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Evaluation of drinking water quality of Navsari District (Gujarat)

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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 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 analyze results is compared with permissible limits as prescribed by WHO, GPCB for drinking water quality.

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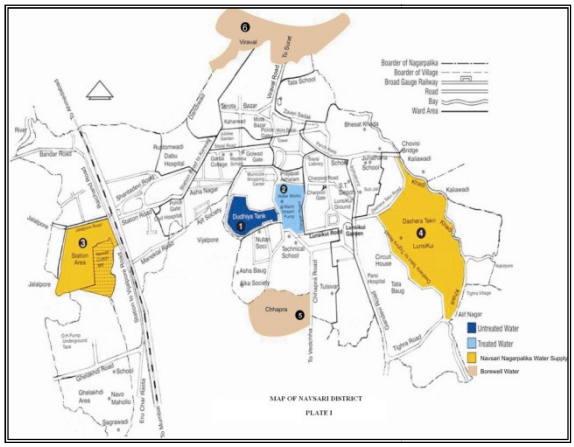
Keywords: Drinking water | Hardness | Total solids | Pollution | Navsari

Introduction

Water is the most beautiful and precious gift of nature without which no life could survive on earth (Dara, 1998; Kumar and Kakrani 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.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 Kakarapar through a canal and is stored in a small reservoir called "Dudhiya Talao" (Patel *et al*., 2000)**.** The kakrapar wier 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 Method

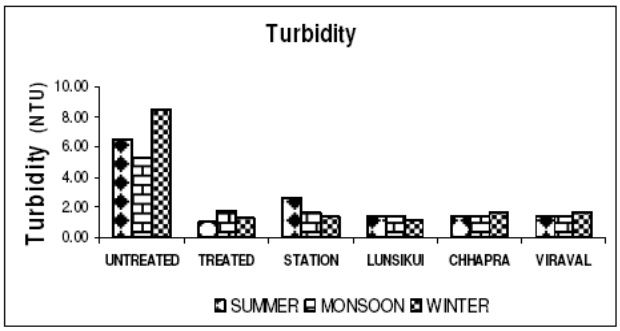
In the present study, six sampling sites were selected. The sampling was done on seasonal pattern. Composite sampling method was particularly adopted in Dudhiya Talao (Site 1). The taps were kept open for 2-3 minutes while collecting samples from pipeline supply to remove the possible impurities in water 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.

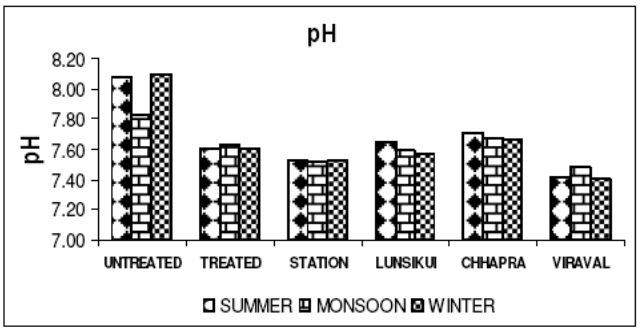
The methods of APHA (1995) and Trivedi and Goel (1986) were followed for water analysis. The parameters such as turbidity, pH, total solids, total suspended solids, total dissolved solids, total hardness, magnesium hardness, calcium hardness, phenolphthalein alkalinity, total alkalinity were brought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

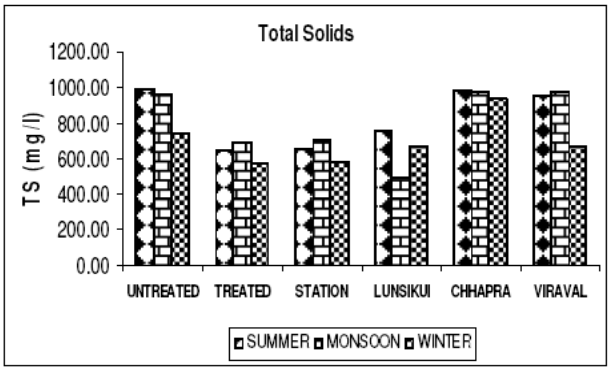
Results

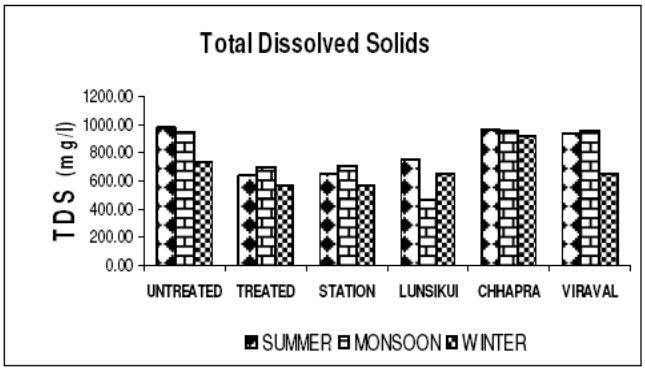
The results of physico-chemical parameters of average of six sampling sites are shown through graph. Turbidity of drinking water of Navsari district was higher from untreated water (site 1) and reduced drastically after treatment (site 2). More or less same value was recorded from remaining sampling sites3-6 in all the three seasons except in summer season from (site 3).

