RESEARCH ARTICLE

Assessment of potability of water with respect to physical parameters

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ABSTRACT

India is blessed with high average rainfall and abundant water resources. Inspite of this, millions of people do not have access to safe drinking water and severe drought is experienced in many parts of the country. The rivers, lakes and reservoirs are being used indiscriminately for disposal of urban, industrial and agricultural wastes thereby polluting surface and ground water beyond permissible limits. The emerging water crisis has clearly brought the need to address the issues at different levels of policy and governance, with a particular emphasis on the need of drinking water. There are innumerable factors responsible for the pollution and degradation of water bodies. Water Quality assessment involves analysis of physical, chemical, biological and microbial parameters which reflects on biotic and abiotic status of the ecosystem. This helps in planning the strategies for conservation and preservation of available resources. Less than 1% of total water on the surface of Earth is available for human use. This amount of water constantly passes through a system called as Hydro biological Cycle. The present study aims to study the physical parameters which affect the potability of the water body.

Key words: Abiotic, hydro biological cycle, potability, microbial.

INTRODUCTION

Water quality at a given time and space acts as a limiting factor which in turn regulates biotic diversity, biomass, material cycles and trophic levels. A poor environment undermines development; while inadequate or inappropriate development results in lack of resources for environmental protection. According to the Environmental Report published by Government of India 1999, the environmental pollution was responsible for 20% of the burden of diseases in the country. 11% of the total burden of the diseases are attributed to water pollution and poor sanitation. The natural environment system is a self-regulating one with its ecological processes which shape the climate, cleanse the air and water, regulate water flow, recycle essential elements and keep the planet fit for life. Deterioration of even a single element inevitably affects all other elements. Man's activities, coupled with constant

interaction between the forces of nature, produce a complex network of interrelationships in our environment which is delicately balanced and prone to disturbances. New perceptions and fresh insight related to development and environment have broadened the context of environmental study tremendously to include a host of problems, not only the biophysical ones, but also the socio-cultural, economical, political and administrative components. India has vast and varied inland water resources, which are considered to be the richest in the world's natural lakes. Fresh water lakes are the vital resources for any country. The exploitable water resources are very few and this is the reason to plan for their development and protection.

MATERIAL AND METHODS

WATER SAMPLING AND PRESERVATION

The main purpose of sampling is to collect a portion of the material, small enough in volume to be conveniently transported to and handled in the laboratory for further investigation. A single point analysis and conclusion of a water body may be misleading hence five different sampling stations were selected. Samples from various stations, S-1 to S-5 were collected for study of physical parameters biweekly for two years.

The samples were labeled properly and preserved at 4˚ C by refrigeration. The sample collection and analysis was done with in a very short span of time according to the standard methods prescribed by NEERI. Physical parameters under study for different water samples collected from Wunna Lake were Temperature, Electrical conductivity and turbidity.

Temperature:
Temperature is basically important for its effect on the chemistry and biological activities of the organisms in water. Rise in temperature leads to increase in rate of chemical reactions, reduces the solubility of gases and amplifies the taste and odor. Temperature was recorded by using mercury thermometer in Celsius scale nearest to 0.1˚ c.

Electrical Conductivity (EC):
Conductivity (specific conductance) is the numerical expression of the ability of water to conduct electric current. The conductance of water samples gives rapid and practical estimate of the variation in dissolved mineral content. The electrical conductivity was measured by Conductivity meter. (Systronic Make) and the readings were noted in micro Siemens/cm.

Turbidity: Suspension of particles in water interfering with the passage of light is called as turbidity. It is caused by a wide variety of suspended matter which ranges from colloidal to coarse. Turbidity was measured by Nephlometer. The calibration of the instrument was done by using standard turbidity suspension. The readings were recorded in NTU (Nephlometric Turbidity Unit).

RESULTS AND DISCUSSION

1. Temperature

Measurement of temperature is an important parameter required to get an idea of self-purification of rivers and reservoirs which helps to decide the potability of water. Temperature, as an ecological factors, plays a major role in the life cycle of organisms. No other physical factor has profound direct or indirect influence of the aquatic habitat. It is also an important factor for Dissolved oxygen and CO_2 levels.

The yearly fluctuations of temperature in Wunna lake have been observed and the same have been depicted in the Table 1. The Figure No.1 reveals comparative monthly mean values of temperature in °C for samples collected from different sampling stations during the period of study 2006 and 2007 respectively.

