International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133, Print ISSN: 2664-7125
Received: 13-03-2022, Accepted: 27-03-2022, Published: 15-04-2022
Volume 4, Issue 2, 2022, Page No. 24-31

The effect of anthropogenic activities on the surface water body of Taal Ratoi

Ajay Kumar Gautam, Abdullah
Department of Botany, Shibli National College, Azamgarh, Uttar Pradesh, India

Abstract
The water body of Mau district indicates symptoms of deterioration due to several factors. This analysis investigates the causes of Taal Ratoi water quality. Over the period of two years, a total of 12 water quality measures were examined (2019-2021). Along the length of Taal Ratoi, water samples were taken at ten distinct sampling sites. Water quality was found to be degraded during the months of June - October-January because of maximum agricultural activities. Total phosphorus, orthophosphate phosphorus showed higher concentrations in October and January at some sites. The concentrations of nitrate-nitrogen, as well as ammoniacal nitrogen, increased in January, whereas the level of dissolved oxygen declined, resulting in a degradation of water quality. Furthermore, the widespread use of fertilizers and pesticides within agriculture during the growing season contributes to Taal Ratoi's declining water quality. Furthermore, the increasing use of fertilizers and pesticides in agriculture, and the flow of domestic sewage, are all contributing to the degrading of Taal Ratoi's water quality.

Keywords: land use, water quality parameters, domestic sewage, agricultural activities

Introduction

Water is the most valuable natural resource on the planet. Water is essential for all life. It is necessary for the growth and preservation of every aspect of society's dynamics. This is due to its physical and biochemical features. It's a critical component of cells, accounting for 70-90% of the total mass of each cell. The hydrogen bonding in this sample molecule makes it difficult to separate. In addition, since it is a liquid, it serves as a channel for other molecules and ions to interact with it. Despite the simplicity of its molecule, water exhibits numerous unexpected features. Water is ideal for polar and ions molecules. When a chemical dissolves in water, the water molecules are drawn to molecules like sugars and glycerol that have an uneven charge. The chemicals in the solution travel about in the water and react with other substances. In living organisms, the bulk of reactions takes occur in aqueous solutions.

Surface water is a combination of surface runoff and groundwater that is mostly derived from rainfall. It comprises large lakes, ponds, rivers, and the tiny upland streams that could originate from springs and gather the runoff from watersheds. The number of live organisms in surface water, as well as the proportions of mineral and organic materials which it could have taken up during its development. Rainfall accumulates dust and absorbs oxygen and CO_2 from the air as it passes through the atmosphere. Surface water gathers silt and organic matter particles as it flows over the ground, some of which may eventually dissolve. Surface water bodies have long been a vital resource for meeting a wide range of human needs but, owing to a variety of anthropogenic activities, the water quality of such resources is now under significant environmental stress, and the situation is much worse in lentic water bodies (Bhatnagar Anita et.al)

Anthropogenic effects are known water pollution sources and comprise agricultural, industrial, and urban activities, growing water resources exploitation and natural processes, like erosion, precipitation inputs, and weathering of crust materials which degrade surface waters and harm their usability for drinking water, recreational and other reasons (Karbassi et.al. 2008a, b; Nouri et.al. 2008; Mahvi et.al.2005; Simeonov et.al. 2003; Jarvie *et al*. 1998) [3, 4, 5, 6]. There are several religious activities that are also responsible for the contamination of lake immersion of detergents, ash, soap, oil, flour, mass bathing, and floral offspring's are also one of the significant reasons that degrade the water quality of the lentic water bodies. Floral offerings, adding ashes, flour, urination, and bathing could raise the nitrate and chloride content of water in accordance with pilgrims' high organic matter and pollution load on water bodies (Gupta et.al, Kiran et.al, Munnawar). Impurities from human activities, including industrial and home waste, agricultural chemicals, and other less visible toxins, add to the contamination.

The world is on the verge of a freshwater catastrophe, owing mostly to poor natural resource management. In many places of the globe, this crisis is already apparent in varying degrees of severity and size. Water supplies are expected to decline by 30 percent in the next 20 years, according to UNESCO's "World Water Development Report" (WWDR, 2003) from the World Water Assessment Program. Freshwater is now inadequate for minimum hygiene for 40percent of the world's population. In the year 2000, over a 2.2million people died as a result of illnesses caused by polluted water.

