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Full Length Research Paper

Evaluation of drinking water quality

Krishna Vaidya[1]* and Mohini Gadhia[2]

[1]Department of Biology, K.B.S. College, Vapi, Gujarat, India.
[2]Veer Narmad South Gujarat University, Surat, Gujarat, India.

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Navsari District is located in the south eastern part of Gujarat State in the coastal lowland along Purna River in India. It's geographical coordinates are 20°51' 0" North, 72°55' 0" East. In the present study, the physico-chemical parameters of Navsari District (Gujarat, India) have been analyzed regarding their suitability for drinking purpose. The study was carried out by collection of water samples from six sampling sites. These samples are analyzed for turbidity, pH, total solids, total suspended solids, total dissolved solids, total hardness, magnesium hardness, calcium hardness, phenolphthalein alkalinity and total alkalinity. The analyze results is compared with permissible limits as prescribed by World Health Organization (WHO), Gujarat pollution control board (GPCB) for drinking water quality.

Key words: Drinking water, hardness, total solids, pollution, Navsari.

INTRODUCTION

Water is the most beautiful and precious gift of nature without which no life could survive on earth (Dara, 1998; Kumar and Tripathi, 2000). Water takes many different shapes on earth and to study water a new science evolved named as "Hydrology" which is the science to know the properties, distribution and behavior of water in nature (Fair and Geyer, 1958). Among the various needs of water, the most essential need is drinking. Surface water and ground water are two major sources for the supply of drinking water. Surface water comes from lakes, reservoirs and rivers. Groundwater comes from wells that the water supplier drills into aquifers (Park, 1997). Maintaining the quality of water is the most important one for human being since it is directly linked with his daily life (Gosh, 2002). Thus, proper and managed study of water, especially freshwater is essential to understand the relationship and interdependence of various constituents of any habitat.

The town of Navsari is approximately about 2000 years old. The city is situated at southeastern Gujarat State, west-central India. It is situated in the coastal lowland along the Purna River. District covers an area of 2,211 km^2 and has population of 1,229,463 of which 27.36% is urban. It lies between 20°51' 0" North, 72°55' 0" East. Weather is pleasant almost all the year around, sunny from September to May, rainy from June to August. There are two lakes in the city namely; Dudhiya Talao and Sarbatiya Talao. The main source of Nagarpalika water works supply in Navsari City comes from Kakarapar through a canal and is stored in a small reservoir called "Dudhiya Talao" (Patel et al., 2000). The kakrapar dam is constructed across the river Tapi and down stream of Ukai dam. To monitor the potable water quality, total selected six sampling sites shown in Plate 1 are untreated water of Dudhiya Talao (Site 1), treated water of Navsari water works (Site 2), Station Area (Site 3), Lunsikui Area (Site 4), Chhapra Village (Site 5) and Viraval Village (Site 6).

MATERIALS AND METHODS

In the present study, six sampling sites were selected. The sampling was done on seasonal pattern. Composite sampling method was particularly adopted in (Site 1). The taps were kept open for 2 to 3 min while collecting samples from pipeline supply to remove the possible impurities in water through pipes. Water samples were collected at fixed time to maintain the consistency in the results. Care was also taken for collection timing depending on

*Corresponding author. E-mail: krish_bio@yahoo.co.in.

