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"ASSESSMENT OF WATER QUALITY INDEX (WQI) FOR THE GROUNDWATER IN AGRA AND ALIGARH CITIES, UTTAR PRADESH, INDIA"

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ABSTRACT

WQI is defined as a rating reflecting thecomposite influence of different water quality parameters. We calculate WQI from the pointof view of the suitability of groundwater for human consumption. The paper aims at determining the suitability of groundwater of different locations in Aligarh and Agra city regarding the index also termed as Water Quality Index (WQI).We focus the present work at assessing the Water Quality Index (WQI) for the groundwater of Agra and Aligarh cities. This has been determined by collecting groundwater samples. For calculating the WQI, the following 13 parameters have been considered: pH, Total Dissolved Solids, Electrical conductivity (EC.), Alkalinity, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD),Fluorides(F), Copper (Cu),Iron (Fe), Manganese (Mn), Nickel (Ni), Lead (Pb) and, Zinc (Zn). The WQI for these samples ranges from 189.29 (Sadar, Agra) to 621.41(Dodhpur, Aligarh). We have found the high value of WQI to be mainly from the higher values of nitrate, iron,hardness; total dissolved solid (TDS), fluorides, bicarbonate, and manganese in the groundwater. The results of analyses have been used to suggest models for predicting water quality. The analysis reveals that the groundwater of the area needs of treatment before consumption, and it also needs to be protected from the perils of contamination the results of analyses have been used to suggest models for predicting water quality. The water quality in the Aligarh and Agra city is unsuitable for drinking and irrigation purposes. The Water quality index shows that the maximum area of the Aligarh and Agra city are poor (5% samples), very poor (40% samples), and unsuitable for drinking (55% samples).We should implement proper treatment methods and measures beforethe consumption of the water for drinking and irrigation.To tackle the groundwater depletion in the region, we recommended it to adapt sprinkling irrigation for proper utilization of water resources and to overcome the shortage of water faced in the future.

Keywords: Groundwater, Water quality standards, Pollution, Water quality index, India.

Introduction:

Water is a rudimentary human need and a critical national asset. It is the key to socio-economic development and quality of life. As the pressures of population and economic activities converge requirements, the water sector will increasingly face the challenge of bridging the demand-supply gap.The Agra and Aligarh cities, in particular, is facing a significant water resource problem and as trends suggest, it is expected to become 'water-stressed' by 2025 and 'water-scarce' by 2050 (IDSA, 2010). The groundwater is under stress in almost all parts of India due to swift development in agricultural activities, industrialization, urbanization, education, improved sanitation and an increase in population. These scarcities of water make groundwater more precious. Aligarh and Agra district is also marred by off and on the water crisis.

Groundwater is used for domestic and industrial water supply and irrigation all over the world. In the last few decades, there has been a amazing increase in the demand for freshwater due to the swift growth of the population and the accelerated pace of industrialization. Human health is threatened by most of the agricultural development activities particularly in relation to excessive application of fertilizers and unsanitary conditions. Rapid urbanization, especially in developing countries like India, has affected the availability and quality of groundwater due to its overexploitation and improper waste disposal, especially in urban areas. According to the WHO

Organization, about 80% of all the diseases in human beings are caused by water. Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source. It, therefore, becomes imperative to regularly monitor the quality of groundwater and to device ways and means to protect it. Water quality index is one of the most effective tools. It, thus, becomes an important parameter for the assessment and management of groundwater. WQI is defined as a rating reflecting the composite influence of different water quality parameters. WQI is calculated from the point of view of the suitability of groundwater for human consumption. The objective of

