EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 11
Issue: 4
251-256
Year: 2024

SURVEILLANCE AND MONITORING OF pH AND ELECTRICAL CONDUCTANCE IN DRINKING WATER IN MEERUT DISTRICT FROM DECEMBER 2019 TO JULY 2020

Gargi Pachauri, Prakshi Singhal* and Navdeep Arora

Department of Chemistry, Meerut College, Meerut (UP).

***Corresponding Author: Prakshi Singhal**

Department of Chemistry, Meerut College, Meerut (UP).

Article Received on 19/02/2024 **Article Revised on 10/03/2024** **Article Accepted on 31/03/2024**

ABSTRACT

The study aims to offer a detailed examination of the water quality in the Meerut district, employing advanced methodologies for detecting and quantifying the presence of harmful chemicals. The study's primary objective is to comprehensively analyze the types and levels of pollutants present in the water supply of the Meerut district and to develop innovative methods for monitoring these contaminants. To do this, a case study was conducted in the selected points, namely *Sadar Thana*(P_1), *Village Partapur*(P_2), *Village Kharkhaoda*(P_3), *Village Daurala*(P_4) and *Village Kaserukhera*(P_5), represent a strategic geographical distribution, encompassing different urban and rural areas. This selection accounts for the variability in industrial activities, population density and environmental characteristics, ensuring a holistic understanding of the overall drinking water quality in Meerut. In order to conduct a comprehensive evaluation Water samples for drinking are gathered from the various city monitoring stations. The points are *Sadar Thana*, *Village Partapur*, *Village Kharkhaoda*, *Village Daurala* and *Village Kaserukhera*. The rapid urbanization and industrialization in Meerut, coupled with a high population density, indeed make it a critical area for assessing and addressing water quality issues. Water will thus be analyzed and studied in order to determine its suitability for drinking and other uses. Samples are collected directly from water flow, ensuring representation from points that reflect average conditions of the water supply. This inclusive approach accounts for the various ways in which residents in Meerut access their drinking water, recognizing the diverse sources and potential contaminants that may be present. This temporal approach offers a more comprehensive understanding of the dynamic nature of water quality that differing environmental circumstances throughout the winter and summer might influence the presence of harmful chemical contaminants.

KEYWORDS: pH, Electrical Conductance, Ground Water.

INTRODUCTION

Water is an unquestionably necessary element for life because it is necessary for all living things to exist. This research explores the important problem of water pollution, concentrating on the area of Meerut. There is a serious risk to public health and welfare when dangerous chemical contaminants are found in drinking water. The principal aim of this study is to conduct a thorough analysis of the different types and concentrations of pollutants found in the water supply of the Meerut region. Additionally, novel techniques for monitoring these contaminants will be developed. A multitude of health problems are caused by the rising contamination of groundwater, a crucial supply of drinking water, by both natural processes and human activity. By introducing dangerous materials like pesticides and heavy metals into water bodies, industrial and agricultural activities have significantly contributed to the deterioration of water quality. In heavily industrialised and inhabited places like Meerut, where there is a high risk of exposure to contaminated water, this scenario is especially critical. Additionally, in order to inform regulatory frameworks and management methods, thorough research on the ecological and human health effects of prolonged exposure to emerging pollutants is required (Postigo et al., 2014).[1] The development of sensor technologies for in-situ monitoring of water quality indices, as examined by Shrestha et al. (2014)[2], represents a noteworthy direction for future research. Furthermore, research by Milly et al. (2014)[3] and Agha Kouchak et al. (2015)[4] highlights the need for strong adaptation measures in the face of shifting hydrological patterns, highlighting the impact of climate change on water resources and the need for increasing attention to this issue. According to Yetisen et al. (2017)[5], wearable sensors and paper-based analytical tools have the potential to provide portable, affordable, and real-time solutions for water quality evaluation. Future studies should investigate the relationship between public health and water quality, especially in areas where there are problems with contamination and water scarcity, as noted by Cohen et al. (2017)[6] and Baker et al. (2018).[7] In order to conserve the world's water resources and develop sustainable water management practices, it will be necessary to address these research needs as society struggles with the intricacies of water quality. As examined by Tripathi et al. (2018)[8] and Mao et al. (2019)[9], the application of AI and machine learning to water quality measurement offers promising opportunities for data interpretation, anomaly identification, and predictive modelling. Research on the effects of climate change on water resources is still crucial, and studies such as those by Wada et al. (2018)[10] and Sun et al. (2020)[11] are needed to comprehend the effects of temperature changes and shifting precipitation patterns on water quality.