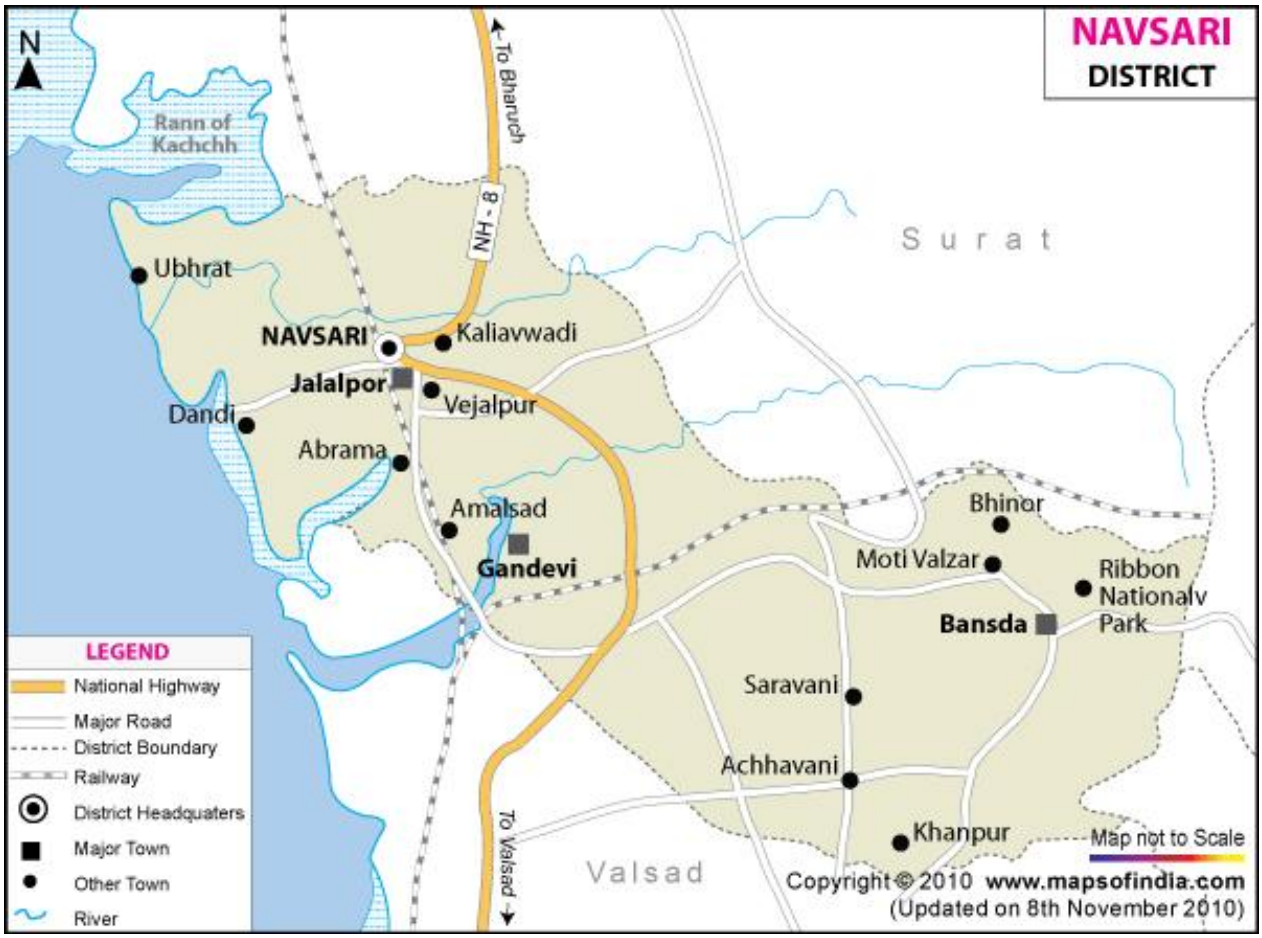


Plate 1. Map of Navsari.

water supply from Navsari Nagar Palika.

The methods of APHA (1995) and Trivedi and Goel (1986) were followed for water analysis. The parameters such as turbidity, pH, total solids, total suspended solids, total dissolved solids, total hardness, magnesium hardness, calcium hardness, phenol-phthalein alkalinity and total alkalinity were brought for further analysis.

