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Review Article

A STUDY ON DIFFERENT CHARACTERISTICS OF GROUNDWATER QUALITY

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ABSTRACT
A water quality analysis was conducted to monitor the ground water of selected locations of Mathura city by evaluating the various physico-chemical parameters. Water samples from Krishna Nagar to Prabhat Nagar were collected and analyzed for physico-chemical parameters such as pH, total dissolved solids, total hardness, chlorides, turbidity and alkalinity. The results were compared with the drinking water standards of CPCB and BIS. The present study indicated that there is a need for regular monitoring of groundwater for physico-chemical characteristics in the area.

INTRODUCTION
In the last few decades, there has been a tremendous increase in the demand for groundwater due to rapid growth of population and the accelerated pace of industrialization (Ramakrishnaiah *et al.,* 2009). Potable water is the water that is free from disease producing microorganisms and chemical substances. About 10% of the rural and urban populations do not have access to regular safe drinking water and many more are threatened (Ramesh *et al.,* 2012). Most of them depend on unsafe water sources to meet their daily needs. The story of each city may be different, but the main reasons for the water crisis are common, such as, increasing demand, zonal disparity in distribution of water supply, lack of ethical framework, inadequate knowledge and resources, major land-use changes, long term water level declines, increase in salinity and pollution (Datta, 2005). Groundwater is the ultimate and most essential suitable fresh water resource for human consumption in both urban as well as rural areas. The importance of groundwater for existence of human society cannot be overemphasized. There are several states in India where more than 90% population is dependent on groundwater for drinking and other purposes (Ramachandraiah, 2004). Groundwater is a source used for agricultural and industrial sector nowadays (Ramesh and Soorya, 2012). Groundwater is used for domestic, industrial, water supply and irrigation all over the world. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population, unplanned urbanization, industrialization and too much use of fertilizers and pesticides in agriculture (Joarder *et al.,* 2008). Ground water meets domestic needs of more than 80 % rural and 50 % urban population besides irrigation. Around two fifth of India's agriculture output is contributed from areas irrigated by groundwater (Anita and Gita, 2008). Over exploitation of ground water through the bore well and their improper handling resulted in very low ground water levels besides contamination of even bore waters at some places (Rao *et al.,* 2013). Unrestricted exploitation of groundwater and excessive use of fertilizers and pesticides has made possible the infiltration of detrimental constituents to the groundwater. Domestic and industrial waste also defiles groundwater (Aoto and Adiyiah, 2007). As a result, groundwater becomes unhygienic (Rajankar *et al.,* 2009). Hence a continuous monitoring on groundwater becomes mandatory in order to minimize the groundwater pollution and have control on the pollutants (Arya *et al.,* 2011; Meena and Bhargava, 2012). This study involves the determination of physical and chemical parameters of groundwater of Mathura city. The objective of this study is to assess the present water quality, through analysis of some selected water quality parameters like pH, Total Hardness, Total Dissolved Solids, Chlorides, turbidity and alkalinity and compare the results with the standards values recommended by CPCB and BIS.

Study Area
The geography of Mathura has a major influence on its climate and topography. Mathura is a city in the North Indian state of Uttar Pradesh. Mathura lies between the coordinates 27°41' North latitude and

77°41' East longitudes. This city in Uttar Pradesh is located on the beautiful banks of the river Yamuna. Mathura, popularly known as Brajbhoomi is 145 km South of the capital city of New Delhi. The holy city is just 50 km from Agra, where the beautiful Taj Mahal is located; about 11 kilometers from the town of Vrindavan and 22 kilometers from Govardhan (MSME, Govt. of India).
It is Hot in summer. Mathura District summer highest day temperature is in between 24°C to 45°C. Average temperatures of January is 15°C , February is 17°C , March is 24°C , April is 31°C , May is 36°C.

MATERIALS AND METHODS

In present investigation fifteen water samples were collected from sampling locations: Krishna Nagar, Dharam Shala, Golpara, Govind Nagar, Bank Colony, Chaubey Apra, Bhuteshwar, Bangali Ghat, Janm Bhumi, Chowk Bazar, Shanti Nagar, Sadar Bazar, River Yamuna, Madhav Puri, Prabhat Nagar, in polythene bottles which were cleaned with acid water, followed by rinsing twice with distilled water. The water samples are chemically analyzed. The analysis of water was done using procedure of standard methods.

RESULTS AND DISCUSSION

pH

pH is affected both by the action of carbon dioxide and by the organic and inorganic solutes present in water. Any alteration in water pH is accompanied by the change in other physico-chemical parameters (Wetzel and Limology, 1975). The range of pH from the study area was found to be between 6.2- 8.7 which is within the maximum limits set by the standards of WHO. High value of pH may result due to waste discharge, microbial decomposition of organic matter in the water body (Patil *et al.*, 2012)

Total Dissolved Solids (TDS)

TDS indicates the concentration of all dissolved minerals in water and the general nature of salinity of water. In the present study TDS value ranged from 876 mg/L to 1817 mg/L. All the values of TDS are found to be within the desirable limits of 500- 2000 mg/L. TDS in groundwater originate from natural sources, sewage, urban run-off and industrial wastes (Yadav *et al.*, 2011).