Perusal of Table No.1 and Figure No. 1 indicate higher temperature during the months May, June and July 2006. The temperature ranges from 25°C to 27°C.The maximum temperature of 27.66 °C has been recorded during the month of June 2006. The temperature of water in the year 2006 showed a gradual increase from a minimum temperature of 19.53°C in January to a maximum temperature of 24.66°C in April. There was a gradual decline from June to September, where the temperature was recorded to be 20.10°C. A steep rise was observed in the month of October, when the temperature was 23.02°C, and there after it declined to 19.73°C in the month of December, 2006.

Table1: Comparative Monthly Mean Values of Temperature for samples of water collected from WunnaLake during the period of study 2006 and 2007.

MONTHS	YEAR 2006	YEAR 2007
	MEAN VALUE	
	A	B
January	19.53±0.01	20.10±0.01
February	20.67±0.01	20.79±0.11
March	23.50±0.01	23.10±0.34
April	24.66±0.01	24.61±0.01
May	25.12±0.01	25.14±0.00
June	27.66±0.02	28.76±0.06
July	25.87±0.01	25.38±0.05
August	24.03±0.01	25.07±0.01
September	20.10±0.01	20.51±0.05
October	23.02±0.01	22.34±0.02
November	22.66±0.01	23.30±0.01
December	19.73±0.00	20.44±0.01

** All values are in Degree Celsius.*

It is evident from Table -1 that the pattern of temperature during the years 2006 and 2007 is more or less similar. Marginal variation in temperature has been recorded during the month of August in 2006 and 2007. This may be due the overall fluctuation in ambient temperature which subsequently affects the temperature of the water body. In the year 2007, the temperature was at a minimum of 20.10°C in January and gradually increased to 28.76 °C in the month of June. There was a decline in the temperature from June to September, where the temperature was recorded to be 20.51°C; there after it gradually fell down to 20.44°C in the month of December, 2007.

Thus, the temperature of the Wunna Lake showed a minimum during the month of December and January and rose to a maximum in the month of June. During the summer months the temperature remained more or less constant. No significant change in the value of temperature was observed from station S1 to S5 throughout the period of study.

The marginal variation of temperature in the year 2006 and the year 2007 may be due to climatological changes, increase in transportation and industrialization. It is obvious from the results that seasonal changes in ambient temperature affect the temperature of the lake water. In the present study the temperature of the water ranged between 19.53 ^{o}C to 27.66 ^{o}C and 20.10 ^{o}C to 28.76 °C for the years 2006 and 2007 respectively.

Minimum temperature was recorded during the month of December and January, however the maximum temperature was recorded in the month of June. Similar results have been quoted by earlier workers, Pophali et al (1990), Singh and Singh, (1990) and Ramadevi et. al.,(1996).The temperature range was recorded to be higher during the summer months i.e., from March to May which may be due to greater solar radiation, low water level, clear atmosphere and higher atmospheric temperature as recorded by the metrological department. These findings are in accordance with the observations put forth by Trivedi et.al., (1990) and Sharma and Diwan, (1989).

