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Physico – Chemical characteristics of 'Ugat Vaniya Lake' in Surat City, Gujarat, India

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Abstract

The Present study deals with some physico - chemical parameters of Ugat Vaniya Lake of Surat city, India, during the period of April – May-2009 to February – March – 2010 to evaluate of water quality. The present study was undertaken to know the water pollution level in lake therefore some parameters like temperature, pH, electrical conductivity, total hardness, turbidity, TDS, dissolved oxygen, nitrate, chloride and sodium were analyzed at regular bimonthly during study period. The result shows various seasonal effects as well as influence of human at site.

Key-Words: Ugat Vania Lake, Physico-chemical characteristics, Water pollution

Introduction

The Present investigation attempts to find out the variation in the physico - chemical parameters of 'Ugat Vania Lake' in Surat city of Gujarat, India. Water is a vital resource used for various activities such as drinking irrigation fish production, industrial cooling power generation and many others (Sanjay Sathe et al 2001). Almost 70 % of the earth surface area is covered by water. The available fresh water to man is hardly 0.3 % to 0.5 % of total water available on the earth and therefore its judicious use is imperative. Without the knowledge of waters quality, it is difficult to understand the biological phenomenon fully, because the increasing anthropogenic influence in recent years in and around aquatic system and their catchment area have attributed to a large extent to deterioration of water quality and dwindling of water bodies leading to their accelerated eutrophication (Bhatt et al. 1999). The quality of water can be assessed by studying by its physical and chemical characteristics. Limnological studies provide a basic understanding of nature and generally help to monitor the environment (forsberg, 1982)

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The objective of study was to determine physico – chemical properties of lake and to study the level of water pollution as well as seasonal effects on water quality at 'Ugat Vania Lake'. Surat is highly developing city of Gujarat, Population, pollution, urbanization, industrialization etc. are rapidly grown in the city. Due to climate change and anthropogenic pressure the quality of water is day by day much affected, so there is a need to find out what change is occurred in the water quality so the present study is designed to monitor the variations of water quality parameters.

Material and Methods

Water samples were collected bimonthly during April – May - 2009 to February – Mar - 2010. Water samples were collected during morning hours between 7:30 am to 8:30 am, during study period. The water samples were collected in glass bottles from site then brought to the laboratory for analysis and analyzed according to the 'standard methods for the examination of water and waste water (APHA-1998) and environmental analysis of water soil and air (M.M. Saxena 1998).

Results and Discussion

The result of physico – chemical parameters of 'Ugat Vaniya Lake' water during April-May-2009 to February – March -2010 are shown in table 1. The present study shows the highest water temperature was 31^0c during April – May it means in summer and lowest was 27^0c in December – January. The variation in water temperature found in the present investigation

may be due to the normal climatic fluctuation and effect of seasons and different times of collection or may be due to the effects of atmospheric temperature as reported by Jayaraman et al., (2003); Tiwari et al. (2004); and Zingade (1981) respectively.

pH is a measure of the acidity and alkalinity of water, expressed in terms of its concentration of hydrogen ions. The pH scale ranges from 0 to 14. A pH, 7 is considered to be neutral. Substances with pH less than 7 are acidic; substances with pH greater than 7 are basic. The pH of water determines the solubility (amount that can be dissolved in the water) and biological availability (amount that can be utilized by aquatic life) of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals (lead, copper, cadmium, etc.). In present study pH range was 7.14 (December- January) to 10.05 (June – July).

pH was high during monsoon and summer months this is because of high photosynthetic activity similar result was noted by Vasumathi Reddy *et al* (2009) and maximum pH in summer was reported in different water bodies by Kushwah (1989), Ingole, S.B. *et al.* (2009). Mostly low pH was noted during winter months and slightly increased in summer months similar trends also have been observed by Jawale C.A. *et al* (2009). High pH value during summer could be due to the uptake of CO_2 by phytoplankton, Sanathanan, 1976. Abhaykumar *et al*. (1995) also stated that pH profile altered with seasons.

Electrical conductivity is the measure of total concentration of dissolved salts in water. When salts dissolve in water, they give off electrically charged ions that conduct electricity. Hard water contains more salts, and therefore more ions, has a high electrical conductivity. Electrical conductivity (EC) estimates the amount of total dissolved salts (TDS), or the total amount of dissolved ions in the water.