Integration of remote sensing technologies for large-scale monitoring, as discussed by Giardino et al. (2019)[12], is essential for understanding spatial and temporal changes in water quality. Future research should focus on standardized methodologies for analyzing microplastics, assessing their ecological consequences, and developing mitigation strategies. The growing threat of emerging contaminants such as pharmaceuticals and personal care products prompted a comprehensive study by Singer et al. (2019)[13] and Tran et al. (2020).[14] A significant area of interest is the continued development of advanced sensor technologies for rapid, high-resolution monitoring of water quality parameters. Research studies such as those by Wang et al. (2019).[15] In addition, research examining the intersection of water quality, public health, and social justice, as highlighted by Collins et al. (2019)[16] and Garcia et al. (2022)[17], is essential for the development of inclusive and sustainable water management strategies. Integrating satellite remote sensing and unmanned aerial vehicles (UAVs) for large-scale water quality monitoring, as discussed by Matos et al. (2020)[18] and Xie et al. (2021)[19], represents a promising avenue for obtaining spatial and temporal insights into aquatic ecosystems. The rise of artificial intelligence and machine learning applications in water quality management was evident, a study by Lin et al. (2021)[20] and Shen et al. (2023)[21] shows the potential for data analysis, pattern recognition, and predictive modelling in understanding complex water quality dynamics. Yang et al. (2022)[22], explore the potential of emerging sensor technologies, including nanomaterial-based sensors and Internet of Things (IoT)-enabled devices, to enable real-time and remote monitoring of water quality. Future research must delve into effective removal technologies and risk assessment strategies for these contaminants in water resources.

EXPERIMENTAL

Methods

An essential component of the extensive research on the observation and tracking of dangerous chemical contaminants in drinking water in the Meerut District is the careful gathering of water samples from several monitoring locations throughout the city. The chosen locations, which include various urban and rural areas, include P_1, P_2, P_3, P_4 and P_5. They constitute a strategic geographical dispersion. The meticulous and precise planning goes into the collecting of water samples, which is a crucial part of the extensive study on the surveillance and monitoring of harmful chemical contaminants in drinking water in Meerut District. The biannual sampling technique is intended to capture the subtle seasonal variations that could affect water quality. It is carried out in the winter, from 15th December 2019 to 15th January 2020, and in the summer, from 15th June 2020 to 15th July 2020. The selected locations, denoted as P_1, P_2, P_3, P_4 and P_5 are strategically chosen to represent various urban and rural settings within the city. With a total of 25 test points spread throughout the five locations, this diverse sampling approach demonstrates a dedication to comprehending the complexities of Meerut City's water quality.

EXPERIMENTAL RESULTS

pH: A scientific tool called a pH metre is used to determine how acidic or alkaline a solution is. It gives the concentration of hydrogen ions in the solution as a numerical value known as pH. The pH scale has a range of 0 to 14, where a value of 7 is regarded as neutral, a value below 7 as acidic, and a value beyond 7 as basic or alkaline.

Electric Conductance: Knowing a material's electric conductance is similar to knowing how easy electricity can pass through it. Consider the water in our watery example as a conduit for little electric charges. Now, what is dissolved or suspended in water determines its capacity to carry electricity. When ions-charged particles-such salt or minerals are added to pure water, which is like a calm stream,it becomes much more conductive.