RESULTS

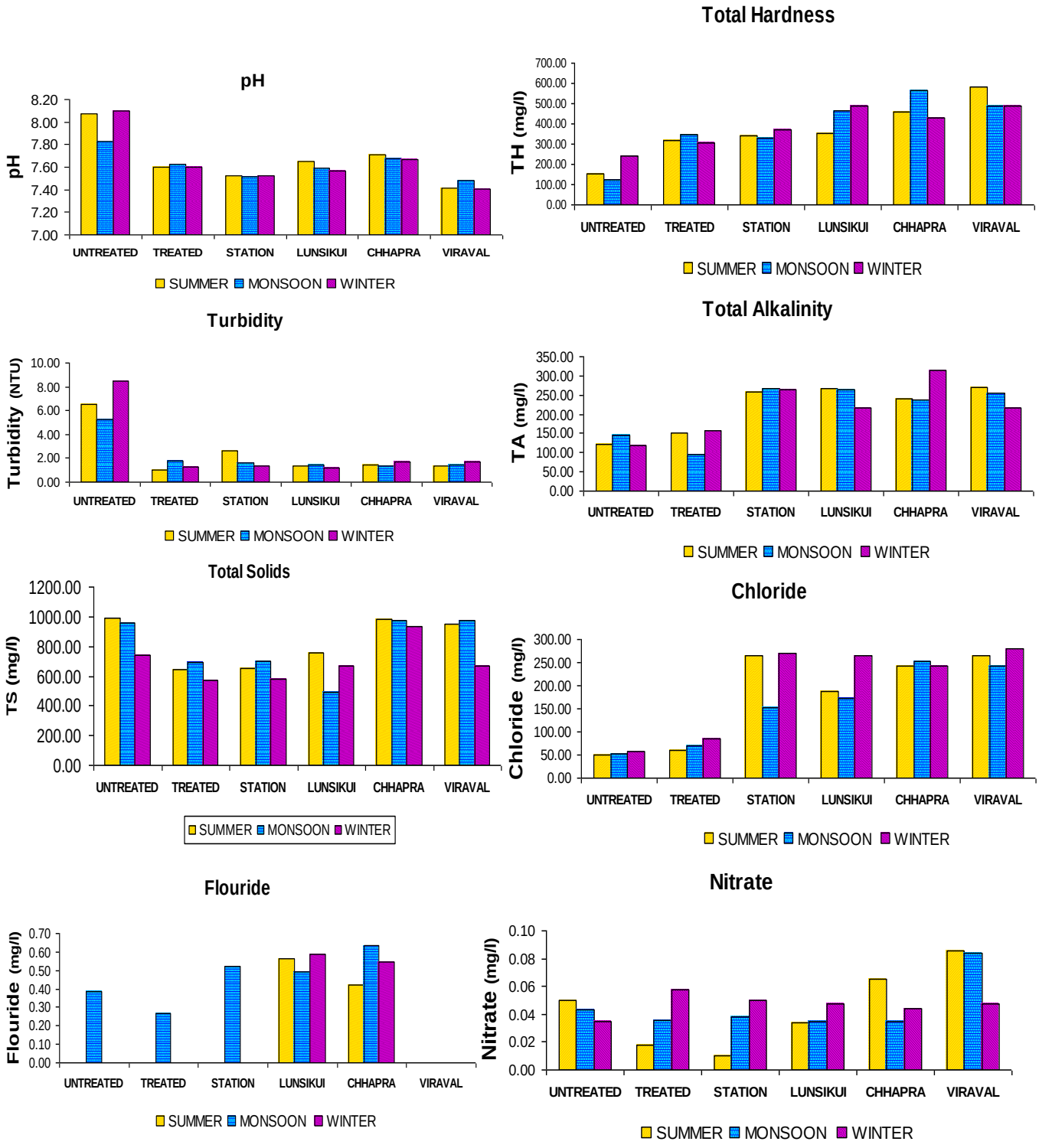
The results of physico-chemical parameters of average six sampling sites are shown through Graph 1. Turbidity of drinking water of Navsari District was higher from Site 1 and reduced drastically after Site 2. More or less same value was recorded from remaining Sites 3 to 6 in all the three seasons except in summer season from Site 3.

The pH was predominantly alkaline ranged between 7.48 to 7.83 in monsoon season, 7.41 to 8.10 in winter season and 7.41 to 8.08 in summer season throughout the study from all the six sampling sites of Navsari district. pH of drinking water was found highest in Site 1 whereas lowest in Site 6 during all the three seasons. The pH of Sites 2, 3, 4 and 5 were more or less same in all three seasons.

Total solids were recorded maximum in the range of 664.47 to 990.50 mg/l from Sites 1, 5, 6 and was found to be minimum 488.16 mg/l from Site 4 in monsoon season whereas it was recorded more or less same from Sites 2 and 3 during all the three seasons. Total dissolved solids of untreated water from Sites 1, 5, 6 were recorded in range of 649.19 to 972.50 mg/l in all three seasons whereas in Sites 2, 3 and 4 were more or less same in range between 472.31 to 749.38 mg/l.