Total Hardness

It is caused primarily by the action of cations such as calcium and magnesium and anions such as carbonate, bicarbonate, chloride and sulphate in water. The hardness of water has no known adverse effects; however, some evidence indicates its role in heart diseases, Schroeder (1960), and hardness of 150-300 mg/L may cause kidney problems and kidney stone formation (Jain, 1998). Hard water is unsuitable for domestic use.

It causes an unpleasant taste and reduces the ability of soap to produce lather. In the present study area, the hardness was found to vary between 380- 601 mg/L. The maximum allowable limit of TH for drinking purpose is 600 mg/L as per standards. Groundwater in the area exceeding the limit of 300 mg/L as $CaCO_3$ is considered to be hard, Sawyer and MxCarthy (2003), which may be due to industrial discharges, sewage effluents and geology of the rocks (Ramesh and Soorya, 2012).

Total Alkalinity

The alkalinity of water is the capacity to neutralize its acidic nature and is characterized by the presence of hydroxyl ions. The range of alkalinity in the study area has found to be 208- 601 mg/L while the standards are 200- 600 mg/L.

Turbidity

Turbidity is caused due to the presence of suspended matters, clay silt, colloidal organic particles, plankton and other microscopic organisms. The recommended values are between 5 NTU and 10 NTU. The minimum and maximum in the present study are found to be 5 NTU and 9 NTU respectively.