Chemical Analytical Data of the Five Sampling Site during the winter months (15th December 2019 -15th January 2020) and the summer months (between 15th June 2020 -15th July 2020)

	Site	pH	Electric Conductance µS/cm		Site	Ph	Electric Conductance µS/cm
(between 15th December 2019 -15th January 2020)	P_1	6.72	351	(between 15th June 2020 -15th July 2020)	P_1	6.65	365
		6.62	361			6.63	366
		6.69	340			6.80	370
		6.77	365			6.69	365
		6.65	342			6.62	350
	P_2	6.69	330		P_2	6.83	340
		6.70	301			6.65	334
		6.66	311			6.60	320
		6.74	309			6.80	314
		6.69	302			6.64	318
	P_3	6.78	291		P_3	6.71	299
		6.60	295			6.70	295
		6.56	280			6.62	290
		6.71	276			6.71	284
		6.68	281			6.76	285
	P_4	6.65	453		P_4	6.70	457
		6.73	441			6.63	452
		6.67	414			6.71	451
		6.69	423			6.75	431
		6.66	427			6.66	439
	P_5	6.71	280		P_5	6.75	284
		6.65	273			6.72	278
		6.66	281			6.61	272
		6.72	270			6.67	274
		6.69	266			6.72	275

Where, P_1= Sadar Thana **, P_2**= Village Partapur **, P_3**= Village Kharkhaoda **, P_4**= Village Daurala **, and P_5**= Village Kaserukhera

RESULT AND DISCUSSION

Result and Discussion of pH of Water Samples in Experimental Groups from December 2019 to July 2020

The pH levels of water samples collected from five sampling points (P_1 to P_5) in Meerut city during the winter months (15 December 2019 - 15 January 2020) showed a range between 6.56 to 6.78, while during the summer months (15 June 2020 - July 15, 2020) the pH ranged between 6.60 and 6.83. These pH values indicate a slightly acidic to neutral nature of the water samples, which falls within the acceptable range for drinking water quality standards. Changes observed in pH levels at different sampling sites and at different times of the year can be attributed to a variety of factors, including natural processes and human activities.

During the winter months, pH tiers in any respect sampling sites remained extraordinarily stable with minor fluctuations within a suitable range. This indicates a constant pH stage in water assets throughout this period, suggesting minimal impact of seasonal adjustments or anthropogenic sports. However, in addition investigation is wanted to determine the underlying elements contributing to these located pH ranges, particularly in urban areas wherein human sports can also have an extra goodsized impact on water satisfactory.

In comparison, the summer months showed slightly better pH values as compared to the wintry weather months, despite the fact that nonetheless inside the appropriate variety for drinking water. This seasonal variant in pH values may be attributed to factors which include extended organic pastime, changes in weather styles, and runoff from agricultural sports. Urban places together with *Sadar Thana* and *Village Partapur* may enjoy greater pronounced fluctuations due to better stages of pollutants and human activities, while rural places which include *Village Kharkhaoda* and *Village Daurala* may also display fairly solid pH values influenced through natural factors.

