

SEASONAL STUDY WITH INTERPRETATION OF THE CHEMICAL CHARACTERISTICS OF WATER POND IN REFERENCE TO QUALITY ASSESSMENT: A CASE STUDY

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Abstract: Water samples were collected from different locations around Lakha banzara Lake. These water samples from 08 sampling points during three seasons were analyzed for their physicochemical characteristics, viz. pH, Colour, Odour, Hardness, Chloride, Alkalinity, TDS, COD, Metal ion content etc. On comparing the results against water quality standards and standard values recommended by World Health Organization (WHO), it is found that most of the water samples are highly polluted not even bathing purposes, due to high concentration of one or the other parameter. A Systematic calculation of correlation coefficient between water quality parameters has been done with the objective of minimizing the complexity and dimensionality of large set of data. The significant correlation has been further verified by using t-test. An attempt has been made to find the seasonal quality of water in Lakha banzara lake, in order to adopt a mathematical model for examine water quality.

Key words: Water quality parameters, Correlation analysis.

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INTRODUCTION

In India ponds, lakes, rivers and ground water are used for domestic and agricultural purposes. The quality of water may be described according to their physico-chemical and micro-biological characteristics. For effective maintenance of water quality through appropriate control measures, continuous monitoring of large number of quality parameters is essential. However it is very difficult and laborious task for regular monitoring of all the parameters even if adequate manpower and laboratory facilities are available. Therefore, an attempt based on statistical correlation, has been used to develop mathematical relationship for comparison of physico-chemical parameters.

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OBJECTIVES

STUDY AREA AND COLLECTION OF WATER SAMPLES

Water samples were collected from 8 sampling station of Lakha banzara lake in sagar city viz: 1). Ganesh Ghat; 2). Chakra Ghat; 3). Gau Ghat; 4).Ghat near Duftrin Hospitil; 5). Baria Ghat; 6). Dhobi Ghat; 7). Sanjay Drive; 8). Centre of lake.

At premonsoon, during monsoon and post monsoon seasons from January 2007 to January 2008.

The samples were collected in clean polythene bottles without any air bubbles. The bottles were rinsed before sampling and tightly sealed after collection and labeled in the field.

The temperatures of the samples were measured in the field on the spot at the time of sample collection. The samples were immediately analysed in the chemistry lab. The error due to time has been omitted for the present study.

MATERIAL, METHOD AND METHODOLOGY

ANALYSIS OF WATER SAMPLE

All the chemicals used were of AR grade. Analysis was carried out for various water quality parameters such as pH, total solids, Total Dissolved solids (TDS), total hardness (TH), total alkalinity, calcium, chloride and chemical oxygen demand (COD) were measured by using Standard methods. pH- measured using standard pH meter, total solids (TS), total dissolved solids (TDS) by standared methods, calcium content by EDTA titrimetric method, chloride content by argentometric method, Total hardness was calculated by complexometric titration using EDTA, methyl orange alkalinity and chemical oxygen demand (COD) by open reflux method.The statistical analysis has been performed using standard methods.Correlation coefficient (r) was calculated and correlation for significance has also been tested by applying t-test. Winks SDA 6.0.5 Statistical Software was used for Statistical analysis.

RESULTS AND DISCUSSION

Table 1. Comparison of physicochemical parameters of Lakha banzara lakes water (In mg/L) at Pre monsoon with standard values (WHO) Physico - Chemical parameters, in mg/L (May 2007)

Parameter	P1	P2	P3	P4	P5	P6	P7	P8	Mean	WHO (Excessive limit)
Temp., °C	20 °C	20 °C	20 °C	20 °C	20 °C	20 °C	20 °C	20 °C	20 °C	-
Colour	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish
Odour	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Unobjectionable
Total solids mg/L	1995	2015	1886	1970	1980	2110	1990	1760	1963.25	1500
Ph	9.0	9.2	9.2	8.9	8.8	8.6	8.7	8.6	8.87	6.5-9.2
TDS mg/L	1700	1820	1560	1700	1740	1930	1800	1660	1738.75	1000
Chloride mg/L	265	273	288	295	256	285	277	274	276.62	-
TH mg/L	1200	1240	1292	1185	1182	1280	1098	1190	1208.37	600
Ca, mg/L	90	96	87	83	100	90	90	94	91.25	200
Alkalinity mg/L	930	1090	1060	890	944	936	1050	1035	991.87	120
COD mg/L	265	278	266	280	285	280	255	260	271.12	255

*P - indicate Sampling place

Matrix of Correlation Coefficients (Pre monsoon)

