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STATUS OF RIVER WATER QUALITY OF SAURASHTRA, GUJARAT, INDIA

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ABSTRACT
The present communication was report the status of river water quality at Kathiawar peninsula, Gujarat, India was studied. The physicochemical parameters like pH, EC, DO, BOD, alkalinity, hardness, Calcium and Magnesium were analyzed during monsoon and post-monsoon season. Physical parameters like temperature, pH, Conductivity were measured on the site by using portable multi parameter analyzer, while chemical parameters were analyzed as per standard methods. The results of the present study have been discussed it is clear that the water is not highly polluted, but the variations in physico-chemical parameters were observed as seasonally. The recorded range of physico-chemical parameters were within the maximum permissible limit.

KEY WORD: Analyze, Gujarat, Physico-chemical parameters, River, Status, Water quality

INTRODUCTION

Water is essential for the existence of life on this planet. Water used for drinking should be potable which means that it could be consumed in any desired amount without adverse effects on health, and that this vital fluid should be free from turbidity, colour and objectionable taste (Jayalakshm and Belagadi, 2005). Water is also important for all anthropogenic activities (Dagaonkar and Saksena, 1992). Due to direct or indirect interferences of men, water bodies have been contaminated with variety of hazardous chemical pollutants causing an adverse impact on human health and aquatic life as well (Telliard and Rubin, 1987). The quality of water is getting vastly deteriorated due to unscientific waste disposal, improper water management and carelessness towards environment, which has also led to scarcity of potable water affecting the human health (Agarkar, 2003).

In India there are enormous number of natural and manmade water bodies used for various purposes, mainly for drinking and agriculture. However, in recent years due to rapid urbanization industrialization and modern agricultural activities, the quality of water bodies deteriorated causing environmental hazards. Due to the growth of population, and man-made activities, the quality of water is deteriorating everywhere. One of the most severe problems in arid and semi-arid regions is high concentration of salts in soils and water resources (Dutta and Chowhan, 2009). Thus, water quality and its management have received much attention in developing countries. The main aim of the present study is to know about different physico-chemical characteristics of water and its classification.

MATERIALS AND METHODS

Study Area

Gujarat is located on the western coast of the Indian Peninsula; falls in the sub-tropical climatic zone and has a varied climate and climatic regions. Gujarat has the longest coastline of about 1663km in India. It borders Rajasthan to the north-east, Madhya Pradesh to the east, Maharashtra and the Union territories of Diu, Daman, Dadra, and Nagar Haveli to the south. The rivers Banas, Sabarmati, Mahi, Narmada, and Tapi are important rivers of Gujarat plain draining into the Gulf of Khambatt. The rivers Bhadar, Ojat and Shetrunji are important rivers of Kathiawar peninsula draining into the Arabian Sea. A few seasonal and small rivers drain into the Gulf of Kachchh.

Junagadh district lies between 21º 10' and 21º 40' north latitude and 70º 18' and 71º 15' west longitude region, in the state of Gujarat India, known as Kathiawar or Saurashtra. This district is bounded by the Rajkot district in North, Amreli district in East, Arabian Sea in South and by the Arabian Sea and Porbandar district in the West. Total geographical area of Junagadh district is 6,996,011.21 hectares (CSPC, 2008). The climate in coastal Junagadh is moist and warm with annual rainfall between 700-800 mm occurring during 20-40 rain-days. For this present study Veraval and Kodinar were selected, it consists of 55 and 63 villages respectively, nearby all facing an acute shortage of water. Therefore, ground water serves as one of the main sources of water in the area.

Veraval was the major seaport for pilgrims. Its importance now is as a fishing port which is one of largest in India. Fisheries have always been the main industry in the town. The fishing is done mostly on traditional boats and trawlers. Veraval also has a large boat making industry. Veraval is home to a large number of fish processing factories which export prime quality seafood to various Countries. Veraval also is home to largest manufacturing companies. There are various chemical, thread and cement companies around Veraval. Similar in Kodinar cements and sugar factory are situated. The present study was carried out in three major rivers such as Hiran, Saraswati and Singoda which situated in the Veraval and Kodinar town along the Saurashtra region (Figure 1).

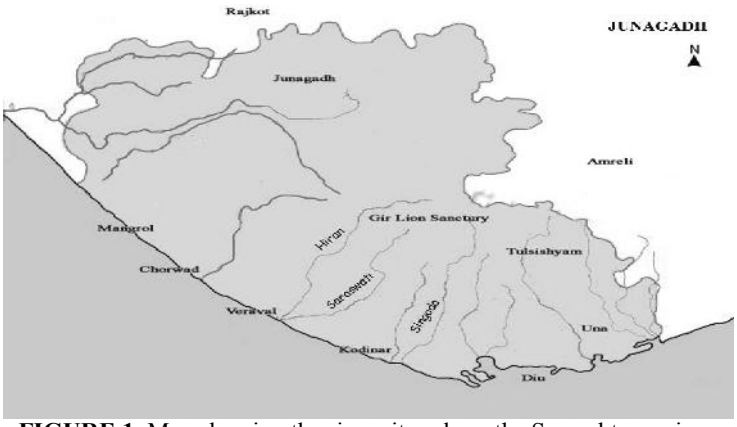

FIGURE 1. Map showing the river sites along the Saurashtra region.

