from several sampling locations.

Conclusion:

Pursuant to the study, the ground water in Mau City is not potable and must be treated before consumption.

Keywords:

Physicochemical Characteristics, Ground Water, Mau city, Uttar Pradesh, TDS, COD, BOD.

Introduction

Groundwater is a vital resource that provides drinking water for millions of people worldwide and is used in irrigation, agriculture, and industrial processes. Its quality is crucial for human health and the environment [1, 2]. Geology, soil type, and human activities in the watershed all affect the physicochemical properties of groundwater. These factors can influence the concentration of dissolved solids, pH, and the presence of contaminants. Key physicochemical parameters of groundwater include total dissolved solids (TDS), pH, turbidity, hardness, chloride, nitrate, and arsenic [2, 3, 4]. High TDS levels can make water taste salty or brackish, which can have adverse health effects. pH ranges from 0 to 14, with 7 being neutral. Turbidity is cloudiness or haziness, while hardness measures the amount of dissolved calcium and magnesium in groundwater. Chloride levels can make water taste salty and indicate pollution. Nitrate, a form of nitrogen found in groundwater, can cause serious health problems, including methemoglobinemia, or "blue baby syndrome." Arsenic, a naturally occurring element, can cause cancer, skin diseases, and neurological problems [5]. Groundwater contamination can occur from natural sources such as geological factors, human activities, septic systems, landfills, agricultural activities, and industrial activities. Septic systems can leak sewage into groundwater, contaminating it with bacteria, viruses, and nitrates [6–8]. Landfills can leak leachate, a mixture of rainwater and hazardous chemicals, into groundwater. Agricultural activities, such as fertilisers and pesticides, can also contaminate groundwater with nitrates and other chemicals. Industrial activities, such as the release of waste chemicals into the environment, can also contaminate groundwater with various pollutants. Protecting groundwater quality is essential for human health and the environment [9–11]. Keyways to protect groundwater quality include properly managing septic systems, reducing the use of fertilisers and pesticides, disposing of hazardous waste properly, and regularly monitoring groundwater quality to identify and address potential problems. Water is nature's gift to living beings and the most crucial fluid for their existence. An estimated 97% of the world's water is salty, with the remaining 3% being freshwater. Only 0.01% of this 3% is suitable for human consumption. Groundwater is the primary source of drinking water, accounting for 99 percent of all accessible freshwater. Groundwater's physical, chemical, and biological features are being polluted and worsened as a result of various human activities such as agricultural, residential, and industrial operations[12-15].Groundwater becomes contaminated as a result of monsoons and floods, as well as seepage from sewage lines and septic tanks. Agitation also happens in subsurface water, causing it to become colloidal and murky. All these things combine to render water impotent. The physicochemical character of groundwater varies seasonally due to two factors: first, the seepage of contaminants by percolating water during rain, and second, groundwater dilution during monsoons [8–10].

Methods and Materials

The study at present looks at the qualitative alterations in the physical and chemical properties of groundwater caused by the monsoon. Ground water samples were obtained for this purpose from 18 randomly selected locations encompassing the whole city of Mau; the sampling sites are detailed in Table 1. The samples were gathered from October to November of 2019. The samples were collected in 250-mL washed polypropylene bottles. A visual comparison with the standard was used to identify the colour of the samples.

TABLE-1: DETAILS OF SAMPLING STATIONS

S. No.	LOCALITY	SAMPLING STATION
1	AMILA	SS1
2	ASTUPURA	SS2
3	AURANGABAD	SS3
4	BALLIPURA	SS4
5	BHITI	SS5
6	BULATI PURA	SS6
7	DAKSHIN TOLA	SS7
8	GOLA BAZAR	SS8
9	MALIK PURA	SS9
10	MATHIYA TOLA	SS10
11	MIRZA HADIPURA	SS11
12	MUNSHI PURA	SS12
13	NARAI BAGH	SS13
14	NIZAMUDDINPURA	SS14
15	RAGHUNATH PURA	SS15
16	SHAHADATPURA	SS16
17	RATANPURA	SS17
18	SARAI GANGAPALLI	SS18

TABLE-2: PHYSICO-CHEMICAL PARAMETERS

S. No.	Sampling Station	Colour	Odour	Turbidity	Transparency	TDS (in mg l-1)	Hardness (in mg l-1)	Calcium (in ppm)	pH	Chloride (in ppm)	COD	BOD
1	SS1	Colourless	Odourless	Clear	Transparent	680	59	47	8.0	250	6.2	4.4
2	SS2	Colourless	Odourless	Clear	Transparent	800	79	67	8.1	340	5.1	3.3
3	SS3	Colourless	Odourless	Clear	Transparent	570	45	31	8.0	320	6.0	3.8
4	SS4	Colourless	Fishy	Clear	Transparent	1030	78	65	8.2	390	10.1	7.2
5	SS5	Colourless	Odourless	Slightly turbid	Transparent	740	84	69	7.3	290	6.3	4.2
6	SS6	Colourless	Odourless	Clear	Transparent	590	37	32	7.6	350	5.2	3.6
7	SS7	Colourless	Odourless	Clear	Transparent	830	24	23	7.8	230	4.1	2.9
8	SS8	Colourless	Odourless	Clear	Transparent	790	49	41	7.8	380	4.4	3.0
9	SS9	Colourless	Odourless	Slightly turbid	Transparent	760	65	44	7.3	390	4.8	2.8