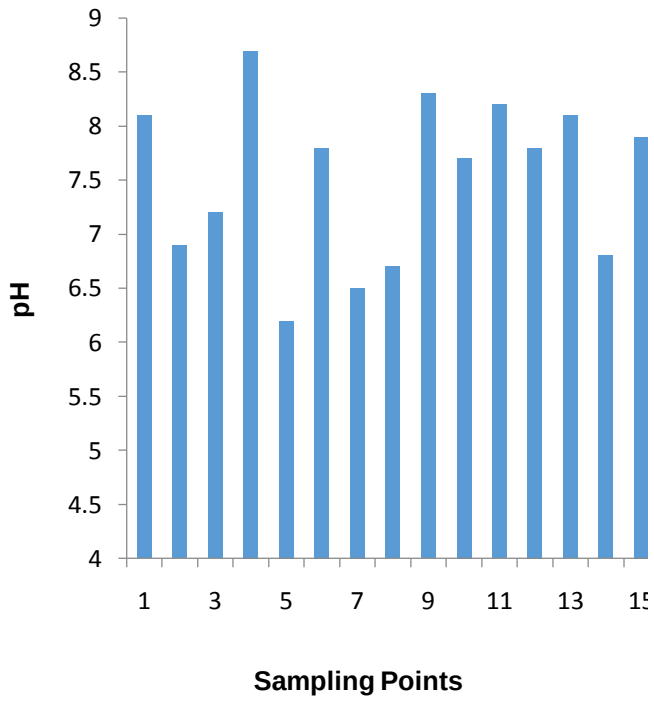


Figure 1: Variation of pH

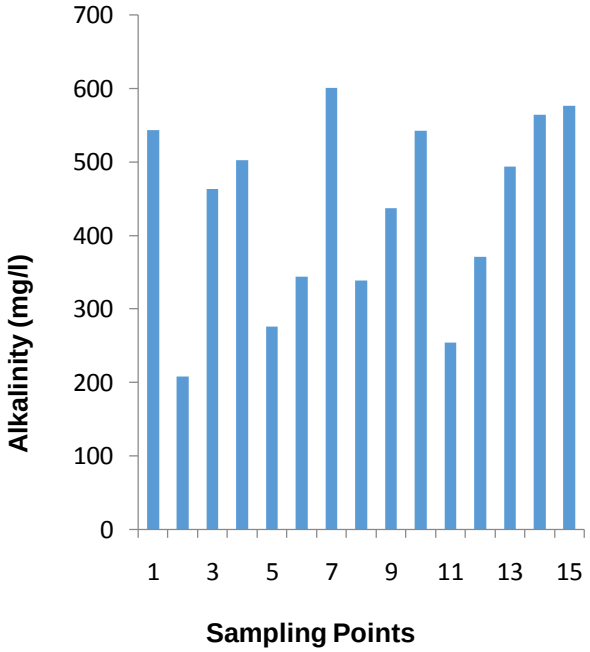


Figure 2: Variation of Alkalinity

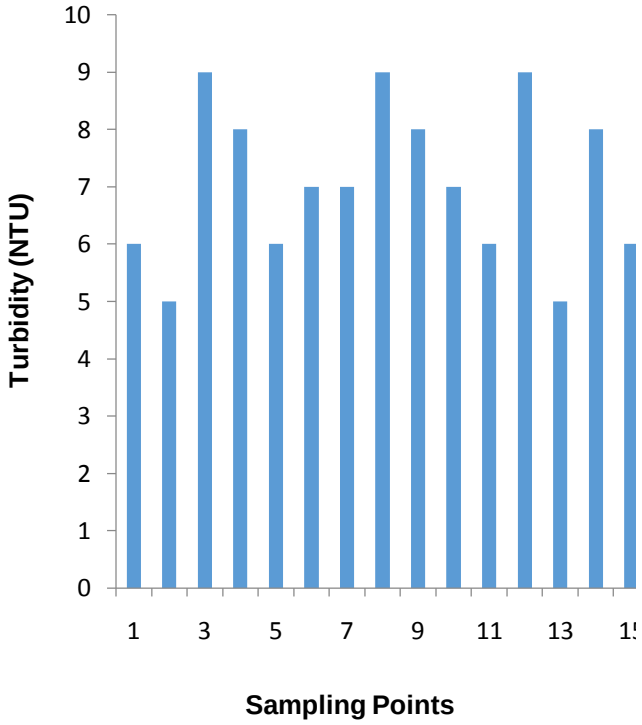


Figure 3: Variation of Turbidity

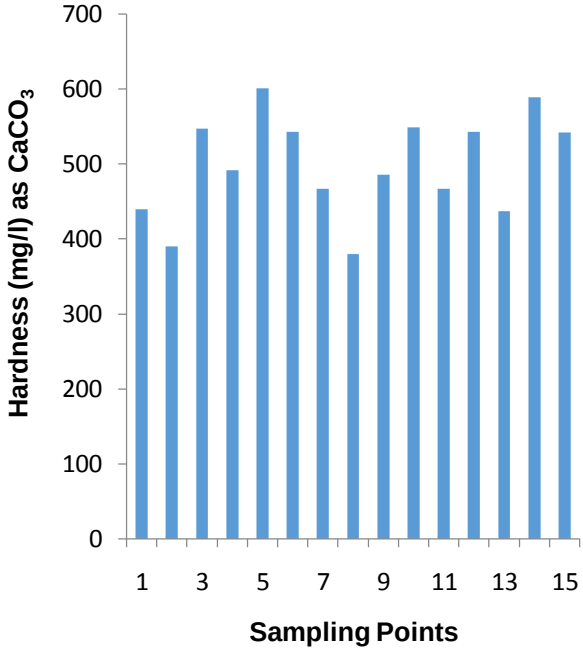
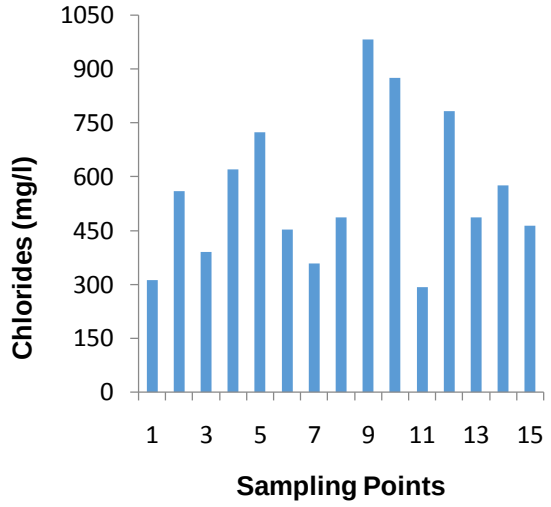


Figure 4: Variation of Hardness



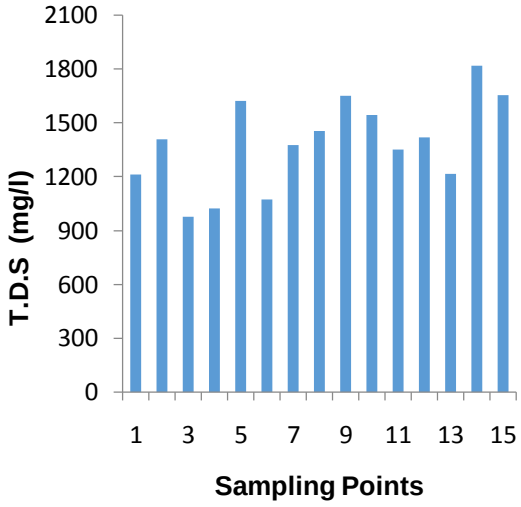


Figure 5: Variation of Chlorides

Figure 6: Variation of T.D.S

Chloride

Chloride, a major anion in potable and industrial water has been found to have no adverse effects on health, but imparts a bad taste to drinking water. The chloride concentration usually serves as an indicator of water pollution by sewage. The chloride content of groundwater in the study area is found to range from 292 to 982 mg/L.

Conclusion

Analysis of groundwater samples collected from the study area indicates that the pH of the water samples analyzed was within the desirable limit of 6.5-8.5 given by BIS standards and most of the samples were slightly alkaline in nature. Similarly TDS and total hardness in the water samples were found to be within the permissible limits of drinking water. The total alkalinity and turbidity were found to be within their respectable standard limits.

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