Collection of Samples

The present study has been carried out in eight different locations covering rivers and ponds situated in Veraval and Kodinar were selected along the Junagadh district, Gujarat. Water samples were collected from selected locations was done in the Monsoon and Post-monsoon for the year 2010 and 2011. Samples were collected periodically at the first week of every month during morning hours. The samples for Physico-chemical parameters were collected in one liter plastic bottle which were thoroughly cleaned and rinsed with distilled water before collection. The samples for DO and BOD analysis were collected in separate 300 ml BOD bottles and oxygen is fixed immediately.

Physico-chemical analysis

Some physical parameters like surface water temperature, pH and electrical conductivity were measured on the spot using portable multi parameter analyzer. Physico-chemical analysis such as alkalinity, calcium, magnesium, total hardness, DO, BOD, total solids, total suspended solids, total dissolved solids of the water samples was done according to Standard Methods (APHA, 1998; Trivedi and Goel, 1986). The values obtained were compared with standards prescribed by WHO (1992) and BIS (1991).

RESULTS AND DISCUSSION

The physico-chemical parameters of water are considered as the most important principles in the identification of the nature, quality and type of the water for any aquatic ecosystem (Abdo, 2005). The average values of physico-chemical parameters of various samples during 2010-11 are presented in Table. 1. Some chemical parameters are also illustrated by graphically for comparison (Figure 2-4).

TABLE-1 Physico-chemical parameters of water samples from selected locations during winter and summer season.

	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
Temperature (^{0}C)	23	26	24	27	24	23	22	25
pH	7.5	7.8	7.3	7.5	7.5	8.0	7.6	7.7
Electrical conductivity(µS/cm)	380	450	410	413	465	430	405	433
Total Alkalinity (mg/l)	3.3	3.9	3.3	3.5	4.1	3.6	3.3	3.7
Calcium hardness (mg/l)	45.0	55.5	60.4	53.6	62.4	48.6	57.5	56.2
Magnesium hardness (mg/l)	30.2	35.0	29.6	31.6	32.5	24.8	26.0	27.8
Total hardness (mg/l)	172	180	194	182	210	178	175	188
DO (mg/l)	5.8	6.2	5.6	5.9	6.5	6.1	5.8	6.1
BOD (mg/l)	1.20	3.75	4.00	3.0	2.00	1.90	0.24	1.4
Total Solids (g/l)	405.0	370.0	420.0	398.3	355.0	378.0	390.0	374.3
Total Suspended Solids (g/l)	35.0	20.0	42.0	32.3	38.0	24.0	30.0	30.7
Total Disssolved Solids (g/l)	250.0	250.0	298.0	266.0	376.0	340.0	268.0	328.0

The water temperature is one of the most important physical characteristics of aquatic ecosystem, as it affects the organisms. It affects a number of water quality parameters that is one of the concerns for domestic, environmental, industrial and agricultural applications (Parasar et al., 2007). In the present study temperature was raged between 22 to 27 ^{o}C, which was within the range of 25 and 30ºC needed by fish to grow well (Abulude et al., 2006). The chemical and biological reaction rates increase with increased water temperature. Thus the seasonal variations are quite significant in fresh water lake and ponds and the pattern of variation is dependent on the geographical locations. In case of the water temperature in the present study were within the acceptable levels for survival, metabolism and physiology of aquatic organisms (Lawson, 2011). Water temperature has also some positive and negative effects on plant growth. The most suitable water temperature for plant growth is 20 - 35°C, Temperature over 30°C can cause regression in growth and decay in plants (Kara et al., 2004). pH has direct or indirect effects on photosynthesis and growth of water plants. High pH causes more carbonate and bicarbonate in

water (Kara et al., 2004). Pidgeon and Cains, 1987 observed that organic acids resulting from decaying vegetation might be responsible for the low pH in most aquatic ecosystems. In the present investigation the pH of water samples varied from 7.3 to 8.0 (Table 1), which is quite normal and within the range of 6.5 - 8.5 prescribed by Bureau of Indian Standards. The lowest value of pH was observed in sampling site-3, while maximum pH was observed in sampling site-6. pH range of 6.5 to 9.0 is an indicator of a good fish population (Addo et al., 2011).

Conductivity is related to the concentration of Total Dissolved Solids (TDS). According to Chapman (1992), TDS may be obtained by multiplying the conductivity by a factor between the ranges of 0.55 to 0.75. The electrical conductivity of the water samples ranged between 380 µS/cm and 465 µS/cm throughout the study period. Minimum value was recorded from sampling site-1, on the other hand sampling site-5 showed the maximum value. Water of higher conductivity may be used with suitable amendments and precautions, but under normal conditions they are harmful to the soil structure and their continuous use will result in salinity hazard, with ultimate effect on plant growth (Dutta and Chowhan, 2009). There is currently no official guideline as to what is considered safe level for conductivity (Karikari, 2007). However, the conductivity of most freshwaters ranged from 10 to 1000 S/cm, but many exceed 1000 S/cm. especially in polluted waters, or those receiving large quantities of land run-off (Chapman, 1992).

