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Quality assessment of Ground water at Agra district, India

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A B S T R A C T

A water quality analysis was carried out in Agra city for the evaluation of the current status of physico-chemical contaminants and their sources in groundwater. Groundwater samples were obtained from fifteen different sampling stations in Agra city. The results were compared with standards prescribed by CPCB and BIS. Different parameters were analyzed that are pH, alkalinity, turbidity, TDS, total hardness and chlorides. The sampling sites showed that the physicochemical parameters were within the water quality standards and the quality of water was found to be fit for drinking purposes.

Introduction

Water is a prime need for human survival and industrial development (Shahnawaz and Singh, 2009). Physico-chemical parameters are highly important with respect to the occurrence and abundance of species. Discharge of urban, industrial and agricultural wastes have increased the quantum of various chemicals that enter the receiving water, which considerably alter their physico-chemical characteristics. In advanced life of present era, water has direct bearing on health of all the animals including man. Accountable reflection of quality of water in various sectors is the subject of interest of modern life. Advancement in technology has boosted the human population and also enhanced water

use and simultaneously put burden on the existing water bodies to fulfill the industrial, agricultural and domestic use of water; which is said to be unending process of development (Agarwal et al., 2012).

Among the various source of water, groundwater is considered to be the safe for drinking purposes. The water which is being used for industries, agriculture and human needs adds continuously contaminants to the ground water. Groundwater is used intensively for irrigation and industrial purposes. People around the world are using ground water as a source of drinking water and even today, more than half of the world's population depends on it for

survival. Ground water constitutes 97% of global fresh water and many regions, ground water sources are the single largest supply for serving drinking water to the community. Moreover, for many communities it may be the only economically viable option for drinking. Thus the availability of clean ground water is most essential, as it serves as the basic and critical component in different spheres of human life for a large number of habitations (Tewari et al., 2010). Due to the paucity of sufficient surface waters, invariably the people are thriving upon the groundwater sources to meet their water requirements (Abbulu and Rao, 2013). A variety of land and water-based human activities are causing pollution of this precious resource. Its over-exploitation is causing aquifer contamination in certain instances (Tewari et al., 2010).

The rapid growth of population and the resultant increased demand of water, necessitated for the usage of groundwater to augment the existing water supply systems, in most of the cities in the country. Secondly, the growing urbanization and industrialization and the consequent pollution of surface water sources, also increased the necessity of using groundwater for various domestic and industrial purposes (Abbulu and Rao, 2013). With this background, the present study was initiated to determine the concentration of contamination and the suitability of groundwater for drinking purpose. The present investigation deals with the study of physico-chemical parameters like temperature, pH, total hardness, total dissolved solids, chlorides, turbidity and alkalinity.

Study Area

The city of Agra is in Uttar Pradesh, which is a state located in the northern part of

India. It is located at a distance of about 200 kilometers from New Delhi, which is the capital city of the Indian Republic. In geographical terms, the exact location of the city of Agra is 27.10° north and 78.05° east. The city of Agra is built along the banks of the Yamuna, one of the premier rivers in the nation. The city is located at an average altitude of 171 meters or 561 feet above the sea level. The geography of Agra is such that it is surrounded by the city of Mathura on the northern side. To the south of Agra is Dhaulpur. Firozabad is located on the eastern side of the city of Agra. Fatehabad lies on the south-eastern side of Agra city. To the west of Agra lies Bharatpur. The city of Agra forms a part of the great northern plains. On the basis of landmass, Agra is the third largest city in the state of Uttar Pradesh (MSME, Govt. of India). Agra features a semiarid climate that borders on a humid subtropical climate. The city features mild winters, hot and dry summers and a monsoon season. However the monsoons, though substantial in Agra, are not quite as heavy as the monsoon in other parts of India. This is a primary factor in Agra featuring a semiarid climate as opposed to a humid subtropical climate.

Materials and methods

A total of twenty water samples were collected from different locations (IIMT Group of Colleges, Rei Inter College, Saran Ashram Hospital, Basanth Vihar, Kamla Nagar, Dayal Bagh, ITI, Agra University Boys Hostel, Rambagh, Bhardwaj Hospital, Ram Lakhari Inter College, Nawalganj, Lohiya Nagar, Astha City Centre, Agrasen, Seva Sadan) in Agra, UP, India. All the samples were collected in sterilized bottles and were stored at 4°C till further investigation. The collected water samples were analyzed for various physico-chemical parameters.

The procedure for analysis was followed as per standard methods of analysis of water and wastewater. The parameters analyzed were temperature, pH, hardness, total dissolved solids (TDS), turbidity, alkalinity and chlorides. All the chemicals and reagents used for the study were of analytical grade and instruments were of limit of precise accuracy.

