



EVALUATION OF DRINKING WATER QUALITY

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ABSTRACT

Navsari district is located in the south eastern part of Gujarat state in the coastal lowland along Purna River in India. Its geographical coordinates are 20°51' 0" North, 72°55' 0" East. In the present study, the physico-chemical parameters of water resources 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, total alkalinity. The analyzed result is compared with permissible limits as prescribed by WHO, GPCB for drinking water quality.

KEY WORDS: Drinking water, Hardness, Total solids, Pollution, Navsari



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INTRODUCTION

Water is the most beautiful and precious gift of nature without which no life could survive on earth [1, 2]. It takes many different shapes on earth and "Hydrology" is the new science to know the properties, distribution and behavior of water in nature [3]. Among the various uses of water, the most essential 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 [4]. Maintaining the quality of water is the most important one for human being since it is directly linked with the daily life [5]. Thus, proper and managed study of water, especially freshwater is essential to understand the relationship and interdependence of various constituents of any habitat. The history of the town of Navsari is approximately dates back to about 2000 years. The city is situated at southeastern Gujarat state, west-central India. It is situated in the coastal lowland along the Purna River. The district covers an area of 2,211 square kilometers and has population of 1,229,463 of which 27.36% is urban. It lies between 72.5 east latitude and 65.3 west longitudes. 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 Kakrapar

through a canal and is stored in a small reservoir called "Dudhiya Talao" [6]. The Kakrapar wier is constructed across the river Tapi and down stream of Ukai dam. To monitor the potable water quality, selected six sampling sites shown in Plate 1, are untreated water of Dudhiya Talao (Site1), treated water of Navsari water works (Site2), Station area (Site3), Lunsikui area (Site4), Chhapra village (Site5) and Viraval village (Site6).

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 Dudhiya Talao (Site1). The taps were kept open for 2-3 minutes 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 water supply from Navsari Nagar Palika. The methods of APHA [7] and Trivedi and Goel [8] 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, phenolphthalein alkalinity, total alkalinity were brought for further analysis.