Electrical conductivity was recorded between range 260 µmho/cm. (April – May) to 414 µmho/cm.(February – March). The higher conductivity was observed during summer season this may be due to the evaporation of water in summer season similar result was noted by Vasumathi Reddy et al. 2009. Several factors influence the conductivity including temperature, ionic mobility and ionic valencies. The higher conductivity values may be due to more concentration of organic matter and also due to human intervention (Claymo, 1983; Koshy and Nayar, 2000; Dakshini and Soni, 1979; Madhavan and Krishnaswami, 1983; Datta *et al*, 1988; Mathew Vergis, 1995; Mathew Koshy, 2005).

Turbidity in water is caused by suspended matter like clay, silt, organic matter, phytoplankton and other microscopic organisms. It is an expression of optical property (Tyndall effect) in which light is scattered by the suspended particle present in water. During the present study turbidity show range between 0.28 NTU (October - November) to 3.8 NTU (April - May). Turbidity is normally increased during and after rainy season and in summer season similar result was reported by Jawale, C. A., *et al*. (2009) Vol.24. Normally turbidity increases after heavy rain because the rain runs along the ground picking up small particles of dirt before emptying into water sources hence increasing turbidity level. Similar work reported by Patil, *et al*. (2009), Govind Balde, Vasumathi Reddy *et al*. (2009). In accordance with general observation turbidity was recorded high in rainy and after rainy season. The turbidity also depends on the rainfall in monsoon period. The correlation of turbidity with other parameters was as under.

Usually, water shows alkalinity due to presence of salts of weak acids and strong bases. Alkalinity in water is caused due to presence of Carbonates (CO_3^-), Bicarbonates (HCO_3^-) and Hydroxides (OH^-). Alkalinity is the buffering capacity of a water body. It measures the ability of water bodies to neutralize acids and bases thereby maintaining a stable pH.

In present study the alkalinity was recorded in range 52 mg/l (June – July) to 148 mg/l (February – March). As per the Bureau of Indian standards the desirable level of total alkalinity for drinking water is below 200 mg/l and permissible level in the absence of alternate source is 600 mg/l (BIS, 1992). At site total alkalinity was high values mostly during summer season while minimum during monsoon season similar observation was recorded by Jawale C.A. (2009), Patil (2009). However most of the water is rich in carbonate, bicarbonate with little concentration of other alkalinity imparting ions (Trivedi and Goel 1984).In this study low alkalinity was recorded in the rainy season this is because the inflow of more rain water in to the water body. Some time high alkalinity is in winter and summer months similar results were also reported by Mishra *et al.* (1989) , Jain *et al*. (1996), Vasumathi (2009); Furhan Iqbal *et al*.(2006).

Hardness can also be defined as water that doesn't produce lather with soap solutions, but produces white precipitate. High levels of total hardness are not considered a health concern. On the contrary, calcium is an important component of cell walls of aquatic plants, and of the bones or shells of aquatic organisms. Magnesium is an essential nutrient for plants, and is a component of chlorophyll. In present study the highest

total hardness was 114 mg/l (February – March) and lowest 46 mg/l (August – September). In general at site total hardness values were high observed in summer and winter months and in monsoon values were low, when rainy water was added. The monsoon value of hardness was in low level indicating influence of dilution of water caused by monsoon water flow (Deka *et al*. 2001) similar observation was made by Koorosh jalizadeh *et al*. 2009.

TDS refer to any minerals, salts, metals, cations or anions dissolved in water. Salts like carbonate, bicarbonates, chlorides, sulphates, phosphates and nitrates of calcium, magnesium, sodium, potassium, iron etc. are dissolved in natural water. The high content of dissolved solids increases the density of water and influences osmoregulation of fresh water organisms. They reduce solubility of gases (like oxygen) and utility of water for drinking, irrigation and industrial purposes.

In the present study minimum TDS was 182 mg/l (April – May)) and maximum 290 mg/l (February – March). TDS gradually increased after monsoon season similar result was noted by Jawale A.K. *et al*. (2009), N. Vijay kumar (2009). The observed variation could be attributed to dilution effect associated with rainy season, while to high evaporation of water during summer (Sitaramassamy -1995). The human interference also contributed to the enrichment of dissolved solids (Devi 1997).