Results and discussion

pH

pH is a measure of the hydrogen ion concentration in water and indicates the acidity and alkalinity of water. The standard values of pH for drinking water by BIS is between 6.5-8.5 while that of WHO standards is between 7.0- 8.5.

High value of pH may results due to waste discharge, microbial decomposition of organic matter in the water body (Patil et al., 2012). In the present study all the samples have pH values were between 6.4- 7.9 and were within the prescribed limits.

Total dissolved solids

The total dissolved solids (TDS) observed in the study area is found to be between 722-1910 mg/L. It is in the standard range of 500- 2000 mg/L. Generally, the higher TDS causes gastro-intestinal irritation to the human beings, but the prolonged intake of water with the higher TDS can cause kidney stones and heart diseases (Garg et al., 2009).

High TDS is usually due to the influence of anthropogenic sources such as domestic sewage, industrial waste, septic tanks, agricultural activities and influence of rock-water interaction (Ramesh and Surya, 2012).

Total Hardness

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water¹⁵. The total hardness is an important parameter of water quality assessment and conveys if the water can be used for domestic, industrial or agricultural purposes.

The hardness is caused due to the presence of excess of Ca, Mg and Fe salts (Kumar and Kumar, 2013). The maximum total hardness value was observed as 549 mg/L and minimum was 307 mg/L in the study area.

Turbidity

The turbidity in the present area of study was found to be between 5- 9 NTU. It was well within the prescribed standards of 5- 10 NTU.

Total Alkalinity

Alkalinity value in water indicates the presence of natural salts in water. The alkalinity is mainly due to the bicarbonates. In the present study the alkalinity ranged from 259– 604 mg/L. The alkalinity values are under the reasonable limit of 200- 600 mg/L as per WHO standards (1993). Yadav et al., 2012 reported the total alkalinity (330– 525 mg/L) in Agra city.

Chloride

Chloride content of the ground water samples obtained from the study area was found to be in the range of 256- 976 mg/L. It was well within the standard range of 250-1000 mg/L.

