

Analysis of Water Quality of Gandhi Sagar Lake, Nagpur, India

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Abstract

The appropriate direction and valuation of lake water condition and its refinement is very crucial for appropriate care and management purposes. The nature of drink condition scrutinizing and recapitulate of the Gandhi Sagar creek was invoked for multifarious specification in the month of June, 2020. These specifications are: (i) pH, (ii) electric conductivity, (iii) dissolved oxygen, (iv) biochemical oxygen demand, (v) chemical oxygen demand, (vi) total phosphorus, (vii) suspended solid (viii) total nitrate and (ix) total coliforms conjointly. Maximum attributes do not satisfy the permissible limit.

Keywords: Gandhi Sagar Lake, Nagpur city, World Health Organization, Water specimen, Dendogram .

1. INTRODUCTION

Water is very essential to sustain life [1][2][3][4]. It is predicted that two-thirds of the human body is integrated of water. Water is the dominant environment of these ecosystems. Water gets desecrated with microbe through intestinal discharge of human and animals. The rapid growth of population and technological and industrial boom has brought prodigious problems and decadence of environment chemical and toxic elements are being let into the drain streams and even open spaces adjoining the industrial area switch out any check. The quantity of consumable water decreases due to over exploitation and also by impurity. Wise and restrained use of the earth's resources, especially water being the most vital one is emphasized. For the quantification of the effects of aquatic habitats contamination, analysis of the composition of aquatic constituents, physicochemical specifications are needed. Therefore, keeping in view of the above mentioned factors, the physico-chemical

property of specifications of Gandhi Sagar lake were investigated in the present study. The objectives behind the study were to identify a clear picture of the lake water quality, assessment in the water quality, suitability of water for different purposes, and identify possible contamination causes.

2. MATERIALS AND METHODS

2.1 Study Area

Gandhi Sagar Lake is located in Nagpur city in front of Raman science centre (21.146°N 79.099°E). It is created before 275 years ago by Chand sultan for diverting the Nag river water (Fig 1).



Fig1: Picture of the research area

2.2 The morphometry of Gandhi Sagar lake

The research consideration handles the Gandhi Sagar Lake to investigate morphometric data for the collected samples as given in the Table 1.

Table 1. Morphometric data of Gandhi Sagarlake

The tropic situation	Eutrophic in nature
Ingress	Open lake
Silhouette	Rectangular with Rounded edge
Area covering	191500 square meter
Depth	7 meter

2.3 Collection of Specimen:

Water specimen were assembled in morning hours from the selected sites of the lake in ductile bottle to obviate fluky contraction in specimen using definitive approach[5][6]. The physic-chemical parametersof the specimen were properly studied.

2.4 Investigation of Samples:

The specimen were evaluated for different attributes such as pH, electric conductivity(EC),dissolved oxygen(DO),chemical oxygen demand(COD), biochemical oxygen demand (BOD), total phosphorous(TP),suspended solid(SS),total nitrate(TN) and total coliforms(TC) as per the standard methods (APHA, 1998)[7][8]. Attributes of water quality characterization and standards are shown in Table 2.

Table 2 Standard value of attributes.

Attributes	WHO	ICMR	USPH	ISI	NDWSQ
pH	6.5 – 9.2	7.0 – 8.5	6.0 – 8.5	6.5 – 8.5	
Electrical conductivity Mho/cm	300	300	300	-	
Total Nitrate	45	20	45	45	
Total Phosphorus	0.03	-	-	-	
Dissolved Oxygen	4 – 6		4-6	3.0	

Attributes	WHO	ICMR	USPH	ISI	NDWSQ
BOD	6.0	-	5	-	
COD	10	-	4	-	
Suspended solid					25
Total Coliform	0				

All units except pH, total coliform and Electrical Conductivity are in mgL^{-1}

pH and total coliform are without unit.