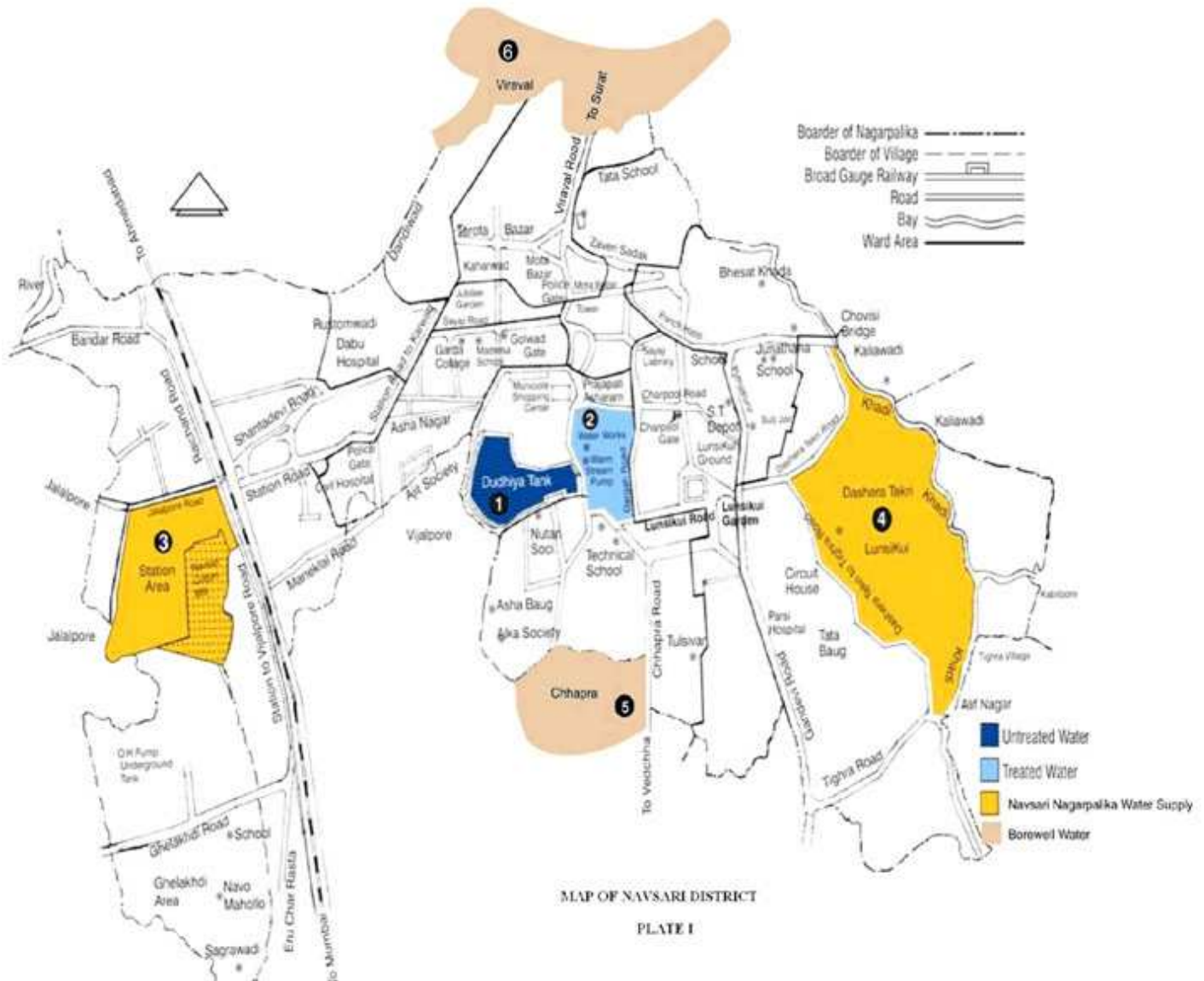


Plate 1

RESULTS

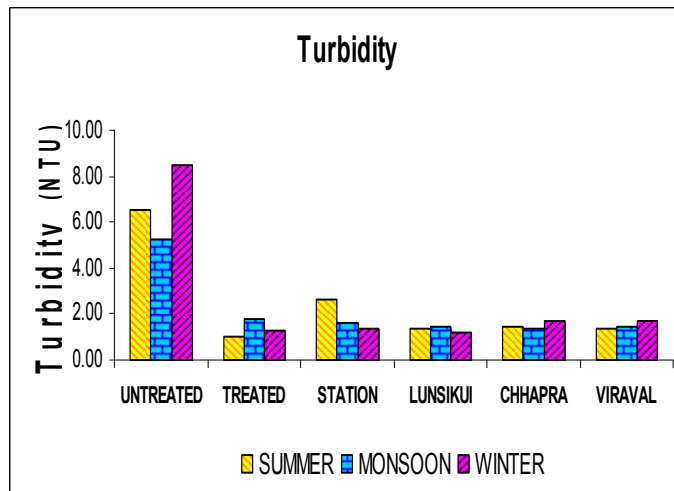
The results of physico-chemical parameters of average of six sampling sites are shown through graph. Turbidity of drinking water was higher from untreated water (site1) and reduced drastically after treatment (site2). More or less same value was recorded from remaining sampling sites3-6 in all the three seasons except in summer season from

(site3).

