IMPACT OF ANTHROPOGENIC ACTIVITIES ON PHYSICOCHEMICAL PROPERTIES OF WATER OF POND SITUATED IN MADHEPURA DISTRICT, BIHAR

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Abstract

Perennial ponds are productive source of aquatic biota. Nowadays, anthropogenic activities like bathing, washing of clothes, utensils, immersion of idols and disposal of domestic wastes, cattle dumping, etc are adversely affecting the pond ecosystem. Moreover lack of awareness among users is growing day by day which affects health of the water bodies. Fresh water bodies are always at risk so its proper management and regular quality assessment become essential to maintain the ecological balance. With this background impacts of human activities on physicochemical and biological properties of the pond water and its sediment were assessed in pond situated in the northern side of Madhepura district known as Basdeva pond. Water sampling and analysis were performed periodically on a monthly basis for twelve months from January 2020 to December 2020 to determine the physicochemical properties of the pond water (water temperature, transparency Dissolved oxygen, Free Carbon dioxide, Bicarbonate Alkalinity, Total hardness, Total Dissolved Solid, Phosphate, Nitrate) and sediment (soil organic Carbon, nitrogen, phosphorus, and potassium).

Key words: Anthropogenic activities. Alkalinity, Dissolve oxygen, pH, Temperature, Water

Introduction

The majority of ponds are being polluted as a result of human activities including bathing, washing dishes and other household items, washing clothes, and immersing idols. The end result of all these interferences is an unfavourable change in the physical, chemical, and biological characteristics of the water as well as the sediment and soil, which eventually affects the productivity of the pond.

The water quality and soil characteristics of freshwater bodies have a significant impact on fish productivity. The observations on physicochemical properties of inland water bodies made by Kamath et al. (2006), Dhirendra et al.(2009), Mahananda et al.(2010), Debnath et al. (2011), Nkwocha et al. (2011), Yadav & Kumar (2011), Ajit et al. (2012), Kumar et al. (2014), Abdul et al. (2015), Borkar (2015), Chakravarty et al. (2016) have been of special relevance to this investigation.

Study area: The pond under study is located in the district town area of Madhepura, Bihar State, India. It is perennial in character. The pond has a rectangular shape and covers an area of roughly 1.2-1.3 hectares. 3.5 metres is the average depth. A reliable source of fish culture, this pond satisfies the district's need for fish. It is surrounded by human settlements and is impacted by a variety of anthropogenic activities, including the dumping of home and municipal sewage, the dumping of cattle, the washing of clothes and other household items, the submerging of idols, etc. Through an inlet, monsoon runoff also enters the pond.

Materials and Methods

During the course of a year (January 2020 to December 2020), we looked at the physico-chemical characteristics of the water and the sediment and soil conditions in the pond. At 9am and 10AM every month, water samples were taken from the pond's surface. According to the procedure outlined by Trivedy and Goel

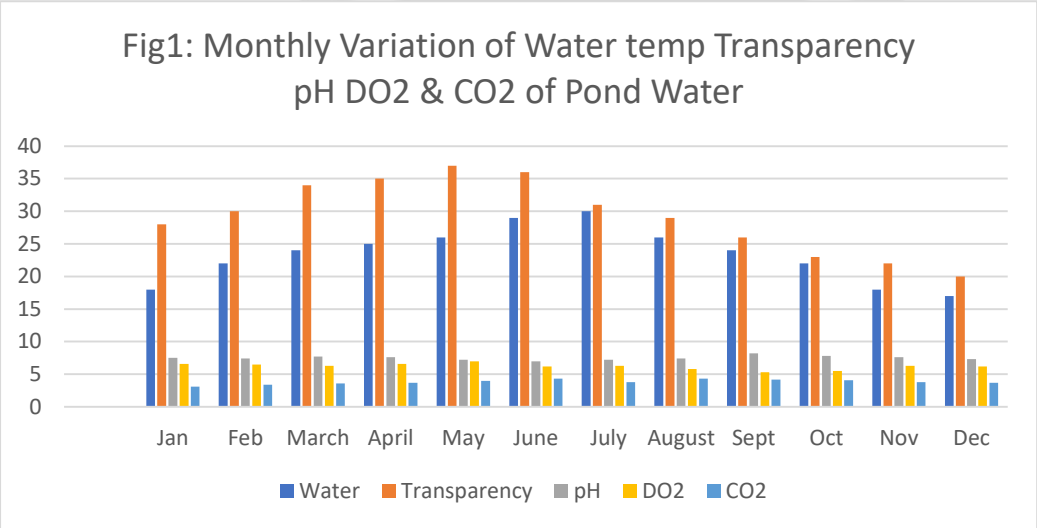
(1986), samples of water and soil were analysed for temperature, transparency, pH, dissolved oxygen, and free carbon dioxide on the spot. Four sampling locations on the pond's bottom were used to collect soil samples, which were then examined using standard techniques for p^H, electrical conductivity, organic carbon, accessible phosphorus, potassium, and nitrate (Trivedy and Goel 1986).