Sewage and industrial waste runoff into rivers, on the other hand, are more likely to pollute the water. Heavy metals, acids, hydrocarbons, and air deposition are often found in industrial influents. Agricultural runoff, which comprises the bulk of nitrogen and phosphorus compounds from fertilizers, salts, pesticides, and poultry wastes, is another cause of water contamination. As per a report performed by NEERI, India's accessible water is contaminated to the tune of more than 80%. In such circumstances, shallow and tiny water bodies, like ponds, are more prone to changes in water quality caused by nutrient input. Nutrient enrichment as a consequence of excessive loading has enhanced productivity, resulting in eutrophication. According to WHO (1993), water is responsible for about 80percent of all human illnesses. As a result, continuous monitoring of such freshwater bodies is critical for physicochemical examination to determine the appropriateness of the water in use, not only to avoid disease outbreaks but also to prevent future degradation of the water.

The current study was conducted on Taal Ratoi to study 12 Physico-chemical parameters.

The fast growth of the population in recent years has led to the creation of new communities in the Taal Ratoi catchment. Humans started to degrade the environment, specifically the lentic water bodies by deforestation. Nutrient contents in lentic water bodies are also influenced by population density. The significant pollution load supplied by the household and agricultural sectors is now one of the noticeable concerns with the Taal Ratoi waters.

Study Area

The study area is Taal Ratoi which lies to the east of Mau district with geographical coordinates of 26° 8′ -3.73″ N latitude and, 83° 42′ -14.23″ E longitude. Taal Ratoi is a natural lake near village Fatehpur-Talratoy, which has an area of around 1837hectares. It is connected to the adjacent Saryu (Ghaghara) river through a canal. It acts as an irrigation source for the area's farmers. Nonetheless, it is a popular tourist attraction and picnic site for locals. The area has a humid temperate climate**.** The majority of the rainfall is between June 15 to September 15. Taal Ratoi provides drinking water to a large population in the area it covers. Taal Ratoi is significant for agriculture since it provides a source of irrigation. Additionally, the Taal is a major source of fisheries.

Fig 1: Google image of Taal Ratoi

Fig 2: Location of Taal Ratoi in the map of India

Fig 3: Image of Taal Ratoi

Fig 4: Image of Taal Ratoi

Material and Methods

For physicochemical investigation, ten water sampling locations throughout the length of Taal Ratoi's lentic water bodies were selected. All of the sample bottles were cleansed with Laboline and cleaned with distilled water before collecting the water samples. Water samples were obtained in the morning from 8:30 a.m. to 12:00 noon. Glass jars with a 3-1 capacity were used to collect the samples. For the estimation of DO ("Dissolved Oxygen"), separate specimens were gathered in 250ml glass bottles. All samples were taken to the S.N.P.G College laboratory for refrigeration and were examined within 48 hours. The current study examined 12 physicochemical parameters such as orthophosphate phosphorus, total phosphorus, nitrate-nitrogen, ammoniacal nitrogen, total suspended solids, biological oxygen demand, total dissolved solids, total chlorides, total solids, dissolved oxygen, electric conductivity, and pH. All four seasons were analyzed: winter, autumn, summer, and spring. Priority was given to the evaluation of physicochemical variables. The measurements of phosphates, nitrates, DO, conductivity, as well as pH were placed immediately after those of the other variables. Standard procedures (AWWA and APHA 1999) [11] were used to examine the physicochemical characteristics. DO was predicted using a modified Winkler's technique, total chlorides were calculated using the argentometric technique (Mackerath *et al.*1978), nitrate nitrogen and ammoniacal nitrogen using the salicylate technique (CSIR 1974) [13], and orthophosphate phosphorus as well as total phosphorus using the Stannous Chloride approach (APHA 1999) [11]. The main goal of the current work was to examine the effect of anthropogenic activities on the surface water body of Taal Ratoi.