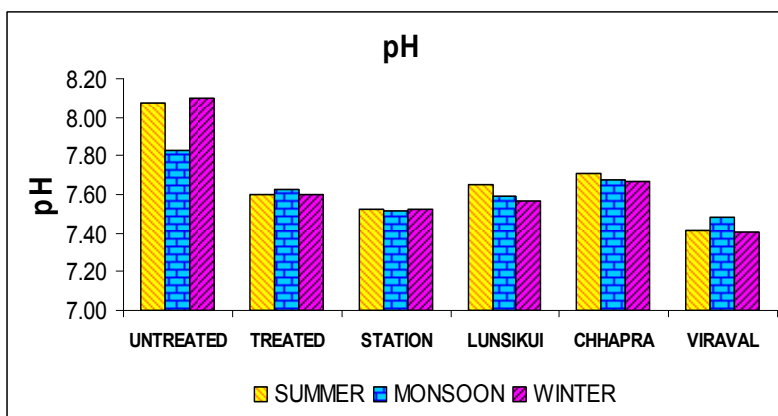
The pH was predominantly alkaline ranged between 7.48 to 7.83 in monsoon season, 7.41 to 8.10 in winter season and 7.41 to 8.08 in summer season throughout the study from all the six sampling sites of Navsari district. pH of drinking water was found highest in untreated water (site1) whereas lowest in Viraval village

(site6) during all the three seasons. The pH of treated water (site2), station area (site3), lunsikui area (site4) and chhapra village (site5) were more or less same in all three seasons. Total solids were recorded maximum in the range of 664.47-990.50mg/l from untreated water (site1), chhapra village (site5), viraval village (site6) and found to be minimum 488.16mg/l from lunsikui area (site4) 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 (site1), chhapra village (site5), viraval village (site6) were recorded in range of 649.19-972.50mg/l in all three seasons whereas in treated water (site2), station area

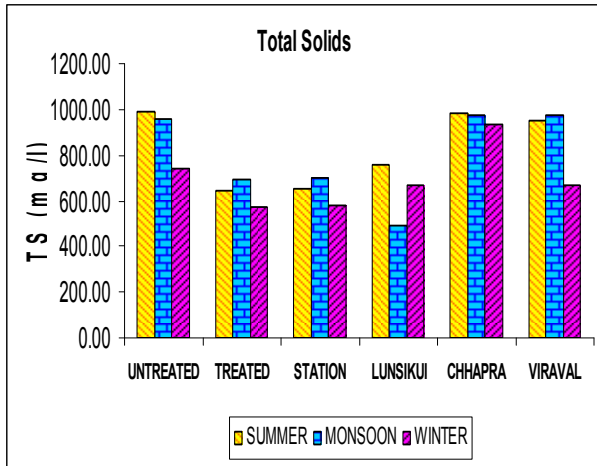
(site3) and lunsikui area (site4) were more or less same in range between 472.31-749.38mg/l. The results of total suspended solids were found to be higher from untreated water (site1) and reduced drastically after the treatment (site2). More or less same value was recorded from chhapra village (site5) and Viraval village (site6) whereas in station area sampling site3 and lunsikui area sampling site4 results were close to sampling sites 5 and 6. Total hardness of untreated water (site1) was found to be minimum during all three seasons. It was recorded in the range 306.50-486.47mg/l from treated water (site2), station area (site3) and lunsikui area (site4) whereas it was