The results of total suspended solids were found to be higher from Site 1 and reduced drastically after the Site 2. More or less same value was recorded from Sites 5 and 6 whereas in Sites 3 and 4 results were close to Sites 5 and 6.

Total hardness of Site 1 was found to be minimum during all three seasons. It was recorded in the range 306.50 to 486.47 mg/l from Sites 2, 3 and 4 whereas it was found to be in similar range of 426.85 to 565.36 mg/l from Sites 5 and 6. The results of calcium hardness, in Site 1 was far below than the Site 2 in summer and monsoon seasons whereas it was found in same range between 241.82 to 499.66 mg/l from Sites 3, 4, 5 and 6.



Graph 1. The PH, turbidity, total solid, flouride, total hardest, total alkalinity, chloride and nitrate of Navsari District.

Magnesium hardness was recorded in range 58 to 67.78 mg/l from Site 1 and was minimum from Site 2 whereas it was more or less similar range from 67.09 to 95.63 mg/l from Sites 3, 4, 5 and 6 during all the three seasons.

Total alkalinity of Sites 1 and 2 was found minimum during all the three seasons in range 93.50 to 156.50 mg/l whereas it was more or less similar range from 217.69 to 315.03 mg/l from Sites 3, 4, 5 and 6 during all the three seasons as shown in the Graph 1. Phenolphthalein alkalinity were recorded in the range of

1.66 to 4.06 mg/l from Sites 2 to 6 except during monsoon season from Site 1 it was highest in range of 7.25 mg/l was depicted in the graph.

DISCUSSION

In the present study, turbidity was observed highest in untreated water and was reduced in all the sites and maintained well. The highest turbidity in untreated water was due to presence of clay and silt brought with runoff of water from Kakrapar canal though it has not crossed the standard limits.

pH is the measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water (Mackee and Wolf, 1963). pH value with 7 is considered to be the best and most ideal (Sawyer and Mc Carty, 1967). During the present study, pH was found in alkaline range between 7.4 to 8.10 which was under the desirable limit.

The survey regarding the taste threshold level of TDS was done by Bruvold and Ongerth (1969) and was concluded that the range between 658 to 758 mg/l was good enough and the range between 1283 to 1333 mg/l was unpalatable for drinking. So, water with presence of high level of TDS was not used by the consumers. In the present study, TDS was found in the range 472.31 to 972.50 mg/l which was within the desirable limit.

Hardness is defined as the concentration of calcium and magnesium ions content of water (Kumar and Kakrani, 2000). Most probably natural water supplies contain at least some hardness due to dissolved calcium and magnesium salts (Fulvio and Olori, 1965). Hardness was higher from sampling Sites 3 to 6 compared to untreated and treated. However, the value did not cross the limits.

Calcium is important as a nutrients, its deficiency causes rickets (Trivedi and Goel, 1986). High concentrations of calcium are not desirable in washing, laundering and bathing. Scale formation in boilers takes place by high calcium along with magnesium (Park, 1997). In the present study, calcium was found highest from Sites 5 and 6 due to bore well water.

Magnesium also occurs in all kinds of natural waters with calcium, but its concentration remains generally lower than the calcium (Purohit and Saxena, 1990). So, if calcium and magnesium is high in water, it may cause kidney disease (Taylor, 1958). In the present study, magnesium was found below the desirable limit.

Alkalinity in natural waters is due to free hydroxyl ions and hydrolysis of salts formed by weak acids and strong bases. Water with low alkalinity is more likely to be corrosive, which could cause deterioration of plumbing and an increasing chance for lead in water if present in pipe, solder or plumbing fixtures (Frank, 1987). In the present study, alkalinity was high from Sites 3 to 6; this may be due to corrosion in distributing pipes and the bore well supply but were found in normal range.

Conclusion

The research work is an attempt to assess the drinking water quality. The physico-chemical analyses reveal that the present status of drinking water quality is suitable for drinking purposes. The quality of physic-chemical falls within the standard limits of WHO standards. This indicates that the water of Navsari District and its vicinity is suitable for drinking purpose.

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