Result and Discussion

Table 1 summarizes the findings of the water quality analysis. The pH scale measures the strength of the acidic or alkali character of water by measuring hydrogen ion concentration. As per WHO recommendations (WHO 2017), the pH value range allowed for drinking purposes is 6.5 to 8.5. In the current study, the pH value varies from 6.8-10.1 indicating that at some sites water is alkaline in nature. The lower value at site 10 (Fatehpur) is 6.8 in April month whereas in site 3(Mariyadpur) and site 10 (Fatehpur) in the month of January the value of pH is 10.1. The increasing value of pH is related to the rising pressure of pollution due to agricultural activities and domestic wastes. According to WHO (2017) EC ("Electrical Conductivity") reveals the concentration of ionized chemicals in water, and also is an indicator of salinity. Excessive salinity inhibits plant osmotic activity and hence water and nutrient uptake from the soil (Thakur et.al 2018; Cao et.al. 2019). The EC values in this lake's water samples ranged from 170 to 278µS/cm, showing that the EC values were greater than the recommended limit for drinking water. Dissolved oxygen varies from 5.3-11.2 mg/L. The maximum concentration of DO was noted in January month at site 1 but in the same month at sites 7, 8, and 9 the value of dissolved oxygen is minimum. This is a sign of heavy organic pollution leaches to the flushing of sewage into the lake. The BOD value should be less than 3mg/L according to the "Central Pollution Control Board" (CPCB 2008). It is observed from the current research BOD value ranges between 13-20mg/L. The value of BOD is varied from season to season. The BOD value is not acceptable for drinking purposes. Total chlorides concentration ranged from 28.5-38.9 mg/L. Chlorides are found as potassium, sodium, as well as calcium salts. In addition, weathering causes rocks to release minerals into the soil and water. A high chloride content shows a considerable level of organic contamination (Munawar). The waste intake in the form of domestic sewage raised the lake's overall chloride content. TDS applies to every solid material in solution, whether ionized or non-ionized, but excludes dissolved gases or suspended colloids. The TDS shows the overall nature of the quality. Therefore, TDS levels are among the factors that determine the quality of drinking water (Prakasham et.al). The value of TDS was ranged from 121-199 mg/L. TDS was highest during the month of October which may be ascribed to human activities. But their value is not the worst. An increase in TDS affects the conductivity of water which shows the pollution load. Nitrogen nitrate levels have risen considerably. There's a connection between human activity and the introduction of nitrogenous wastes (bathing and other domestic activities). The value of nitrate-nitrogen ranged from 9.8-15.4 mg/L. Excessive nitrogen fertilizer usage in the catchment, which eventually ends up in the lake. Ammoniacal nitrogen, orthophosphate phosphorus, total phosphorus indicated almost the same pattern as nitrate nitrogen. Because these parameters are directly related to anthropogenic activities. Phosphorus contamination is due to the high pressure of human activities.

Table 1: Physicochemical analysis of Taal Ratoi across the different season

			Taal Ratoi (District Mau)									
Parameters	**Month**	**Machhirahwan**	**Utrain**	**Mariyadpur**	**Bairiyadeeh**	**Gopalpur**	**Dubari**	**Ramupur**	**Gangaupur**	**Kakradeeh**	**Fatehpur**	**Average**
		SITE 1	**SITE 2**	**SITE 3**	**SITE 4**	**SITE 5**	**SITE 6**	**SITE 7**	**SITE 8**	**SITE 9**	**SITE 10**	
pH	June	9.5	8.6	8.1	9.3	8.9	8.9	9.1	8.3	8.9	9.3	8.89
	October	9	8.9	9.2	9.6	9.3	8.9	9.4	9.6	9.2	9.4	9.25
	January	9.7	9.6	10.1	8.9	9.1	9.4	9.9	9.5	9.5	10.1	9.58
	April	9.5	9.1	8	9.1	8.8	8.7	9.1	8.2	8.5	6.8	8.58
E C	June	204	199	186	173	172	185	189	207	211	278	200.4
(µ S/cm)	October	197	187	185	177	180	178	189	204	209	268	197.4
	January	209	207	195	191	218	212	198	226	277	271	220.4