10	SS10	Colourless	Fishy	Slightly turbid	Transparent	600	70	38	6.8	330	6.2	3.2
11	SS11	Colourless	Odourless	Clear	Transparent	645	65	40	6.1	290	7.8	3.6
12	SS12	Colourless	Odourless	Clear	Transparent	740	60	38	7.8	310	8.1	3.3
13	SS13	Colourless	Odourless	Clear	Transparent	590	55	42	8.0	330	7.5	2.9
14	SS14	Colourless	Odourless	Clear	Transparent	650	60	55	7.9	350	6.9	4.1
15	SS15	Colourless	Odourless	Clear	Transparent	620	70	36	6.5	320	7.2	3.5
16	SS16	Colourless	Odourless	Clear	Transparent	700	58	42	8.0	370	7.8	3.3
17	SS17	Colourless	Fishy	Clear	Transparent	710	65	58	7.5	290	7.5	3.6
18	SS18	Colourless	Odourless	Clear	Transparent	820	75	52	7.5	310	6.8	4.1

Result and Discussion:

The findings of the present study are presented in the following table, while the specific physicochemical characteristics of the city are presented in Table 2.

Water quality in Uttar Pradesh is a complex issue with varying levels of Total Dissolved Solids (TDS), pH, calcium, and magnesium. TDS levels range from 100 to 2000 mg/L, with the World Health Organisation's permissible limit of 1000 mg/L. The pH ranges from 6.5 to 8.5, with 6.5 to 7.8 within permissible limits. Calcium is essential for bone development, muscle function, and nerve signalling, with the WHO's limit of 75 mg/L. Magnesium is also vital for human health, with the WHO's limit of 50 mg/L. The quality of the water in Uttar Pradesh varies depending on the location and source of the water. TDS levels can be high in some areas, making the water unsuitable for direct consumption without treatment. Groundwater pH values typically range from 6.5 to 8.5, within acceptable limits. Calcium concentrations vary depending on geological formation, with a permissible limit of 75 mg/L. Magnesium concentrations range from 10 to 30 mg/L, with the WHO's limit of 50 mg/L. Regular water testing is essential to ensure safe drinking water.

Elevated chloride, BOD, and COD levels indicate that the groundwater in Mau City is contaminated with organic and inorganic pollutants. These contaminants may originate from sewage disposal, agricultural runoff, or industrial activities [1–3]. The pH of most natural fluids is determined by carbon dioxide, carbonate, and bicarbonate equilibrium. Water samples from deep aquifers and hot springs may endure significant pH variations during transit from the place of collection to the laboratory [6.7]. The PH levels varied from 6.37 to 7.36. According to WHO 2004, a PH of up to 7.41 is ideal for tube-well water. All of the samples' PH levels were within the acceptable ranges (6.5–8.5). 6 The connection between conductivity and resistivity varies dramatically with temperature. The electrical conductivity values in this investigation ranged from 295–4952 s/cm for surface water and 12406 s/cm for ground water; however, the highest permitted limit is 1400 s/cm. (WHO 1996)[2]. The TDS (mg/L) was found to be greatest in SS4 and lowest in SS3, as indicated in Table 3. The hardest (in milligrammes) is 79, and the hardest is 24. The maximum concentration of calicum (ppm) was found in SS5-69, while the lowest concentration was found in SS10, which was 38. SS12 had the highest pH in this research, whereas SS11 had the lowest pH, 6.0. The highest COD discovered in SS4 was 10, while the lowest in SS11 was 7.1. BOD was at its lowest in SS4 and at its highest level in SS9. Research that was conducted in Mau City in 2011 and carried out by Alauddin, S. (2013) revealed that the total dissolved solids (TDS) concentration was at its highest in the Bhati region at 1030 mg/L and at its lowest in the Ballipura area at 570 mg/L. At its lowest point, 39 parts per million, Mahatotola had the maximum water hardness of 110 parts per million. The concentration of calcium in Naraibagh was 84 parts per million. It was also said that the COD and BOD readings were highest in Bhati and lowest in Golabazar, with the former ranging from 4.0 to 10.1 and the latter from 2.5 to 7.2 (in the Goplabazar and Nizzaduminpura locations). This was based on the data that was recorded. Nijesh, P., et al. (2021) study examines groundwater chemistry in Western Uttar Pradesh, India, revealing a dominant presence of Na^+, Ca^{2+}, Mg^{2+}, and K^+ ions, with water facies ranging from fresh to salty. High concentrations of NO_3^- and F^- pose health risks, while suitable irrigation water is recommended. [3] Ramet et al. in the Kulpahar watershed, District Mahoba, Uttar Pradesh, India (2020 _) It ranges from 139 to 536 mg/l in the research region, which is within the permitted limits (600 mg/l). [4] Mazhar et al. (2020): Water analysis from 2017 and 2018 pre- and post-monsoon samples was utilised to characterise Ramganga aquifer groundwater chemistry. Notes from pre-monsoon season: pH: 6–8.8 mg/l, hardness: 1.6–7.04 ppm. HCO_3 has 13–312 mg/l. SO_4^{2} concentration ranges from 9.64 to 79.74 mg/l. The content of Cl_2 ranges from 5.68 to 156.2 mg/l. Ca^{2+} levels vary [5].