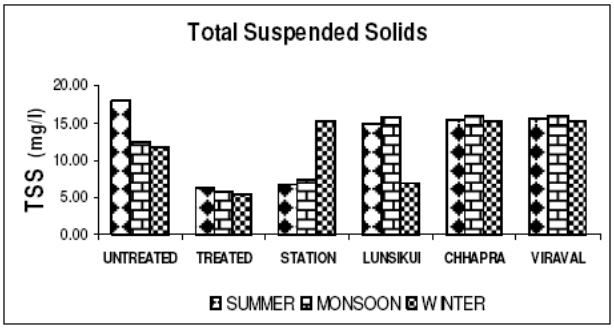
The pH was predominantly alkaline ranged between 7.48 to 7.83 in monsoon season, 7.41 to 8.10 in winter season and 7.41 to 8.08 in summer season throughout the study from all the six sampling sites of Navsari district. pH of

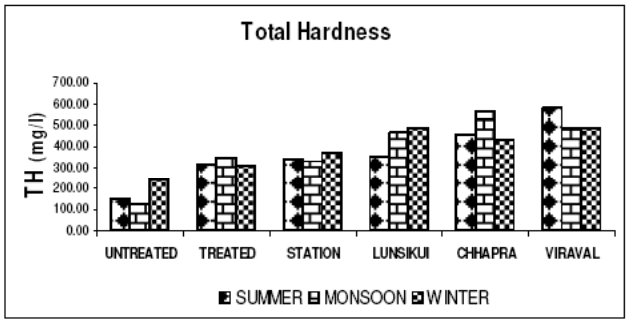

Turbidity
Turbidity (NTU)
10.00
8.00
6.00
4.00
2.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

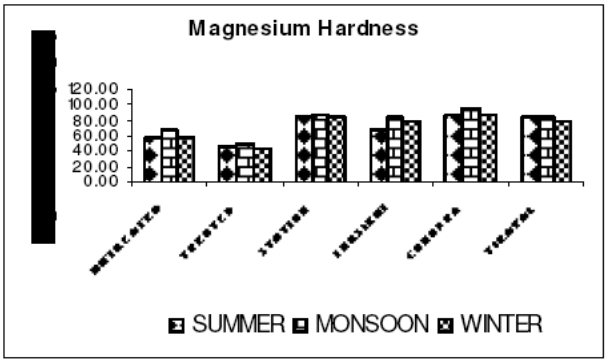

pH
pH
8.20
8.00
7.80
7.60
7.40
7.20
7.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

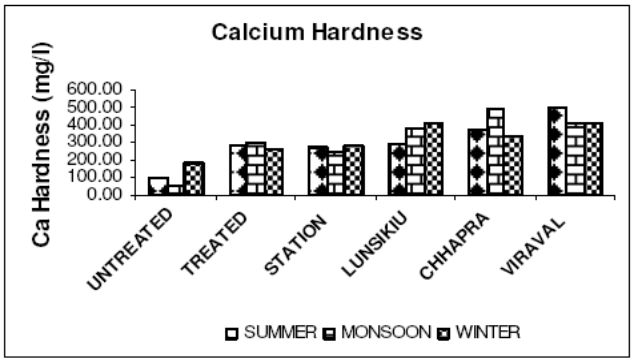

Total Solids
TS (mg/l)
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

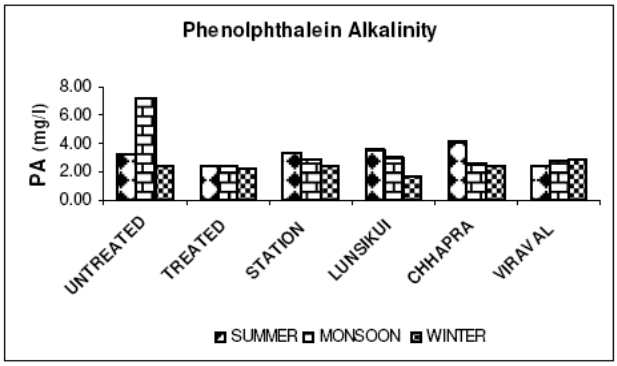

Total Dissolved Solids
TDS (mg/l)
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