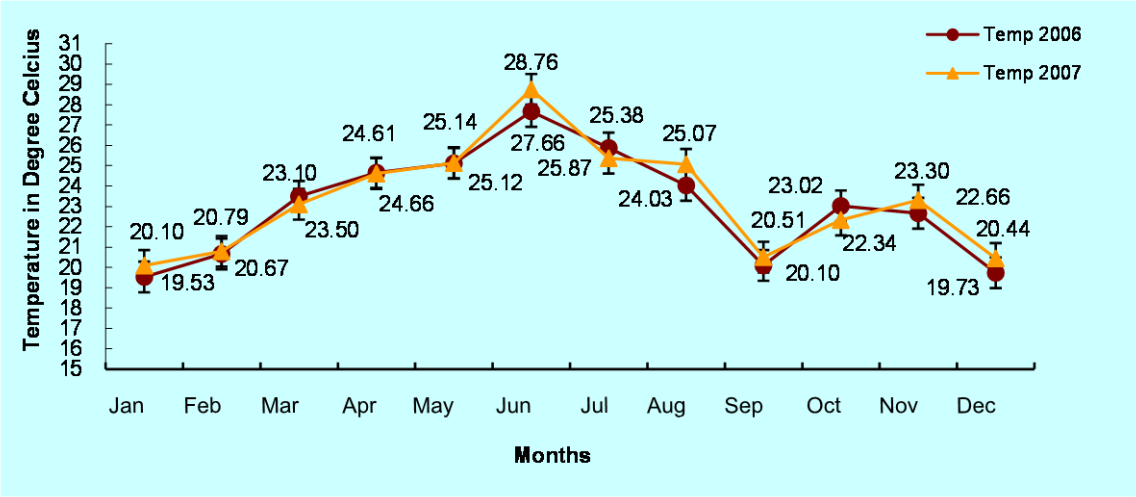

Fig. 1: Comparative Monthly Mean Values of Temperature for samples of water collected from Wunna Lake during the period of study 2006 and 2007.

The temperature range of the water body never increased beyond 30^{0}C indicating potability of the water body in terms of bacterial quality, because at this temperature range bacterial proliferation would be minimal. The temperature range of the water body also indicated minimum dissolution of inorganic salts and that the water body was not subjected to organic pollution, industrial discharge or distillery effluents. (Gunale, 1991; Sahu et, al., 1991 and Chauhan, 1991).

ELECTRICAL CONDUCTIVITY (EC)

Conductivity is the capacity of water to carry an electrical current and varies both with number and types of ions the solution contains. Conductivity measurement gives rapid estimate of dissolved mineral contents of a water body. It is an important criterion in determination of suitability of water. The EC values and the class of water in terms of salinity are given below.

Table – 2. Classification of Electrical Conductivity.

EC µ siemens/cm	CLASS	SALINITY
< 250	Excellent	Low
250 – 750	Good	Moderate
750 – 2250	Moderate	Medium high
2250 – 4000	Unsatisfactory	High
>4000	Unfit	Very high

The electrical conductivity was measured at five sampling stations S_1, S_2, S_3 , S_4 . Table – 3. Figure No. - 2 show comparative monthly mean values of Electrical Conductivity in the years 2006 and 2007.

The observations recorded in the year 2006 reveal that electrical conductivity shows a gradual increase from the month of April 2006 up to August, where it was 287.24 µ siemens/cm.. It remained fairly constant up to October 2006 where it was recorded to be 288.04 µ siemens/cm. in the month of November and then a sharp increase in the month of December where it was found out to be 354.32 µ siemens/cm.

A sharp decline in monthly mean values in EC in January 2007, have been observed. Perusal of Table- 3 shows that EC was 312.12 µ siemens/cm. in the month of January after which it followed a trend similar to the monthly observations recorded in the year 2006. There was a gradual decline in the mean value of EC up to June 2007 from 264.93 µ siemens/c and an increase there after up to December 2007, where EC is found to be 352.00 µ siemens/cm.

The study period spread over two years indicated that lowest value of 263.79 ± 0.65 µ siemens/cm and 264.93 ± 0.15 µ siemens/cm in the year 2006 and 2007 respectively. The higher limit of EC in the year 2006 is 354.32 ± 0.51 µ siemens/cm and 352.00 ± 0.14 µ siemens/cm in the year 2007.

EC for the water body under consideration was seen to be minimum in the pre monsoon month of June in both the years of study, and showed increase through the monsoon months of July and August, maintaining high levels up to the winter months of December and January.