	April	186	188	195	179	174	170	176	195	203	227	189.3
Dissolved oxygen (mg/L)	June	9.6	8.5	7.7	7.4	6.8	7.2	5.9	5.6	4.9	8	7.16
	October	8.9	8.5	7.9	6.8	6.9	7.8	6.7	7.5	8.2	7.5	7.67
	January	11.2	8	8.2	7.5	8.6	7.8	5.3	5.3	5.9	6	7.38
	April	8.5	7.8	7.4	8.1	8.2	7.2	6.5	5.9	6.4	10.15	7.615
BOD (mg/L)	June	17	18	17	18	18.9	16.5	19.5	18.9	16.5	16.7	17.7
	October	15	16	16	16.5	18.6	17.6	19.1	18.3	16.7	16.9	17.07
	January	19	15	15	15.6	16.7	16.4	17.9	17.6	16.8	17.6	16.76
	April	20	13	14	17	16.6	19.5	16.8	16.9	17.3	18.3	16.94
Total solids (mg/L)	June	142	142	137	132	142	129	133	147	164	171	143.9
	October	156	160	163	145	168	149	149	166	170	199	162.5
	January	142	145	137	135	144	141	136	150	174	173	147.7
	April	128	127	125	123	121	126	128	131	126	151	128.6
Total dissolved solids (mg/L)	June	97	98	91	90	102	87	92	105	121	127	101
	October	100	101	104	103	107	90	97	107	106	132	104.7
	January	99	98	91	90	102	98	92	105	129	127	103.1
	April	102	100	99	98	100	103	104	106	110	125	104.7
Total suspended solids (mg/L)	June	45	44	46	42	40	42	41	42	43	44	42.9
	October	56	59	59	62	61	59	62	61	64	67	61
	January	43	47	46	45	44	43	44	43	45	46	44.6
	April	26	27	26	25	21	23	24	25	26	26	24.9
Total chlorides (mg/L)	June	34.5	33.19	31.7	31.4	32.4	32.6	34.6	34.7	34	29.2	32.829
	October	32.2	32.14	32.4	32.3	29.7	32	35.3	36.1	32	28.5	32.264
	January	31.1	30.3	31.7	34.3	31.5	27.6	31	37	29.6	29.6	31.37
	April	37.3	29.4	34.6	33.2	32.4	29.5	35	36	36.5	38.995	34.2895
Nitrate Nitrogen (mg/L)	June	13.2	11.9	12.5	11.9	11.8	11.2	11.6	12.5	12.3	12.3	12.12
	October	12	12.1	12.9	12.1	12.3	12.6	12.2	12.9	13.1	13.5	12.57
	January	14	13.4	13.2	13.9	13.6	13.9	13.3	13.1	14.3	15.4	13.81
	April	10	10.2	10.1	9.9	9.8	9.9	10.2	9.9	11.2	12	10.32
Ammoniacal Nitrogen (mg/L)	June	2.2	2.3	2.3	2.4	2.2	2.3	2.4	2.4	2.7	2.6	2.38
	October	2.5	2.2	2.5	2.7	2.6	2.7	2.8	2.7	2.8	2.8	2.63
	January	3.4	3.6	3.9	4.1	4.3	4.5	4.6	4.5	5.1	5.5	4.35
	April	1.9	1.8	1.5	1.7	1.5	1.6	1.7	1.8	1.9	2.3	1.77
Orthophosphate phosphorus (µg/L)	June	11	12	12.5	12.3	12.3	11.5	11.4	11.6	12	12.3	11.89
	October	16	19	20.2	20.5	20.4	20.1	19	19.5	18.5	19.6	19.28
	January	13	14	13	14	13.6	14	13.2	13.2	14.2	14.2	13.64
	April	10	11	12	13	11	12	11.2	11.4	12.2	11.6	11.54
Total phosphorus (µg/L)	June	14	14	14.3	14.7	15	14	12.5	12.8	13.7	13.2	13.82
	October	19	20.7	22	22.7	22.9	23	21	22.5	20.5	21.5	21.58
	January	12.6	15.6	17	14.8	16	15	14	15.6	16.5	16.2	15.33
	April	12	12.3	14	14.5	13	14	12.5	12.6	13.2	12.7	13.08