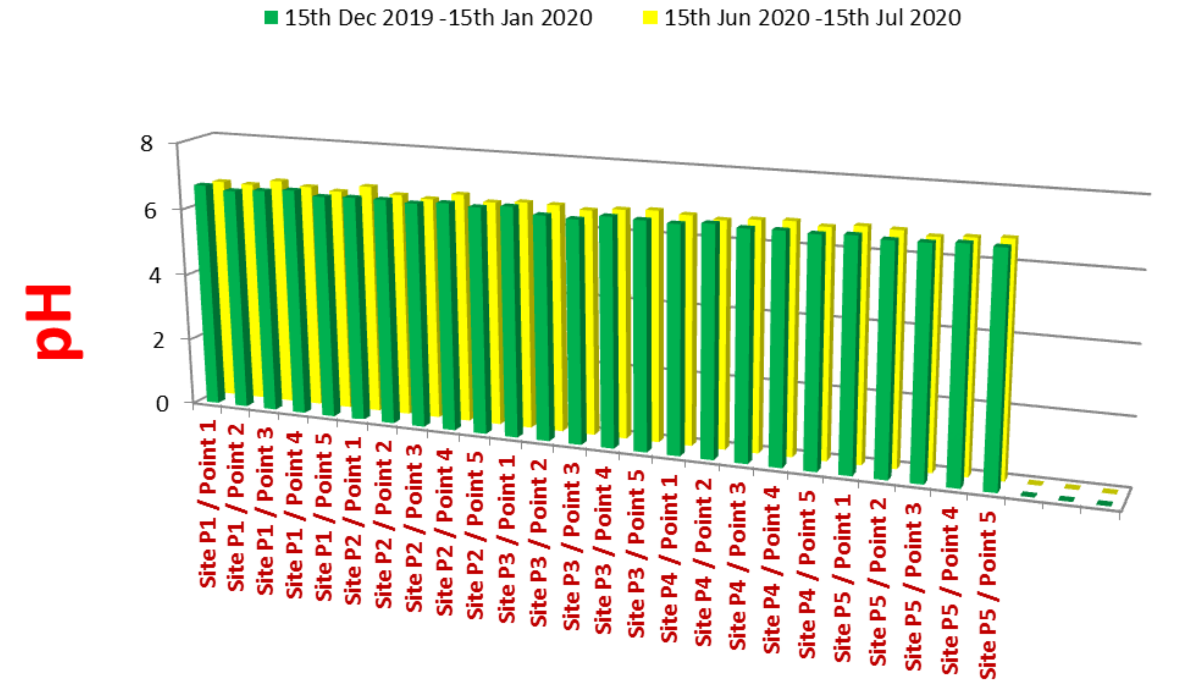

FIGURE 1

Experimental Group - P1, P2, P3, P4 & P5

Result and Discussion of Electric Conductance of Water Samples in Experimental Groups from December 2019 to July 2020

The electric conductance statistics of water samples amassed from the 5 sampling websites (P_1 to P_5) within Meerut town offer treasured insights into seasonal versions and comparative analysis among iciness (15th December 2019 - 15th January 2020) and summer time months (15th June 2020 -15th July 2020). During the winter months, the electrical conductance ranged from 266 µS/cm to 453 µS/cm throughout the sampling web sites. The variety of electrical conductance degrees varied substantially some of the sampling sites, reflecting various environmental conditions and capacity resources of contamination. P_1 exhibited an especially narrow range between 340 µS/cm to 365 µS/cm, indicating slight to excessive stages of ion concentration within the water samples. P_2 confirmed a comparable sample with a variety among 301 µS/cm to 330 µS/cm, suggesting comparable stages of dissolved ions within the water. P_3 had a barely decrease variety among 276 µS/cm to 295 µS/cm, indicating particularly lower ion concentrations compared to P_1 and P_2. Conversely, P_4 displayed a broader range between 414 µS/cm to 454 µS/cm, signifying potentially extended tiers of dissolved ions, in all likelihood attributed to precise neighborhood elements together with commercial sports or geological formations. P_5 exhibited the bottom variety between 266 µS/cm to 281 µS/cm, indicating comparatively cleaner water with lower ion concentrations.

The electric powered conductance facts of water samples gathered from the five sampling web sites (P_1 to P_5) inside Meerut metropolis offer valuable insights into seasonal versions and comparative analysis amongst iciness (15th December 2019 - 15th January 2020) and summer time months (15th June 2020 - 15th July 2020). During the iciness months, the electrical conductance ranged from 266 µS/cm to 453 µS/cm during the sampling internet sites. The sort of electrical conductance stages numerous extensively some of the sampling web sites, reflecting numerous environmental conditions and capacity sources of infection. P_1 exhibited a specifically narrow range between 340 µS/cm to 365 µS/cm, indicating slight to excessive ranges of ion attention inside the water samples. P_2 showed a comparable pattern with a selection amongst 301 µS/cm to 330 µS/cm, suggesting similar degrees of dissolved ions within the water. P_3 had a barely decrease variety among 276 µS/cm to 295 µS/cm, indicating specifically decrease ion concentrations compared to P_1 and P_2. Conversely, P_4 displayed a broader range among 414 µS/cm to 454 µS/cm, signifying probably extended tiers of dissolved ions, probably attributed to unique neighborhood elements collectively with commercial sports or geological formations. P_5 exhibited the bottom range between 266 µS/cm to 281 µS/cm, indicating comparatively purifier water with lower ion concentrations.