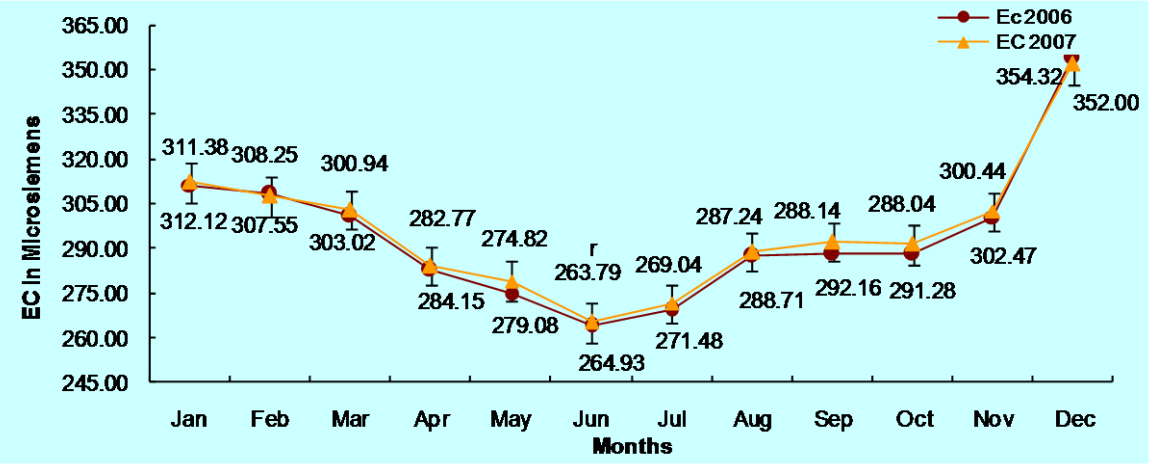

Fig. 2. Comparative Monthly Mean Values of Electrical Conductivity for samples of water collected from Wunna Lake during the period of study 2006 and 2007.

Table – 3 Comparative Monthly Mean Values of Electrical Conductivity for samples of water collected from Wunna Lake during the period of study 2006 and 2007.

MONTHS	YEAR 2006	YEAR 2007
	MEAN VALUE	
	A	B
January	311.38 ± 0.57	312.12 ± 0.02
February	308.25 ± 0.12	307.55 ± 0.12
March	300.94 ± 0.36	303.02 ± 0.05
April	282.77 ± 1.14	284.15 ± 0.69
May	274.82 ± 0.02	279.08 ± 0.14
June	263.79 ± 0.65	264.93 ± 0.15
July	271.84 ± 0.21	271.48 ± 0.24
August	287.24 ± 0.13	288.71 ± 0.23
September	268.04 ± 0.47	269.88 ± 0.46
October	288.04 ± 0.32	291.28 ± 0.20
November	300.44 ± 0.27	302.47 ± 0.22
December	354.32 ± 0.51	352.00 ± 0.14

** All values are in µ siemens/cm*

Similar findings were also found by Kulkarni et. al., (1995) who recorded higher conductivity values during monsoon and winter followed by summer season, in Sadatpur reservoir, Ahmednagar District (M.S.). A positive correlation of EC with temperature was thus observed in the present study. The values of conductivity were higher in the month of April and lower in September, in Kuttanad wet land ecosystem (Narayan and Chauhan, 2000).

During the rainy season due to surface run off from the catchment areas the ionic content of water and the values of conductivity were marginally on the higher side. Bajpai and Tamot, (1999) in their investigation noticed that the electrical conductivity rises during rainy season and showed downward trend in winter. Higher conductivity in water bodies may be attributed to the agriculture run off, Shoukat Ara et. al., (2004).

TURBIDITY

The changes in value of turbidity have been observed for two consecutive years 2006 and 2007 and the same are reflected in Table- 4 . The comparative monthly mean values of turbidity during the course of study 2006-2007 have been plotted in Figure No.3.

Table 4. Comparative Monthly Mean Values of Turbidity for samples of water collected from Wunna Lake during the period of study 2006 and 2007.

MONTHS	YEAR 2006	YEAR 2007
	MEAN VALUE	
	A	B
January	1.10±0.04	1.12±0.04
February	1.06±0.02	1.10±0.04
March	2.08±0.04	1.92±0.04
April	2.92±0.04	3.00±0.03
May	3.60±0.03	3.84±0.04
June	4.30±0.03	4.86±0.03
July	5.08±0.04	5.44± 0.07
August	5.36±0.04	5.52±0.06
September	4.18±0.04	4.08±0.04
October	3.08±0.05	2.74±0.07
November	1.06±0.04	1.14±0.08
December	1.06±0.04	1.00±0.00