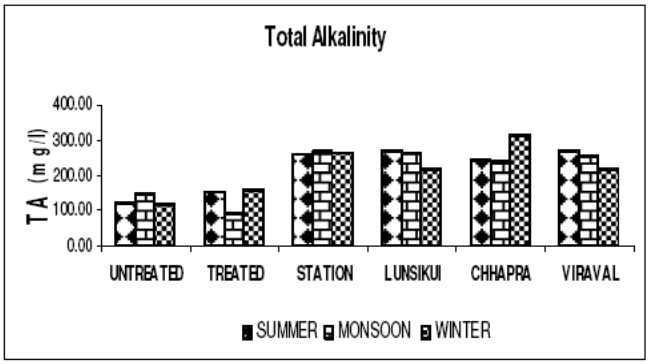

Total Suspended Solids
TSS (mg/l)
20.00
15.00
10.00
5.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

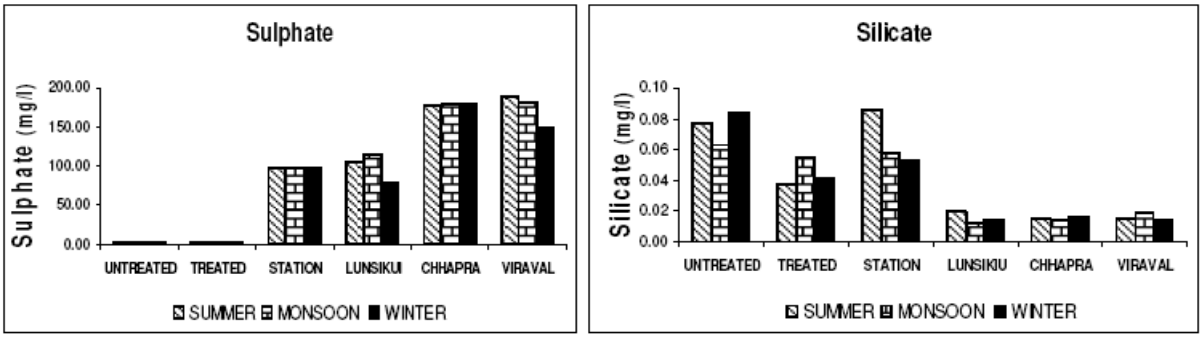

Total Hardness
TH (mg/l)
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER


Magnesium Hardness
120.00
100.00
80.00
60.00
40.00
20.00
0.00
SUMMER MONSOON WINTER

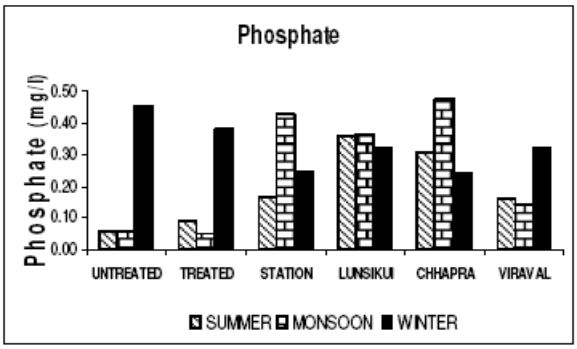

Calcium Hardness
Ca Hardness (mg/l)
600.00
500.00
400.00
300.00
200.00
100.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

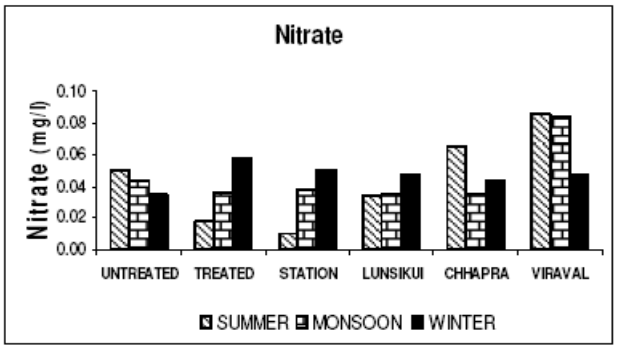

Phenolphthalein Alkalinity
PA (mg/l)
8.00
6.00
4.00
2.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