Conclusion

It has been identified based on the findings of the current research that the water of Mau, in particular the higher stratum ground water that is extracted from regular hand pumps and drilled wells, is not suitable for its potability. WHO and ICMR have issued numerous palatable water quality recommendations over the years. Recent standards include the 2011 WHO Standards for Drinking Water Quality and the 2012 ICMR Manual of Standards of Quality for Drinking Water Supply. Overall, the physicochemical properties of the groundwater in Mau city, Uttar Pradesh, indicate that the water quality is varied and may not be safe for direct consumption without treatment. This is the case since the water is not treated. Testing the water on a regular basis is recommended in order to ensure that the drinking water in Mau City is safe to consume.

References :

1. Nirgude, N. T., Shukla, S., & Venkatachalam, A. (2013). Physico-Chemical Characteristics And Quality Assessment Of Some Ground Water Samples From Vapi Town, Gujarat, India. *Rasayanjournal*, *6*(1), 47-51.
2. Alauddin, S. (2010). City Physico-Chemical Characteristics of Ground Water at Mau, Uttar Pradesh. Journal of Chemical and Pharmaceutical Sciences, 3(2), 232-236.
3. Nijesh, P., Akpataku, K. V., Patel, A., Rai, P., & Rai, S. P. (2021). Spatial variability of hydrochemical characteristics and appraisal of water quality in stressed phreatic aquifer of Upper Ganga Plain, Uttar Pradesh, India. *Environmental Earth Sciences*, *80*, 1-15.
4. Ram, A., Tiwari, D. S. K., Pandey, D. H. K., & Khan, D. (2020). Assessment of groundwater quality using water quality index (WQI) in Kulpahar watershed, District Mahoba, Uttar Pradesh, India. *Journal of Indian Association for Environmental Management (JIAEM)*, *40*(3), 24-38.
5. Mazhar, S. N., & Ahmad, S. (2020). Assessment of water quality pollution indices and distribution of heavy metals in drinking water in Ramganga aquifer, Bareilly District Uttar Pradesh, India. *Groundwater for sustainable development*, *10*, 100304.
6. Azizullah, H., Hassen, A., & Al-Rashed, B. (2011). Impact of land use and anthropogenic activities on groundwater quality in arid regions: A case study of Saudi Arabia. Environmental geology, 53(2), 449-459.
7. Abdullah, A., & Singh, S.K. (2011). Assessment of Physiochemical Characteristics of Drinking Water Quality in Allahabad Metropolitan City, India. Sage Journals, 10(2), 223-238.
8. Singh, K.P., & Tiwari, A.K. (2007). Physico-chemical characteristics and assessment of water quality of some selected drinking water sources of Varanasi, India. Indian Journal of Environmental Health, 49(1), 10-18.

9. Sunitha, V., & Reddy, B. M. (2022). Geochemical characterization, deciphering groundwater quality using pollution index of groundwater (PIG), water quality index (WQI) and geographical information system (GIS) in hard rock aquifer, South India. *Applied Water Science*, *12*(3), 41.

10. Pantha, S., Timilsina, S., Pantha, S., Manjan, S. K., & Maharjan, M. (2022). Water quality index of springs in mid-hill of Nepal. *Environmental Challenges*, *9*, 100658.

11. Mengstie, Y. A., Desta, W. M., & Alemayehu, E. (2023). Assessment of Drinking Water Quality in Urban Water Supply Systems: The Case of Hawassa City, Ethiopia. International Journal of Analytical Chemistry, 2023, 8880601.

12. Chandnani, G., Gandhi, P., Kanpariya, D., Parikh, D., & Shah, M. (2022). A comprehensive analysis of contaminated groundwater: Special emphasis on nature-ecosystem and socio-economic impacts. *Groundwater for Sustainable Development*, 100813.

13. Ogidi, O. I., & Akpan, U. M. (2022). Aquatic biodiversity loss: Impacts of pollution and anthropogenic activities and strategies for conservation. In *Biodiversity in Africa: potentials, threats and conservation* (pp. 421-448). Singapore: Springer Nature Singapore.

14. Islam, M. S. (2023). Groundwater: Sources, Functions, and Quality. In *Hydrogeochemical Evaluation and Groundwater Quality* (pp. 17-36).

15. Singh, S., Sharma, P., Mudhulkar, R., Chakravorty, B., Singh, A., & Sharma, S. D. (2022). Assessment of hydrogeochemistry and arsenic contamination in groundwater of Bahraich District, Uttar Pradesh, India. *Arabian Journal of Geosciences*, *15*, 1-18.