** All values are in NTU.*

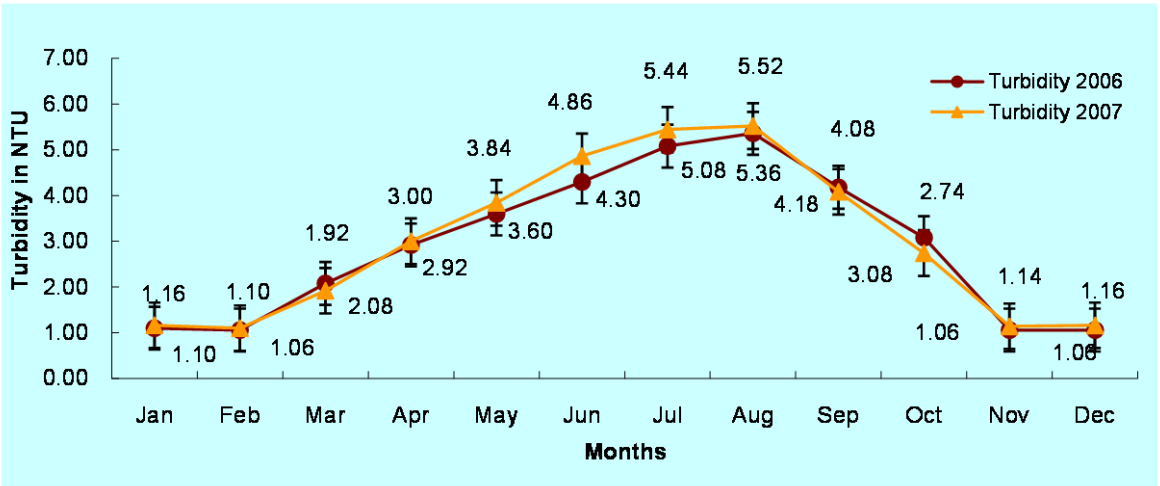

Fig. 3: Comparative Monthly Mean Values of Turbidity for samples of water collected from Wunna Lake during the period of study 2006 and 2007.

In the year 2006 the monthly mean value was observed to be 1.10 NTU in the month of January and February. After which the value showed a gradual rise through March, April, May, June and July where it was recorded to be 5.08 NTU. In the month of August the increasing trend continued and the mean value of turbidity was recorded to be 5.36 NTU. Here after the values showed a decline through September, October and November where it was recorded to be 1.06 NTU which remained constant in the month of December 2006.

The value of Turbidity showed a slight increase to 1.12 NTU in the month of January 2007 as compared to December 2006. In the month of February a marginal decline was recorded to 1.10 NTU. Here after an increasing trend was observed through March, April May, June and July where it was recorded to be 5.44 NTU. Slight increase to 5.52 NTU was observed in the month of August 2007. A declining trend was observed through September, October and November where it was recorded to be 1.14 NTU. The lowest mean value of 1.00 NTU turbidity was recorded in the month December 2007.

The monthly mean values of turbidity of the water samples collected during 2007 were comparatively higher as compared to the corresponding values in the year 2006 except in the month of March, September and October.

The degree of turbidity of water may be used as a measure of the intensity of pollution, Harish Kumar (1998). During the present study monitoring of turbidity in Wunna Lake revealed that the values of turbidity were on the higher side in the months of July and August, where they were recorded to be to be 5.08 NTU and 5.36 NTU in the year 2006 and 5.44 NTU and 5.52 NTU in the year 2007. The turbidity increased as a consequence of the surface run off soil and the inflow of water carrying suspended solids. These findings are similar to those of Vaishya and Adhoni (1992); Rajmani Singh(2003) and Kshama Khobragade (2006). The highest values of turbidity were recorded in the month of August in both the years, similar results were observed by Kulkarni et al., (1995).

The findings indicate that the turbidity values were quite low and within the permissible limit (10mg/L) indicating that there was no impact of pollution on the water body and the fitness of the water quality for drinking purpose.

CONCLUSION

After the analysis of physical parameters it has been observed that the temperature range of the Wunna lake never increased beyond 30^0C indicating potability of water in terms of bacterial quality, dissolution of inorganic salts, organic pollution, industrial discharge or distillery effluents.

The comparison of results obtained on Electrical conductivity and drinking water standards revealed that all the samples showed excellent class of water in some months and a considerable good water with low and moderate salinity in the remaining months of the calendar. The turbidity values are quite low and within the permissible limit (10mg/L) indicating that there is no impact of pollution on the water body and the fitness of the water quality for drinking purpose.

The present study divulges that taking seasonal variations into consideration the values of all the parameters under study are within the range of potable water body.

Present antagonistic activity study showing different mark of inhibition zone. Fungal inhibition zone or activity line are categarised into two grade. 21 antagonists shows positive activity. 3 antagonists shows negative activity against *C. graminicola*. Hence this study suggested that these antagonists one capable to control anthracnose disease, which is introduce in this area on sugarcane.

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