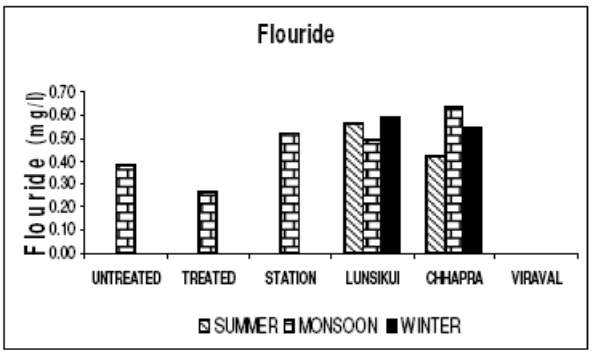

Total Alkalinity
TA (mg/l)
400.00
300.00
200.00
100.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER MONSOON WINTER

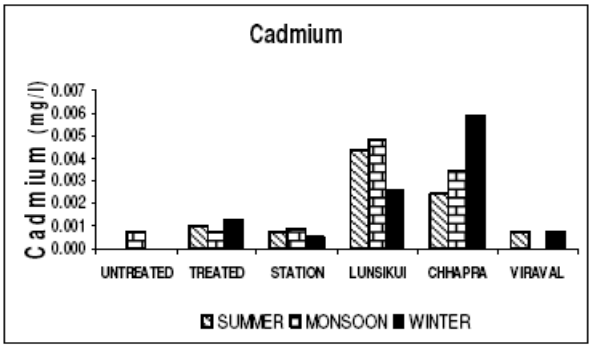

Sulphate
Sulphate (mg/l)
200.00
150.00
100.00
50.00
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER

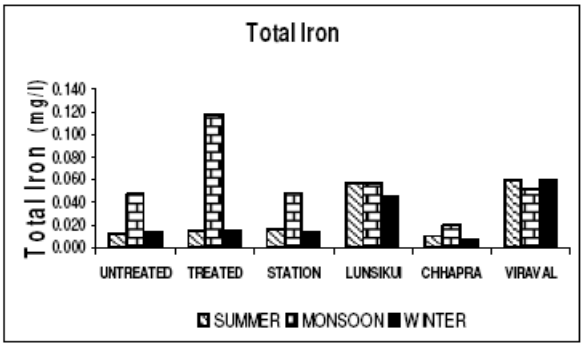
Silicate
Silicate (mg/l)
0.10
0.08
0.06
0.04
0.02
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER

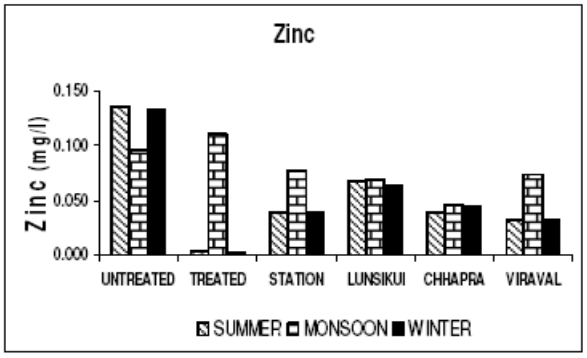

Phosphate
Phosphate (mg/l)
0.50
0.40
0.30
0.20
0.10
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER

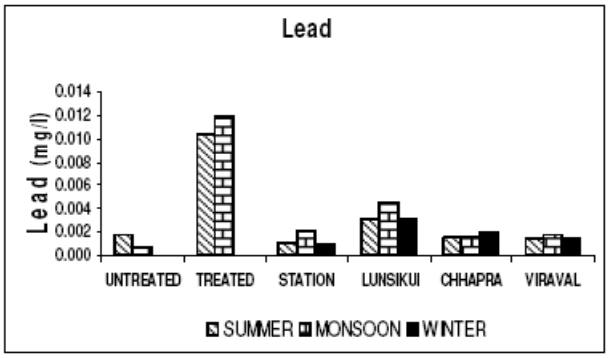

Nitrate
Nitrate (mg/l)
0.10
0.08
0.06
0.04
0.02
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER


Flouride
Flouride (mg/l)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER


Cadmium
Cadmium (mg/l)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER


Total Iron
Total Iron (mg/l)
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER


Zinc
Zinc (mg/l)
0.150
0.100
0.050
0.000
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER


Lead
Lead (mg/l)
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
UNTREATED
TREATED
STATION
LUNSIKUI
CHHAPRA
VIRAVAL
SUMMER
MONSOON
WINTER

drinking water was found highest in untreated water (site 1) whereas lowest in Viraval village (site 6) during all the three seasons. The pH of treated water (site 2), station area (site 3), lunsikui area (site4) and chhapra village (site 5) 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 (site 1), chhapra village (site 5), viraval village (site 6), and found to be minimum 488.16 mg/l from lunsikui area (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 (site 1), chhapra village (site 5), viraval village (site 6) were recorded in range of 649.19 - 972.50 mg/l in all three seasons whereas in treated water (site 2), station area (site 3) and lunsikui area (site4) were more or less same in range between 472.31 - 749.38 mg/l.