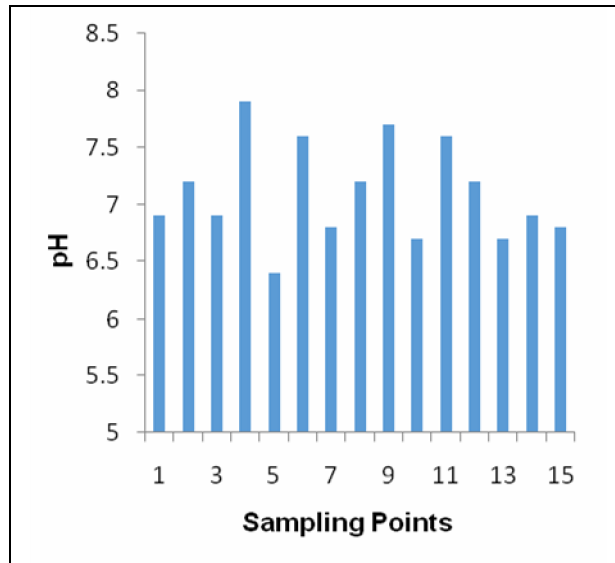


Fig 1: Variation of pH

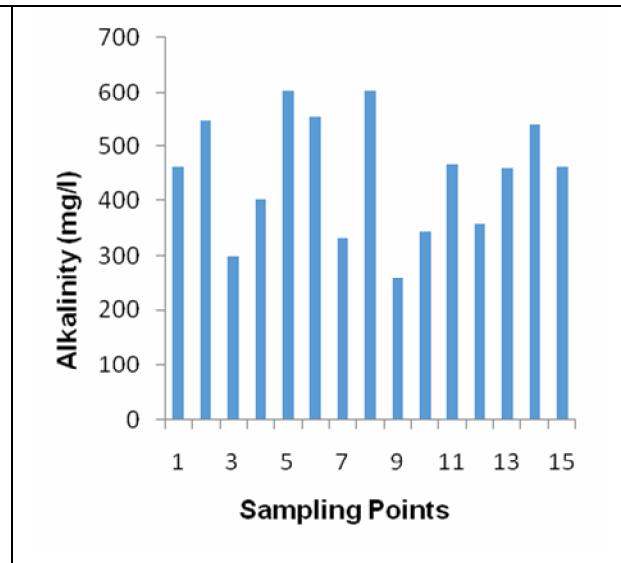


Fig 2: Variation of Alkalinity

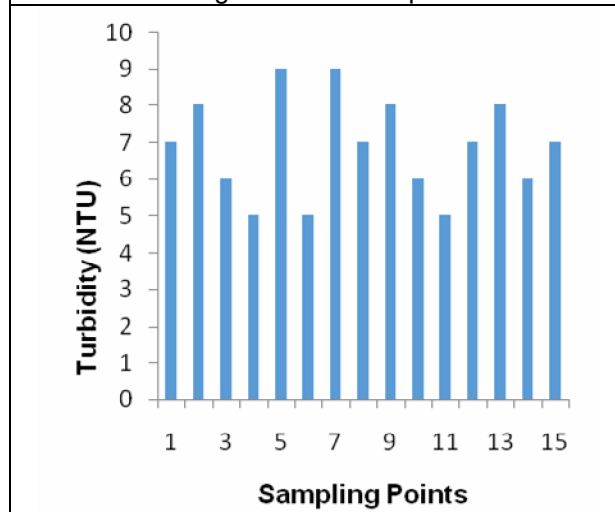


Fig 3: Variation of Turbidity

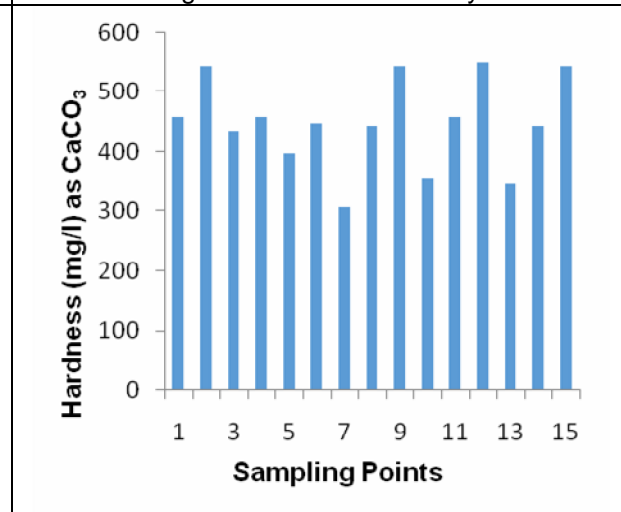


Fig 4: Variation of Hardness

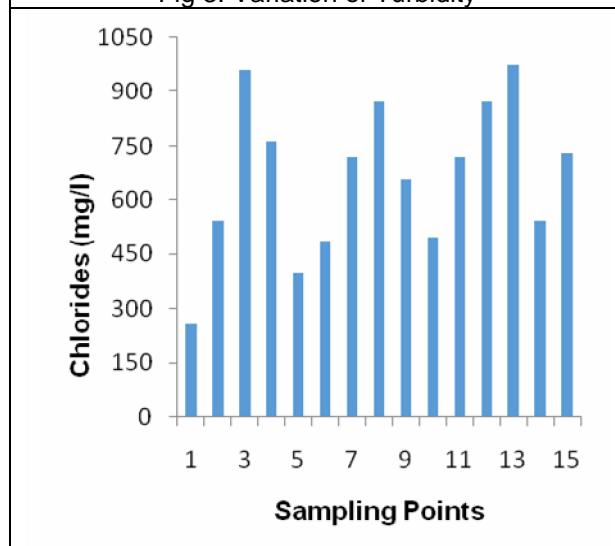


Fig 5: Variation of Chlorides

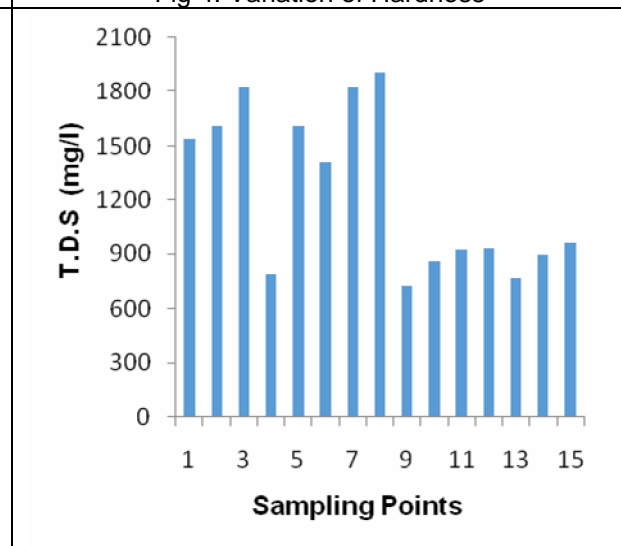


Fig 6: Variation of T.D.S

Conclusions

The groundwater quality analysis of Agra city is found to be fit for drinking purposes. The different values of the parameters under consideration were found to be- 7.2 for pH, 450 mg/L for total alkalinity, 7 NTU for turbidity, 425 mg/L for total hardness, 700 mg/L for chlorides and 1200 mg/L for total dissolved solids. All the parameters were found to lie well within the prescribed standard limits.

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