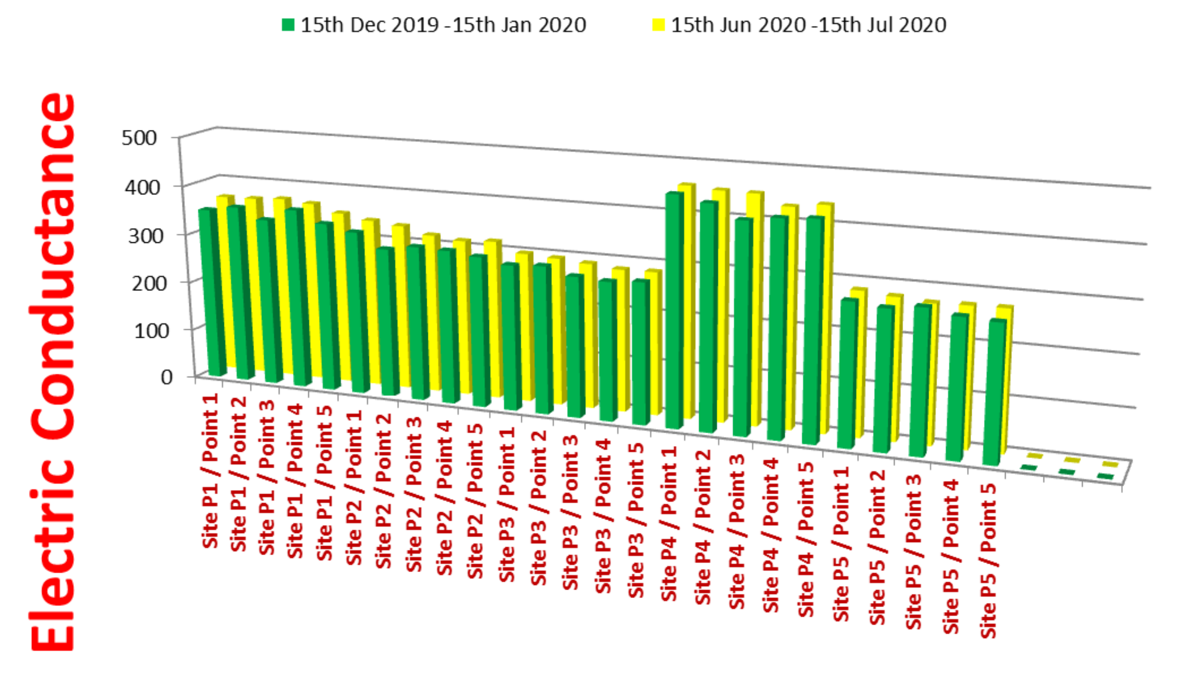

FIGURE 2

Experimental Group - P1, P2, P3, P4 & P5

CONCLUSION

It is concluded from the above discussion that safety measures should be taken at government level to improve water quality in Meerut district. Some awareness campaigns are also needed in Meerut district to improve water quality and strict rules have been implemented for this. Some penalty should be imposed for violating the rules.