The results of total suspended solids were found to be higher from untreated water (site 1) and reduced drastically after the treatment (site 2). More or less same value was recorded from chhapra village (site 5) and Viraval village (site 6) 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 (site 1) was found to be minimum during all three seasons. It was recorded in the range 306.50-486.47 mg/l from treated water (site 2), station area (site 3) and lunsikui area (site 4) whereas it was found to be in similar range of 426.85-565.36 mg/l from sampling sites 5 and 6. The results of calcium hardness, in untreated water (site 1) was far below than the treated water (site 2) in summer and monsoon seasons whereas it was found in same range between 241.82 - 499.66 mg/l from station area (site 3), lunsikui area (site 4), chhapra village (site 5) and Viraval village (site6). Magnesium hardness were recorded in range 58 - 67.78 mg/l from untreated water (site 1) and was minimum from treated water (site 2) whereas it was more or less similar range from 67.09 - 95.63 mg/l from station area (site 3), lunsikui area (site 4), chhapra village (site 5) and Viraval village (site6) during all the three seasons.

Total alkalinity of untreated water (site 1) and treated water (site 2) was found minimum during all the three seasons in range 93.50-156.50 mg/l whereas it was more or less similar range from 217.69 - 315.03 mg/l from station area (site3), lunsikui area (site 4), chhapra village (site 5) and Viraval village (site 6) during all the three seasons as shown in above graph. Phenolphthalein alkalinity were recorded in the range of 1.66 - 4.06 mg/l from all the sampling sites 2 - 6 except during monsoon season from untreated water (site 1) it was highest in range of 7.25 mg/l was depicted in graph.

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 crosses 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 of 7 is considered to be the best and most ideal (Sawyer and Mc Carty, 1967)**.** 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 (1969) 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 level of TDS was not used by the consumers. In the present study TDS was found in the range 472.31 - 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 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 3-6 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 sampling 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 than 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 sampling sites 3-6, this may be due to corrosion in distributing pipes and the bore well supply but were found in normal range.

Conclusion

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

References

Dara, S.S. (1998): Environmental Chemistry and Pollution Control, S. Chand Publication, New Delhi, pp. 64-69.

Kumar, V. and Kakrani, B. (2000): Water-Environment and Pollution, Agro Bios Publication, New Delhi, pp.1-26.

Fair, G.M. and Geyer, J.C. (1958): Elements of Water Supply and Wastewater Disposal, John Wiley Publication, USA, pp. 1.

Park, K. (1997): Preventive and Social Medicine, Banarsidas Publication, Jabalpur, 15th Edition, pp. 468-479.

Gosh, G.K. (2002): Water of India: Quality and Quantity, A.P.H. Publication, New Delhi, pp. 9, 13, 19, 97,191.

Patel, A.M., Malik, M.M., Parikh and Raman, S. (2000): Ground water fluctuation and quality in Surat branch of Kakrapar command, pp.1-3.

American Public Health Association, American Water Works Association, Water Environment Federation (1995): Standard Methods for the Examination of Water and Wastewater 19th Edition, Washington D.C., New York.

Trivedi, R.K. and Goel, P.K. (1986): Chemical and Biological method for water pollution standard, Ashish publication, New Delhi, pp. 1-25 and 100-105.

Mackee, J.E. and Wolf, H.W. (1963): Water Quality Criteria, Mc Graw Hill Publication, New York 2nd Edition, pp. 136-247, 270, 275-277.

Bruvold, W.H. and Ongerth, H.J. (1969): The taste of water, public health reports, Rawat publication, Jaipur, pp. 110-135.

Sawyer, C.N. and Mc Carty, P.L. (1967): Chemistry for Sanitary Engineers, McGraw Hill, Toronto, 2nd Edition, pp. 117-132.

Fulvio, D.E. and Olori, L. (1965): Hardness of Drinking Water and Public Health, Pergamon Publication, New York, pp. 95.

Purohit, S.S. and Saxena, M.M. (1990): Water life and pollution, Agro Botanical Publication, New Delhi, pp. 61-64.

Taylor, E. W. (1958): The examination of waters and water supplies, Churchill publication, London, pp.27-48.

Frank, N. (1987): Water quality hand book, Mc Graw hill publication, New York, 2nd Edition, pp. 13-19.

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