Dissolved oxygen in water is an index of physical and biological processes going on, non- polluted surface water generally saturated with dissolved oxygen. Dissolved oxygen is probably the most crucial and important water quality variable in freshwater body. Dissolved oxygen analysis measures the amount of gaseous oxygen (O_2) dissolved in an aqueous medium. During the study period minimum dissolved oxygen was noted 2.0 mg/l (February – March) and maximum 3.9 mg/l (October – November). Study shows that minimum dissolved oxygen was noted in summer months and maximum was during winter and moderate during monsoon months similar results were observed by Patil, Anil R. (2009), Jindal, R et al. (2009). Dissolved oxygen also had an inverse relationship with photoperiod. When the photoperiod was long, the dissolve oxygen value was low and when photoperiod was short, dissolved oxygen value was high. Ali *et al*. (2000) and Chaudhary *et al*. (1990) also arrived at the same conclusion.

Nitrate is the highest oxidized form of nitrogen and in water its most important source is biological oxidation of nitrogenous organic matter of both autochthonous and allochthonous origin. Domestic sewage and agricultural runoff are the chief source of allochthonous nitrogenous organic matter. Metabolic waste of aquatic community and dead organisms add to the autochthonous nitrogenous organic matter. The high concentration of nitrate in water is indicative of pollution.

The present study shows the range of nitrate 0.11 mg/l (February – March) to 1.47 mg/l (June – July). At site the minimum nitrate was recorded in starting of summer months (March) Similar data was recorded by Jawale A.K. *et al*. (2009)., however the data revealed no significant seasonal changes during study period.

Chlorides are salts resulting from the combination of the gas chlorine with a metal. Some common chlorides include sodium chloride (NaCl) and magnesium chloride ($MgCl_2$). Chlorine alone as Cl_2 is highly toxic and it is often used as a disinfectant. In combination with a metal such as sodium it becomes essential for life. Small amounts of chlorides are required for normal cell functions in plant and animal life. During the study period range of chloride was between 22.99 mg/l (October –November) to73.97 mg/l (December – January). Minimum chloride was noted during winter and highest during the end of winter and starting of summer, during summer chloride values were high and during monsoon it were low recorded it may be due to inflow of rain water and similar results were reported by Koorosh Jalilzadeh *et al*. 2009, Jindal, R. *et al*., N. Vijaykumar *et al*. (2009). Higher chloride content during summer could be due to continuous evaporation of water especially during summer season (Nair *et al*., 1983, Harikantra and Paruleker 1990; Sampathkumar and Kannan 1998; Borase and Bhave, 2001

Sodium compounds naturally end up in water. As was mentioned earlier, sodium stems from rocks and soils. Not only seas, but also rivers and ponds contain significant amounts of sodium. Concentrations however are much lower, depending on geological conditions and wastewater contamination Sodium is a dietary mineral for animals. Plants however hardly contain any sodium.

During the present study minimum sodium was 14 mg/l (August to November) and maximum 46 mg/l (December – January). Above results show minimum value of sodium recorded in monsoon season and maximum during winter and summer season it may be due to evaporation.

Conclusion

Study data shows all the water parameters are in permissible limit as per the Indian Standard for Drinking Water – Specification IS 10500 : 1991(www.indiawaterportal.org). So the study site

water quality is in permissible limit and site not shows any high water pollution level.

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Table: 1 Physico – chemical parameters of 'Ugat Vaniya Lake' water during April-May-2009 to February – March -2010

Ugat Vania Lake (Water analysis) during Apr.- May 2009 to Feb. - Mar 2010										
Sr. No.	Parameters	April-May 2009	Jun.-July 2009	Aug.-Sep. 2009	Oct.-Nov. 2009	Dec.-Jan.2010	Feb. - Mar. 2010	Min.	Max.	Avg.
1	Temperature (ºC)	31	31	30	30	27	30	27	31	29.83
2	pH	8.21	10.05	7.37	7.62	7.14	7.26	7.14	10.05	7.94
3	EC(µmho/cm)	260	352	308	344	379	414	260	414	342.83
4	Turbidity (NTU)	3.8	2.89	1.71	0.28	2.43	3.63	0.28	3.8	2.46
5	Alkalinity (mg/l)	84	52	86	108	129	148	52	148	101.17
6	Total hardness(mg/l)	90	60	46	102	108	114	46	114	86.67
7	TDS(mg/l)	182	257	220	245	270	290	182	290	244.00
8	Dissolved Oxygen(mg/l)	3.8	3.1	3.4	3.9	3	2	2	3.9	3.20
9	Nitrate(mg/l)	0.8	1.47	0.223	0.885	0.517	0.119	0.119	1.47	0.67
10	Chloride(mg/l)	44.98	48	32	22.99	73.97	72	22.99	73.97	48.99
11	Sodium(mg/l)	30	28	14	14	46	46	14	46	29.67

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