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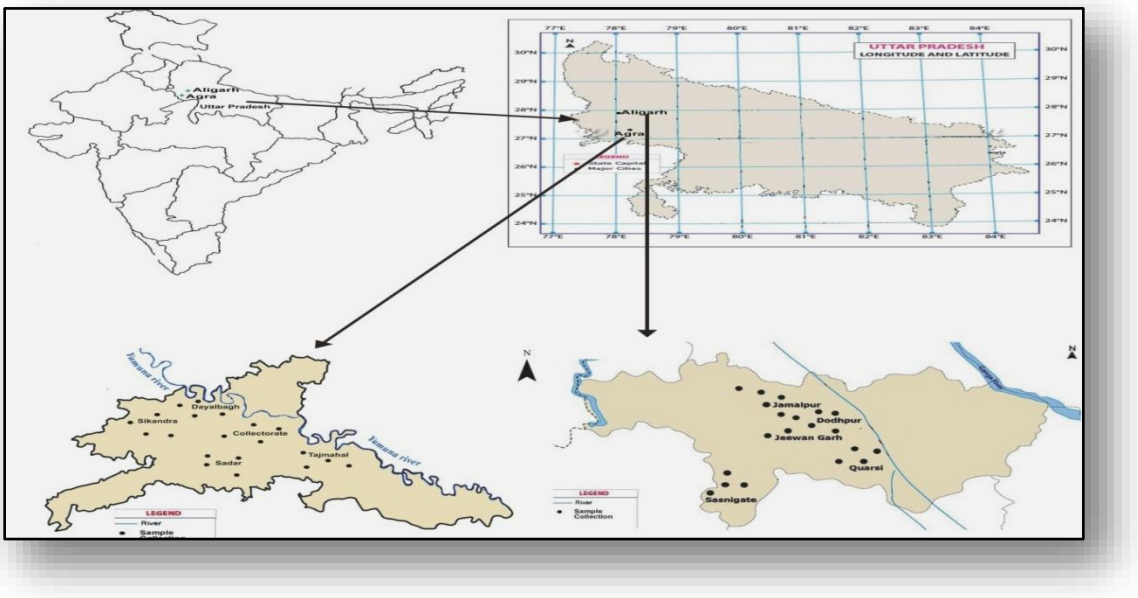
the present work is to discuss the suitability of groundwater for human consumption based on computed water quality index values.

Geology of Study area: The district of Agra and Aligarh occupies a part of Indo-Gangetic plain and its major part is underlined by alluvial sediments of Quaternary age comprising mainly a sequence of clay, silt, sand of different grades, gravels and kankar in varying proportions. The alluvium was deposited over the slopes of the basement of Vindhyan rocks e.g. sand stone, shale, silt stones etc.

Period	Age	Group	Lithology
Quaternary	Holocene	Newer Alluvium	Fine to medium grain micaceous sand with subordinate silt &
	Middle to Late Pleistone	Older Alluvium	Oxidised, Khaki to brownish yellow silt,
Varanasi Alluvium)		clay with kankar dessiminations, and grey to brown fine to medium grained sand	
----------Unconformity----------			
Proterozoic-III	Vindhyan Super Group	Upper Bhander Group	sandstone with shale, siltstone, shale pebble conglomerate.

Study Area:

The Agra district is located in western Uttar Pradesh, India,between 27.11' degree Latitude North and 78.0' degree to 78.2' degree Longitude East. Its Altitude is 169 meters above sea level (Figure 1). On the North it is bounded by Mathura district, on the South it is bounded by Dhaulpur district, on the East it is bounded by Firozabad district, and on the West it is bounded by Bharatpur. Agra is situated on the bank of the Yamuna River.Aligarh is a city in the northern Indian state of Uttar Pradesh and the administrative headquarters of the Aligarh district. The city lies 203 km northwest of Kanpur and is 140 km southwest of the capital New Delhi. Aligarh is located at the coordinates 27.880 N 78.080 E. It has an elevation of approximately 178 meters (587 feet). The city is in the middle portion of the doab.



Figureno.1 Sample Location map of Study area

Methodology:
Groundwater samples were collected from 20 locations during pre-monsoon and a post-monsoon period (July and February 2017) shown in Figure 1. Each of the groundwater samples was analyzed for pH, Total Dissolved Solids (TDS), Electrical conductivity (EC.), Alkalinity, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Fluorides (F), Copper (Cu), Iron (Fe), manganese (Mn), Nickel (Ni), Lead (Pb), and Zinc (Zn), using standard procedures recommended by WHO & BIS. The Water quality index is calculated from the point of view of the suitability of groundwater for human consumption.

OBJECTIVE:
The main objective of the research paper is to deliberate the practicableof groundwater for humanconsumption-based on water quality index values.