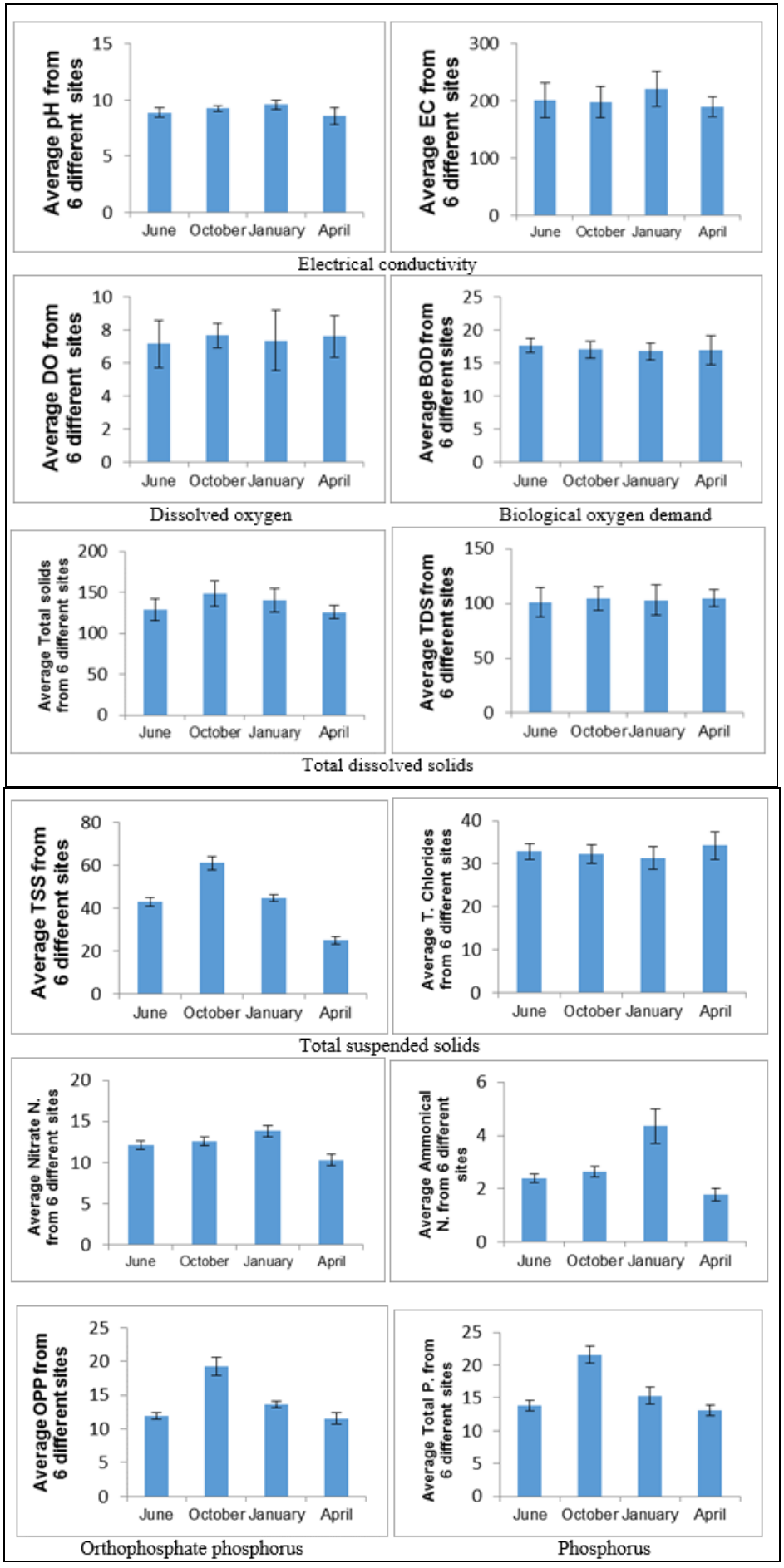
Average pH from 6 different sites
15
10
5
0
June October January April
Average EC from 6 different sites
300
200
100
0
June October January April
Electrical conductivity
Average DO from 6 different sites
10
8
6
4
2
0
June October January April
Dissolved oxygen
Average BOD from 6 different sites
25
20
15
10
5
0
June October January April
Biological oxygen demand
Average Total solids from 6 different sites
200
150
100
50
0
June October January April
Average TDS from 6 different sites
150
100
50
0
June October January April
Total dissolved solids
Average TSS from 6 different sites
80
60
40
20
0
June October January April
Average T. Chlorides from 6 different sites
40
30
20
10
0
June October January April
Total suspended solids
Average Nitrate N. from 6 different sites
20
15
10
5
0
June October January April
Average Ammonical N. from 6 different sites
6
4
2
0
June October January April
Average OPP from 6 different sites
25
20
15
10
5
0
June October January April
Orthophosphate phosphorus
Average Total P. from 6 different sites
25
20
15
10
5
0
June October January April
Phosphorus