REFERENCES

1. Postigo, C., & Richardson, S. D. Transformation of pharmaceuticals during oxidation/disinfection processes in drinking water treatment. Journal of Hazardous Materials, 2014; 279: 461-475.
2. Shrestha, S., Sigmund, E., & Glarborg, P. Miniaturized potentiometric sensors for environmental monitoring of copper. Electrochimica Acta, 2014; 121: 267-272.
3. Milly, P. C. D., Betancourt, J., Falkenmark, M., Hirsch, R. M., Kundzewicz, Z. W., Lettenmaier, D. P., & Stouffer, R.J. Stationarity is dead: Whither water management? Science, 2014; 319(5863): 573-574.
4. AghaKouchak, A., Feldman, D., Hoerling, M., Huxman, T., Lund, J., Sheffield, J., & Udall, B. Water resources in a changing climate. Nature Climate Change, 2015; 5(3): 151-159.
5. Yetisen, A. K., Akram, M. S., Lowe, C. R., & Cooper, J. R. Paper-based microfluidic point-of-care diagnostic devices. Lab on a Chip, 2017; 13(12): 2210-2251.
6. Cohen, A., Colford Jr, J. M., Weir, M. H., & Drayna, P. Water quality, sanitation, and housing in peri-urban neighborhoods in a low-income region of Kisumu, Kenya. Journal of Urban Health, 2017; 94(3): 416-425.
7. Baker, K. K., O'Reilly, C. E., Levine, M. M., & Kotloff, K. L. Sanitation and hygiene-specific risk factors for moderate-to-severe diarrhea in young children in an area of high enteropathogen transmission. Epidemiology and Infection, 2018; 146(1): 87-97.
8. Tripathi, M., Garg, A., Goyal, P., & Varun. Forecasting water quality index in aquatic systems using machine learning approaches. Environmental Monitoring and Assessment, 2018; 190(11): 661.
9. Mao, Q., Wang, X., Zhou, X., & Cao, D. Artificial intelligence in environmental science. Environmental Science: Nano, 2019; 6(7): 1932-1947.
10. Wada, Y., Wisser, D., & Bierkens, M. F. P. Global modeling of withdrawal, allocation and consumptive use of surface water and groundwater resources. Earth System Dynamics, 2018; 9(1): 175-181.
11. Sun, S., Yao, L., Wu, X., Liu, D., & Ding, Y. A review on remote sensing of harmful algal blooms: Current knowledge, challenges, and future directions. Science of The Total Environment, 2020; 747: 141245.
12. Giardino, C., Bresciani, M., Cazzaniga, I., Austoni, M., & Braga, F. Remote sensing of water quality in transitional waters: A new approach for monitoring harmful algal blooms in the Venice Lagoon. Science of The Total Environment, 2019; 646: 1509-1522.
13. Singer, H., Jaus, S., Hanke, I., Lück, A., & Hollender, J. Aldosterone and aldosterone-like molecules in municipal wastewater: Analytical

methods and occurrence. Water Research, 2019; 160: 422-431.
14. Tran, N. H., Reinhard, M., & Gin, K. Y. Occurrence and fate of emerging contaminants in municipal wastewater treatment plants from different geographical regions—a review. Water Research, 2020; 184: 116103.
15. Wang, X., Li, J., He, Y., Shi, Q., Chen, J., Sun, Y., & Pan, W. A highly sensitive and selective nanomaterial-based fluorescent sensor for detection of bisphenol A in water. Chemosphere, 2019; 236: 124388.
16. Collins, S. M., Corman, J. R., Wright, J. M., & Thompson, B. E. The Flint water crisis: A coordinated public health emergency response and recovery initiative. Journal of Public Health Management and Practice, 2019; 25: S84-S89.
17. Garcia, V., Ortiz, L., Rivas, D., Kutz, F., Grotewold, E., & Giri, J. Using remote sensing data and machine learning for assessing water quality in rivers: A case study in the Uruguay River basin. Science of The Total Environment, 2022; 806: 150577.
18. Matos, C. C., & Kiker, G. A. Using unmanned aerial vehicles (UAVs) and remote sensing for assessing water quality and implications for drinking water safety in rural coastal areas. Science of The Total Environment, 2020; 706: 135924.
19. Xie, Y., Huang, W., Ma, R., & Xu, C. Y. Remote sensing and unmanned aerial vehicle applications in water quality monitoring: Current challenges and future directions. Journal of Hydrology, 2021; 595: 125796.
20. Lin, J., Yu, C., Jin, X., Chen, H., Li, L., Zhang, Y., & Zuo, J. A review on the contributions of machine learning approaches in the water quality prediction models. Science of The Total Environment, 2021; 757: 143763.
21. Shen, J., Wei, W., Wu, C., Lu, H., Chen, Y., & Xie, H. An integrated machine learning framework for predicting and explaining water quality in large rivers: A case study of the Yangtze River, China. Journal of Hydrology, 2023; 599: 126352.
22. Yang, Y., Yang, J., Wang, L., Zhu, J., He, J., Huang, L., & Wang, Q. Recent advances in nanomaterials-based electrochemical sensors for the detection of antibiotics in water. Trends in Environmental Analytical Chemistry, 2022; 31: e00146.