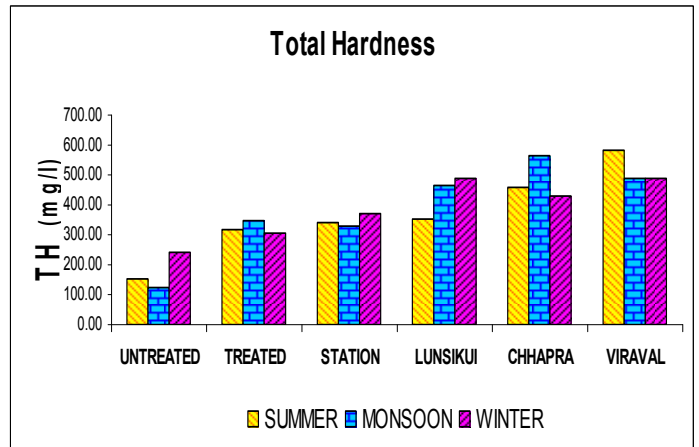
Standard limit:5-10 NTU



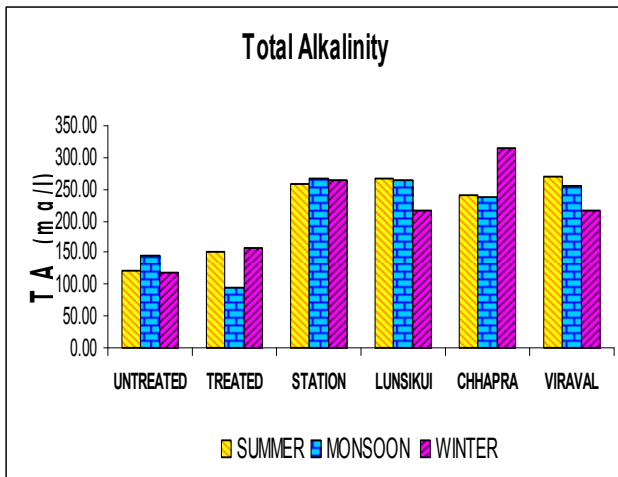
Standard limit:6.5-8.5



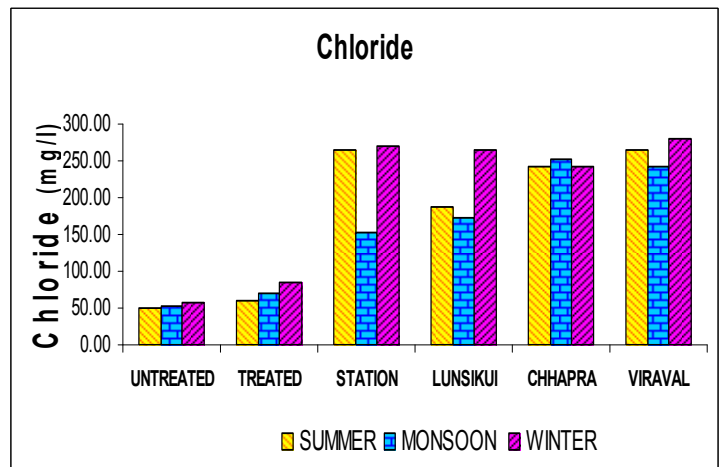
Standard limit:500-2000mg/l



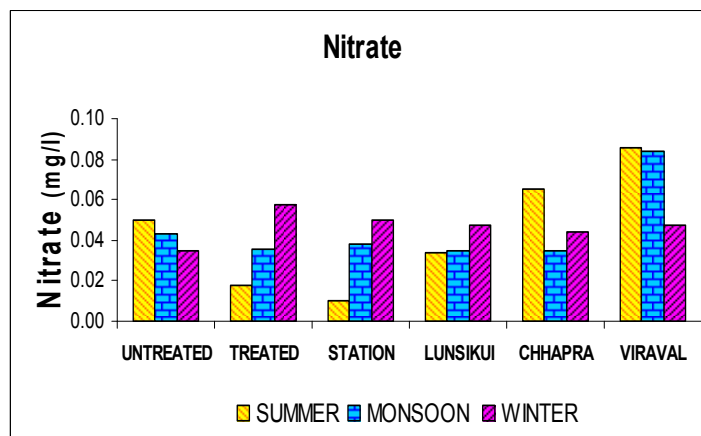
Standard limit:300-600 mg/l



Standard limit:200-600mg/l



Standard limit:250- 1000mg/l

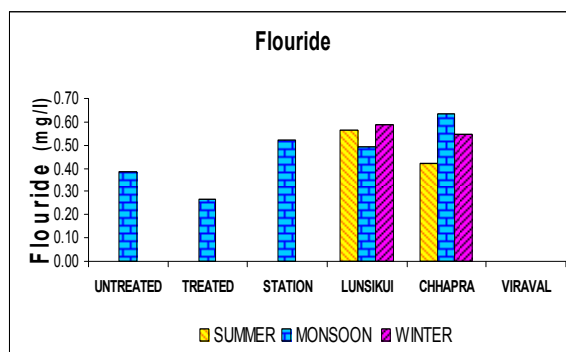


Standard limit:45-100mg/l

found to be in similar range of 426.85-565.36mg/l from sampling sites 5 and 6. Total alkalinity of untreated water (site1) and treated water (site2) was found minimum during all the three seasons in range 93.50-156.50mg/l whereas it was more or less similar range from 217.69-315.03 mg/l from station area (site3), lunsikui area (site4), chhapra village (site5) and Viraval village (site6) during all the three seasons as shown in above graph Chloride was found in lower range between 50.78-85.83 mg/l from untreated water (site 1) and treated water (site 2) whereas other four sites showed the similar range between 151.39-278.96 mg/l as shown in above graph. Nitrate was found in lower range 0.01-0.06 mg/l from sampling sites 1-4 whereas it was highest in range 0.03-0.09 mg/l from sampling sites 5-6. Fluoride is recorded in the range of 0.42-0.64 mg/l from the sampling sites 5 and 6 whereas sampling site6 showed the complete absence of fluoride. However sampling sites 1-3 had concentration below 0.52 mg/l only during monsoon season.

DISCUSSION

In the present study, turbidity was 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, silt brought with runoff of water from Kakrapar canal and did not cross the standard limits. pH is the measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water [9]. pH value of 7 is considered to be the best and most ideal [10]. During the present study pH was found to alkaline range between 7.4-8.10 which was under the desirable limit. The survey regarding the taste threshold level of TDS was done by Bruvold and Ongerth, [11] and was concluded that the range between 658-758mg/l was good enough and the range between 1283-1333 mg/l unpalatable for drinking. So, water with presence of high



Standard limit:1-1.5 mg/l