The recorded dissolved oxygen range was within the maximum permissible limit (WHO, 1984). It was found that higher dissolved oxygen values were observed in monsoon may be due to higher water temperature, higher biological oxygen demand on account of decomposition of organic detritus during this period. It revealed that the quality of water at the residential areas was found to be safe and could be used for domestic purpose & without any treatment (Sathya and Shankar, 2009). Biological oxygen demand is the measure of quantity of oxygen required by bacteria and other microorganisms under aerobic condition in order to biochemically degrade and transform organic matter present in the water bodies.

FIGURE 2. Variations in the DO and BOD values of water samples during Monsoon and Post-monsoon seasons.

In the present investigation the dissolved oxygen values found high during monsoon than monsoon, while contrast results recorded in case of biological oxygen demand, maximum values were observed during monsoon than the post-monsoon season. It is possibly due to the reason of that Mainland Gujarat consists of the eastern rocky highlands (300 to 1000 meters). The hydrological regime of the state is governed by the complex geo climatic condition. Most of the ground water resource is concentrated in the unconsolidated formation, covering about 40 of the area of the state. The surface water is dominantly concentrated in the southern and central parts of the state (Stanley, 2004).

The total dissolved solids (TDS) ranged between 250 mg/l and 340 mg/l. (Table 1), almost all the samples showed normal range of TDS within the desirable limits of 500 mg/l (WHO 1971). The groundwater chemistry changes when the water flows through the subsurface geological environment having overall change in the major ions and dissolved solids (Chebotarve, 1985).

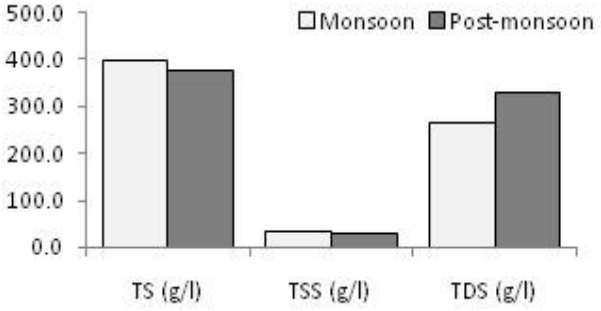

FIGURE 3. Variations in the Solids content of water samples during Monsoon and Post-monsoon seasons.

The levels of total alkalinity and total hardness for good fish culture were within 20 to 300 mg/L (Boyd and Lichtkoppler, 1979). Alkalinity itself is not harmful to human beings (Trivedi and Goel, 1986); moreover the

value of alkalinity provides idea of natural salts present in water (Gawas et al., 2006). Hardness is defined as the some of polyvalent cations present in water, notably Calcium, Magnesium and iron (Dutta and Chowhan, 2009). Jain (1996) reported that excess amount of hardness may cause kidney stones. The main cause of hardness in the drinking water is high concentration of calcium.

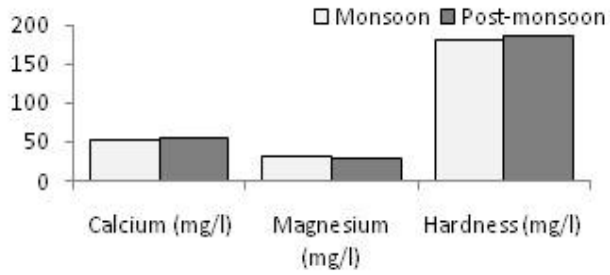

FIGURE 4. Variations in the Calcium, Magnesium and Total hardness values of water samples during Monsoon and Post-monsoon seasons.

In case of hardness in water samples ranges from 172 to 210 mg/l throughout the study (Table 1; Figure 4). The maximum permissible limit for this parameter for drinking water standards is 500mg/l (WHO 1984). Hardness has no known adverse effects on health; however some evidences have been given to indicate its role in heart diseases (Peter, 1974). Calcium and magnesium are common constituents of natural water and important contributor to the hardness of water. The calcium concentration in water samples ranged from 45.0 mg/l to 62.4 mg/l. and in case of magnesium, it was ranged between 29.6 mg/l and 35.0 mg/l. The results revealed that various physico-chemical variables were well within acceptable limits of water quality (Boyd and Tucker, 1998). Perona et al., (1999) suggested that if physico-chemical variables did not show wide range of variation which is due to the closely associated with the lithological composition of the river basin. The physical and chemical characteristics of water showed seasonal fluctuations interacting with one another and have a combined effect on animals and plants (Odum 1971). Factors controlling the composition of natural waters are extremely varied and include physical, chemical and biological processes (Boyd 1979).

CONCLUSION

The present investigation revealed that the physico-chemical parameters of river water were ranged within the permissible standard limit. It was also found the seasonal and temporal variations among the water quality parameters which were due to the local geographic pattern. However it is always necessary to manage some conservation for more suitable aquatic ecosystem, because it is always useful for human being and agriculture.

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