TS	pH	TDS	CHLORIDE	TH	Ca	ALKANITY	COD	
TS	1	.031	.773	.013	.126	-.039	-.355	.505
		(.942)	(.024)	(.976)	(.766)	(.926)	(.388)	(.202)
pH	1	-.415	.066	.402	-.116	.319	.129	
		(.307)	(.877)	(.324)	(.784)	(.441)	(0.76)	
TDS	1	-.079	-.057	.238	-.144	.344		
		(.853)	(.893)	(0.57)	(.734)	(.403)		
CHLORIDE	1	.301	-.854	-.046	-.039			
		(.468)	(.007)	(.914)	(.927)			
TH	1	-.102	.054	.395				
		(.811)	(.899)	(.332)				
Ca	1	.285	.217					
		(.494)	(.605)					
ALKANITY	1	-.483						
COD	1							

Key: Correlation
(p-value)

Table 2. Comparison of physicochemical parameters of Lakha banzara lakes water (In mg/L) at Monsoon with standard values (WHO) Physico - Chemical parameters, in mg/L (Sep. 2007)

Parameter	P1	P2	P3	P4	P5	P6	P7	P8	Mean	WHO
Temp., °C	24 °C	24 °C	24 °C	24 °C	24 °C	24 °C	24 °C	24 °C	24 °C	-
Colour	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	-
Odour	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Unobjectionable
Total solids	2012	2180	1980	2230	2210	2260	2135	2070	2134.62	1500
pH	9.1	9.1	9.3	8.8	8.5	8.6	8.7	8.6	8.83	6.5-9.2
TDS	1740	1970	1670	1860	1850	1990	1870	1730	1835	1000
Chloride	256	270	268	275	276	280	286	269	272.5	600
TH mg/L	900	940	1100	1010	950	980	990	1070	992.5	600
Ca mg/L	95	92	108	97	120	124	116	121	109.12	200
Alkalinity mg/L	915	1050	960	930	910	870	950	960	943.12	120
COD	272	280	286	285	290	295	265	270	280.37	255

Matrix of Correlation Coefficients (monsoon)

	TS	PH	TDS	CHLORIDE	TH	Ca	ALKANITY	COD
TS	1	-.139	.837	.072	-.619	.527	-.451	.618
		(.607)	(0.0)	(0.79)	(.011)	(.036)	(.079)	(.011)
pH		1	-.286	-.173	.078	-.393	.395	.099
			(.283)	(.523)	(.775)	(.132)	(0.13)	(.715)
TDS			1	.088	-.488	.345	-.219	.457
				(.746)	(.055)	(.191)	(.415)	(.075)
CHLORIDE				1	.284	-.114	-.004	-.05
					(.286)	(.675)	(.988)	(.854)
TH					1	-.533	.357	-.273
						(.034)	(.175)	(.306)
Ca						1	-.387	.398
							(.139)	(.127)
ALKANITY							1	-.521
								(.039)
COD								1

Key: Correlation
(p-value)

Table 3. Comparison of physicochemical parameters of Lakha banzara lakes water (In mg/L) at Post monsoon with standard values (WHO) Physico - Chemical parameters, in mg/L (Jan. 2008)

Parameter	P1	P2	P3	P4	P5	P6	P7	P8	Mean	WHO
Temp., °C	10 °C	10 °C	10 °C	10 °C	10 °C	10 °C	10 °C	10 °C	10 °C	-
Colour	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish
Odour	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Bad Smell	Unobjectionable
Total solids	1750	2080	1785	1834	1880	1897	1750	1825	1850.12	1500
pH	9.4	9.0	9.1	8.4	8.5	8.4	8.8	8.5	8.76	6.5-9.2
TDS	1715	1990	1750	1800	1860	1830	1710	1790	1805.62	1000
Chloride, mg/L	260	268	270	280	282	285	290	272	275.87	-
TH, mg/L	880	910	960	850	885	950	920	970	915.62	600
Ca, mg/L	92	88	95	85	96	105	94	88	92.87	200
Alkalinity	925	1010	970	945	960	940	960	1070	972.5	120
COD	282	285	290	292	289	292	276	278	285.5	255

Matrix of Correlation Coefficients (Post monsoon)

	TS	PH	TDS	CHLORIDE	TH	Ca	ALKANITY	COD
TS	1	-.019	.634	-.012	.075	.505	-.256	.082
		(.931)	(.001)	(.957)	(.728)	(.012)	(.228)	(.703)
pH		1	-.137	-.313	.025	-.349	.26	.057
			(.522)	(.137)	(.907)	(.094)	(0.22)	(.792)
TDS			1	.054	-.381	.237	-.108	.415
				(.803)	(.066)	(.265)	(.617)	(.044)
CHLORIDE				1	.141	-.044	-.04	-.009
					(0.51)	(.838)	(.852)	(.965)
TH					1	-.149	.255	-.475
						(.486)	(0.23)	(.019)
Ca						1	-.381	.161
							(.066)	(.451)
ALKANITY							1	-.353
								(0.09)
COD								1
Key: Correlation								
(p-value)								