WHO - World Health Organization

ICMR - Indian Council of Medical Research

USPH - United States public drinking water standard

NDWQS-National drinking quality standard

ISI - Indian Standards Institution

3. RESULTS AND DISCUSSION

Diverseness of various parametrs such as pH, electric Conductivity(EC), dissolved oxygen(DO),chemical oxygen demand(COD), biochemical oxygen demand (BOD), total phosphorous(TP),suspended solid(SS),total nitrate(TN)and total coliforms(TC) absorption along the Gandhi Sagar Lake water are listed in Table 3. The results expose that water is not suitable for drinking purposes because some of attributes are below the permissible limits and some of the parameters are above the permissible limits . Using IBM SPSS 21 software Cluster analysis is completed and a Dendogram is shown in Fig 2. There are two demographically coherent clusters are organized. Suggest result affirms that the results are not similar in cluster 2 and cluster 1. Principal component analysis is also performed and is shown in Table 5 and corresponding plot is shown in Fig 3. PCA shows that pH, COD, suspended solid, total nitrate and total coliforms are recorded for high positive loading in the first component. DO, TP and TN shows high positive loading in the second component. BOD and TP shows high positive loading in third component. EC is recorded as lowest load in first component. So there is dissimilarities in load in case of factor analysis. This means physical and chemical factor involves regarding this. This shows that there is major factor for water quality to drink purposes. Principal component analysis also shows that there is significant difference between the attributes. Correlation matrix has operated using Microsoft Excel 7 software and tabulated in Table 4 to obtain the relationship between the physico-chemical variables[9][10].Correlation analysis shows that pH is positively correlated with dissolved oxygen, COD and suspended solid. pH is negatively correlated with electric conductivity, BOD and total phosphorus. Like this positive as well as negative

correlation raised between other attributes. So suitable measurement required to save the lake water from pollution.

Table 3. Water Quality at different months of Gandhi Sagar lake water (Laboratory Analysis)

Name of Station	pH	EC (mho/cm)	DO (mgL ⁻¹)	COD (mgL ⁻¹)	BOD (mgL ⁻¹)	TP (mgL ⁻¹)	SS (mgL ⁻¹)	TN (mgL ⁻¹)	TC
S1	7.4	692	3.2	70	42	0.25	92	0.44	810
S2	7.6	572	2.2	82	46	0.18	112	0.35	990
S3	7.9	583	2.6	98	27	0.10	179	0.43	1008
S4	8.3	478	3.2	112	35	0.22	208	0.78	1134

Table 4. Pearson Correlation Matrix for the Samples

	<i>pH</i>	<i>EC</i>	<i>DO</i>	<i>COD</i>	<i>BOD</i>	<i>TP</i>	<i>SS</i>	<i>TN</i>	<i>TC</i>
pH	1								
EC	-0.91261	1							
DO	0.243267	0.063701	1						
COD	0.992337	-0.91186	0.148258	1					
BOD	-0.59153	0.300704	-0.17934	-0.64611	1				
TP	-0.20954	0.203898	0.628074	-0.32824	0.648194	1			
SS	0.97486	-0.8348	0.211269	0.987152	-0.75386	-0.37396	1		
TN	0.833593	-0.68337	0.684111	0.760687	-0.31579	0.338367	0.745719	1	
TC	0.930451	-0.99205	-0.09182	0.942124	-0.40688	-0.31314	0.879689	0.652467	1

Table 5. Principal Component Analysis
(Rotation Method: Varimax with Kaiser Normalization).

Rotated Component Matrix^a

	Component		
	1	2	3
pH	.923	.207	-.324
EC	-.997	.075	.024
DO	.009	.996	-.089
COD	.913	.105	-.394
BOD	-.286	-.092	.954
TP	-.135	.695	.706
SS	.837	.157	-.524
TN	.736	.676	-.045
TC	.983	-.114	-.143