Fig 5

Conclusion

The current research provides a better insight into the lake's quality. Various land-use practices and human activities affect the quality of water of Taal Ratoi has significant socioeconomic and ecological value represent the method we are handling our freshwater ecosystems. The physicochemical analysis indicates a rise in the parameters of water quality. After examination and discussion, it is inferred that the primary causes for the degradation of the water quality of the lake are eutrophied due to the use of pesticides and fertilizers. The direct discharge of sewage from the surrounding village increases the nutrient loading which causes a drop in the dissolved oxygen content. This causes many harmful effects on the aquatic fauna and flora. The water of this lake serves agriculture, irrigation, and drinking. Enormous algal growth and growth of other hydrophytes indicates that there is much pollution in this water body.

As a result, there must be appropriate disposal and management of wastes from commercial, domestic & agricultural sectors. An action was developed for the conservation of these lentic bodies.

References

1. Bhatnagar Anita, Devi Pooja, George MP, "Impact of Mass Bathing and Religious Activities on Water Quality Index of Prominent Water Bodies: A Multilocation Study in Haryana, India. International Journal of Ecology, 2016.
2. Karbassi AR, Monavari SM, Nabi Bidhendi GR, Nouri J, Nematpour K. Metals pollution assessment of sediment and water in the Shur River. Environmental Monitoring and Assessment,2008:147:107-116.
3. Karbassi AR, Nouri J, Mehrdadi N, Ayaz GO. Flocculation of heavy metals during mixing of freshwater with Caspian Sea Water. Environmental Geology,2008:53(8):1811-1816.
4. Nouri J, Karbassi AR, Mirkia S. Environmental management of Coastal regions in the Caspian Sea. International Journal of Environmental Science and Technology,2008:5(1):43-52.
5. Mahvi AH, Nouri J, Babaei AA, Nabizadeh R. Agricultural activities impact groundwater nitrate pollution. International Journal of Environmental Science and Technology,2005:2(1):41-47.
6. Simeonov V, Stratis JA, Samara C, Zahariadis G, Vousta D, Anthemidi A et al Assessment of surface water quality in Northern Greece. Water Research, 2003:37:4119-4124.
7. Gupta AK, Mishra K, Kumar P, Singh C, Srivastava S. " Impact of religious activities on the water characteristics of prominent ponds at Varanasi (U.P), India" Plant Archives,2011:2(1):297-300.
8. Kiran BR, Harish K, Ravikumar M, Puttaiah ET, Kamat CD. "Water quality assessment of Bhadra river with special reference to industrial pollution", Indian Journal of Environmental protection,2006:26(2):148-152.
9. Munawar M. "Limnological studies on freshwater ponds of Hyderabad-India," Hydrobiologia,1970:36(1):105-128.
10. WHO (World Health Organisation), Guidelines of Drinking Water Quality, vol.1, WHO (World Health Organisation, Geneva, 2nd edition, 2003.
11. APHA. Standard methods for the examination of water and wastewater (20th edition). Washington, DC: APHA, Awwa, 1999.
12. Mackereth FJ, Haron H, Talling JF. Water analysis. Scientific Publication. Freshwater Biological Association,1978:36:120.
13. CSIR. Analytical guide (laboratory techniques). Pretoria: CSIR, 1974.
14. WHO. Guidelines for drinking water quality. World Health Organisation, Geneva, 2017.
15. Central Pollution Control Board (CPCB), Guidelines for Water Quality Management, Delhi, India, 2008.