A total of 8 water samples from Lakha banzara lake used by people of Sagar City were collected in clean polythene bottles and brought to the laboratory. The samples were chemically preserved by the addition of 3 - 5 ml concentrated HNO₃ per litre of the sample. The standard and observed values of physico-chemical parameters of experimental water samples are presented in table 1 - 3. The chemical data were compiled further to know location wise distribution. The data revealed that there were considerable variations in the examined samples from different sources with respect to their chemical characteristics. The results indicate that the quality of water considerably varies from location to location. Correlation is the mutual relationship between two variables. Direct correlation exists when increase or decrease in the value of one parameter is associated with a corresponding increase or decrease in the value of the other. The correlation is said to be positive when increase in one parameter causes the increase in the other parameter and it is negative when increase in one parameter causes the decrease in the other parameter. Correlation coefficients (r) among various water quality parameters were calculated and the values of the correlation coefficients (r) are given in above correlation matrix table.

At Pre-Monsoon

The observed pH values ranging from 8.6 to 9.2 (table 1) shows that, the present water samples are slightly alkaline. The Weak positive correlation found between Total solid and Ph (-.139), Total solid and Chloride (.013), Total solid and Total Hardness (.126), similarly in between (pH, Chloride), (pH, TH), (pH, alkalinity), (pH, COD), (TDS, Ca), (TDS, COD), (Chloride, TH), (TH, alkalinity), (TH, COD), (Chloride, TH), (Ca, alkalinity), (Ca, COD). The Moderate positive correlation found between (TS, TDS) and (TS, COD). The Weak Negative correlation found between (TS, Ca), (TS, alkalinity), (pH, Tds), (pH, Ca), (Tds, alkalinity), (Chloride, alkalinity), (Chloride, COD), (TDS, TH), (TDS, Chloride), (TH, Ca), (alkalinity, COD). The Strong Negative correlation exist between (Chloride, Ca).

At Monsoon

The Strong positive correlation found between (TS, TDS). The Moderate positive correlation exist between (TS, COD), (TS, Ca). The Weak positive correlation exist between (TH, alkalinity), (pH, COD), (TDS, Ca), (TDS, COD), (pH, TH), (pH, alkalinity), (TS, Chloride), (TDS, Chloride), (Chloride, TH), (Ca, COD). The Moderate Negative correlation exist between

(TS, TH), (TH, Ca), (alkalinity, COD). The Weak Negative correlation exist between (Chloride, alkalinity), (Total solid and pH), (Total solid and alkalinity), (pH, TDS), (pH, Chloride), (pH, Ca), (Tds, alkalinity), (Tds, TS), (Ca, COD), (TH, COD), (Ca, alkalinity).

At Post Monsoon

The Moderate positive correlation found between (TS, Tds), (TS, Ca). The Weak positive correlation found between (TS, TH), (TS, COD), (pH, TH), (pH, alkalinity), (pH, COD), (TDS, Chloride), (TDS, Ca), (TDS, COD), (Chloride, TH), (TH, alkalinity), (Ca, COD). The Weak Negative correlation found between ((TS, pH), (TS, Chloride), (TS, alkalinity), (pH, TDS), (pH, Chloride), (pH, Ca), (TDS, TH), (Tds, alkalinity), (Ca, Chloride), (Chloride, alkalinity), (Chloride, COD), (TH, Ca), (TH, COD), (Ca, alkalinity), (alkalinity, COD). A large number of factors and geological conditions influence the correlations between different pairs directly or indirectly. An appreciable significant strong positive correlation have been recorded for total solid and total dissolved solid (at monsoon). A strong negative correlation was found between Chloride and Ca.

CONCLUSION AND RECOMMENDATION

All the physico-chemical water quality parameters of Lakha banzara lakes water in sagar city are out of the highest desirable limit or maximum permissible limit set by WHO except pH, Chloride and Ca which recorded high values. Hence these sample water can not be much fit for drinking, irrigation and domestic used. The statistical analysis of the experimentally estimated water quality parameters on water samples yielded the range of the variation, mean, standard deviation and co-efficient of variation. Since the correlation coefficient gives the interrelationship between the parameters, correlation coefficients were calculated. Results of correlation analysis show that, at Premonsoon, monsoon, Postmonsoon all applied water quality parameters are beyond the maximum permissible limit set by WHO. The average of alkalinity has exceeded the desirable Limits which are due to improper drainage system. In conclusion from the results of the present study it may be said that the Lakha banzara lakes water of Sagar is not fit for domestic As well as bathing purpose need treatments to minimize the contamination especially the alkalinity. It is recommended that lakes water analysis should be carried out from time to time to monitor the rate and kind of contamination. It is need of human to expand awareness among the people to maintain the cleanness of lakes water at their highest quality and purity levels.

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