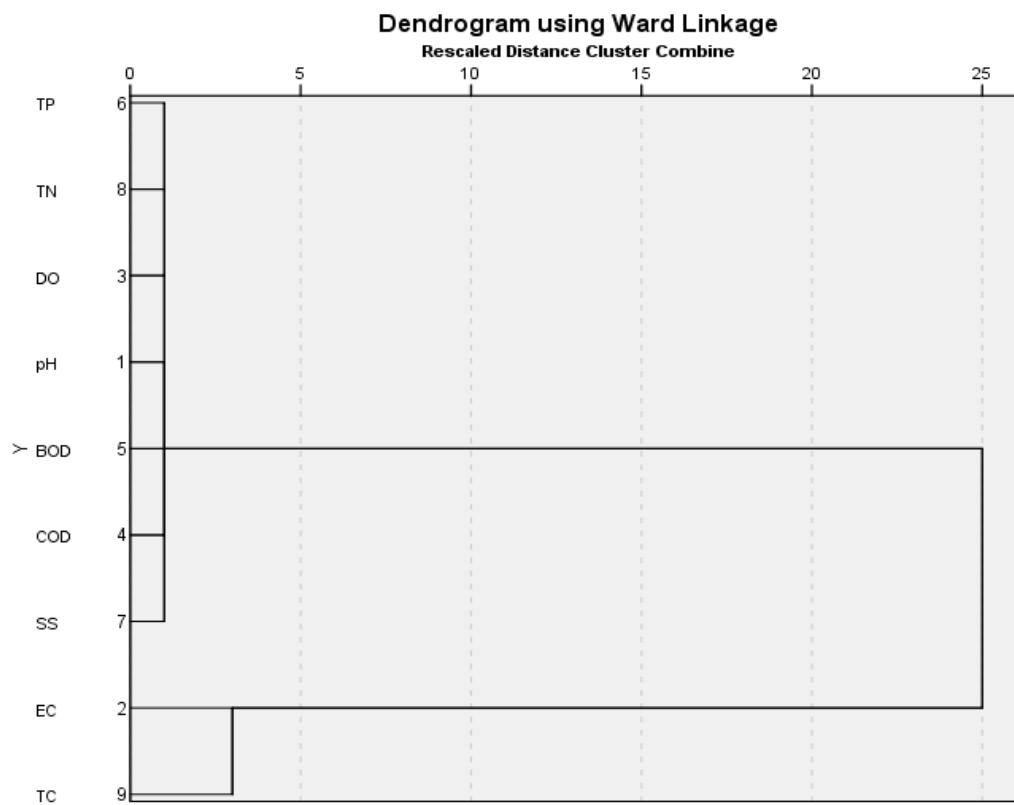


Fig 2. Dendrogram using Ward Linkage

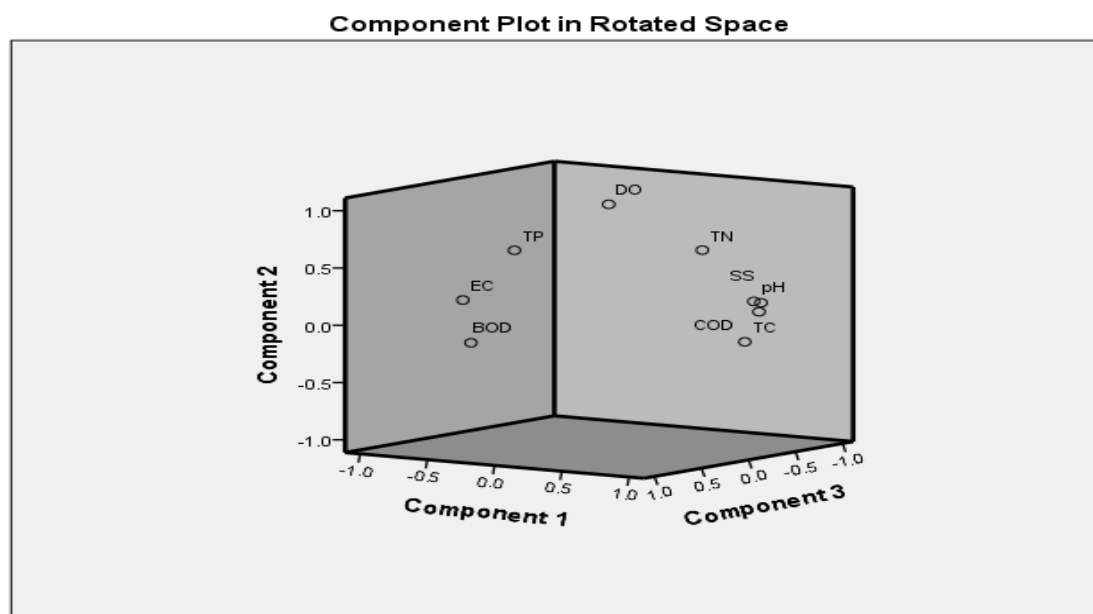


Fig 3. Principal Component Analysis plot for attributes

4. CONCLUSION

It is concluded that the water of Gandhi Sagar Lake is unfit for drinking purposes because maximum parameters are out of permissible limit . It is essential to implement useful methods to restraint the freeing of dispersal. It shows that the desecration is by virtue of uncovering, industrialized discharge, domestic discharge.

Conflict of interest: No conflict of interest regarding this research paper.

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