Results and Discussion: The chemical analyses of the groundwater and the percent assent with the Indian Standards and WHO are summarized in Table 1. The water quality index was calculated by usng the weighted Arithmetic Index method. Necessarily a WQI is aassembling of the number of parameters that can be used to determine the overall grade or quality of the water

Water Quality classification based on WQI value			
WQI Value	**Water Quality**	**Percentage of water samples Pre & Post-monsoon**	**Percentage of water samples Pre &Post-monsoon**
Less than 50	Excellent	Nil	Nil
50-100	Good Water	Nil	Nil
100-200	Poor Water		
200-300	Very Poor Water		0
Above 300	Unsuitable for drinking	1	5
Total samples of Pre & Post -monsoon		20	100

Comparison of Agra and Aligarh Water Quality Index:

Agra City				
Sample Location	Pre-Monsoon	Water Quality	Post - Monsoon	Water Quality
Sikandra	243.72	Very Poor	239.67	Very poor water
Dayalbagh	260.02	Very poor	278.72	Very poor water
Sadar	258.66	Unsuitable for drinking	289.29	Poor Water
TajMahal area	286.33	Unsuitable for drinking	280.69	Unsuitable for Drinking
Collectorate	264.35	Very poor	259.95	Very poor

Aligarh City				
Sample Location	Pre-Monsoon	Water Quality	Post - Monsoon	Water Quality
Dodhpur	312.27	Unsuitable for Drinking	321.41	Unsuitable for Drinking
Sasnigate	266.74	Very poor water	261.23	Very poor water
Quarsi	289.99	Unsuitable for Drinking	354.25	Unsuitable for Drinking
Jeevangarh	325.57	Unsuitable for Drinking	320.42	Unsuitable for Drinking
Jamalpur	250.06	Unsuitable for Drinking	241.89	Unsuitable for Drinking

In this study, the computed WQI values range from 189.29 (Sadar, Agra) to 621.41(Dodhpur, Aligarh) and therefore, can be designate into five types "excellent water" to "water unsuitable for drinking". Table 4 shows the percentage of water samples that fall under different quality. The high value of WQI at these stations has been found to be mainly from the higher values of iron, nitrate, total dissolved solids, hardness, fluorides, bicarbonate, and manganese in the groundwater

The permissible total dissolved salts for drinking water is 500 mg/L. The range of TDS levels in the study area is 301-1030 mg/L.The highest concentration of total dissolved solids was found to be 1030mg/L at Dayalbagh,Agra and 870 mg/L in sasnigate Aligarh due to dense residential area and due to intensive irrigation in that area, but the high values of TDS in groundwater are generally not harmful to human beings but highconcentration of these may affect persons, who are suffering from kidney and heart diseases. Water containing high solids may cause laxative or constipation effects

Conclusions

A mathematical equation used in water quality index to remodel range (sizable amount) of water quality information into one number. For decision makers' possible uses and quality of any water body, a single number (WQI) is straightforward to understandable.The WQI for 20 samples range from 189.29 (Sadar, Agra) to 621.41(Dodhpur, Aligarh). The high value of WQI at these stations has been found to be mainly from the higher values of iron, nitrate, total dissolved solids, hardness, fluorides, bicarbonate, chloride, and manganese in the groundwater. About 5% of water samples are poor in quality, 40% of water samples very poor in quality and 55% of water samples unsuitable for drinking. In this part, the groundwater quality may improve due to the inflow of freshwater of good quality during the rainy season. Magnesium and chloride are significantly interrelated and indicates that the hardness of the water is permanent in nature. Estimation of water quality index by exploitation appropriate technique and verify the standard of bore well water by applied math analysis for post and pre monsoon seasons, results of water quality assessment showed that some water quality parameters slightly higher in wet season as compare to summer season [Devendra Dohare et al. 2014].

Recommendations and Suggestions: There are various measures which made to control the water pollution

1) Proper planning should be executed before drawing the underground water.
2) Groundwater must be pre-treated so as to ensure less health threat.
3) The overall the quality of groundwater is poor and this situation needed urgent treatment.
4) Water quality index is a manual way in order to understand the water quality.

Suggestions:

1) People should be aware about the effect of water-pollution.
2) Sanitation system must be improved.
3) Laws realting to pollution should be strictly enforced on people.
4) Treatment of wastes before discharge is necessary.

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