level of TDS was not used by the consumers. In the present study TDS was found in the range 472.31-972.50mg/l which was within the desirable limit. Hardness is defined as the concentration of calcium and magnesium ions content of water [12]. Most natural water supplies contain at least some hardness due to dissolved calcium and magnesium salts [13]. Hardness was higher from sampling sites 3-6

compared to untreated and treated. However the value did not cross the limits. 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 [14]. In the present

study, alkalinity was high from sampling sites 3-6, this may be due to corrosion in distributing pipes and the bore well supply but were found in normal range. Chloride occurs naturally in all types of waters. In drinking water presence of chlorides is due to irrigation drainage [15]. The average intake of chloride through drinking water is approximately 10mg/l [16] The taste threshold for chloride in drinking water depends upon associated cations and generally the range is 200-300mg/l [8]. Chloride concentrations above 250mg/l in drinking water may cause corrosion in distributing system. Its concentration in water may increase during the treatment process if chlorine is used for disinfection purposes [17]. Chloride content was higher from sampling sites 3-6 compared to untreated and treated water. However the value did not cross the limits. Nitrate and Nitrite are naturally occurring ions that are part of the nitrogen cycle [18]. Nitrate is converted in the gut to nitrite, which then combines with hemoglobin to form methemoglobin, thus decreasing the ability of blood to carry oxygen

[19]. However, the levels of nitrate in the present study were found in normal range. Fluoride was totally absent in viraval village, whereas other sites of Navsari district showed the fluoride level below limit. The effect of fluoride on human health has been reviewed extensively. Fluoride accumulates in young ones more readily than in adults [20]. Skeleton damage both in children and young person.

CONCLUSION

All the physico-chemical are within the permissible limit. This indicates that the water of Navsari district and its vicinity is suitable for drinking purpose.

ACKNOWLEDGEMENT

I am heartily thankful to Navsari Nagarpalika and vapi GPCB for their kind support, without which this research could not be possible.

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