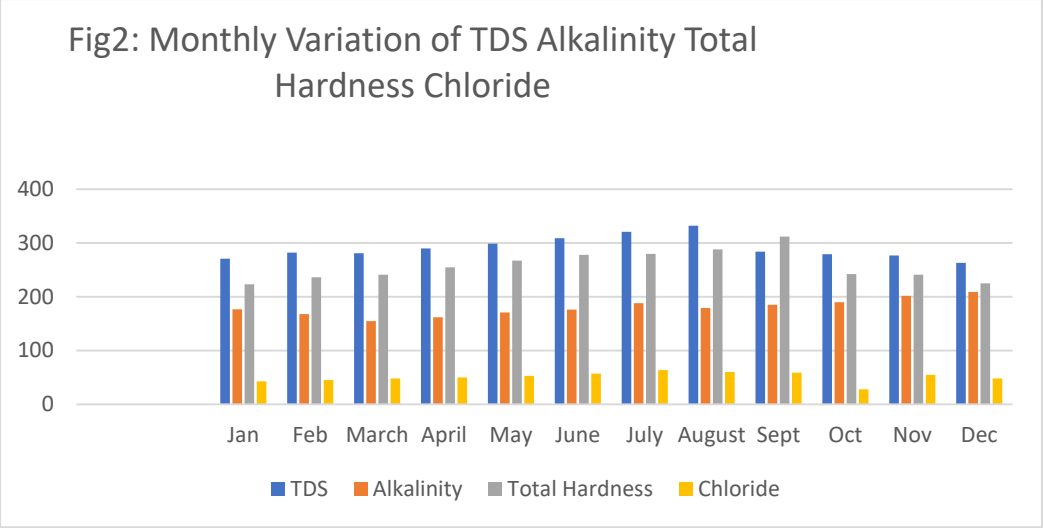
Result and Discussion

The findings are shown in Table 1 and are illustrated in Fig. 1-2. The results show that the water's minimum and maximum temperatures were 17°C (December) and 30°C (July), respectively, with a mean temperature of 23.41°C, its minimum value of transparency was 20°C (December), its maximum value was 37°C (May), and its mean value was 29.25°C. During this time, floating vegetation partially infested the water's surface, which prevented light. Pond water therefore had an alkalinity that was safe for aquatic life. Dissolved oxygen levels ranged from 5.2 mg/L (September) to 7.2 mg/L (May), respectively. Dissolved oxygen content, a quality indicator that represents a system's ability to support a healthy aquatic environment, explains the overall health of a water body. The range of dissolved oxygen (5.2–7.0 mg/L) was higher than what is required for fish and other aquatic organisms to survive.

Month	Water Temp.	Transparency	pH	TDS (mg/L)	DO_2 (mg/L)	CO_2 (mg/L)	Alkalinity (mg/L)	Total Hardness (mg/L)	Chloride (mg/L)	Phosphate (mg/L)	Nitrate (mg/L)	Silicate (mg/L)
Jan	18	28	7.5	271	6.6	3.1	177	223	43	0.48	0.52	17.2
Feb	22	30	7.4	282	6.5	3.4	168	236	45	0.55	0.49	18.0
March	24	34	7.7	281	6.3	3.6	155	241	48	0.59	0.46	19.3
April	25	35	7.6	290	6.6	3.7	162	255	50	0.58	0.52	19.2
May	26	37	7.2	299	7.0	4.0	171	267	53	0.60	0.46	19.7
June	29	36	7.0	309	6.2	4.3	176	278	57	0.60	0.52	20.1
July	30	31	7.2	321	6.3	3.8	188	280	64	0.63	0.61	20.6
August	26	29	7.4	332	5.8	4.3	179	288	60	0.62	0.62	21.2
Sept	24	26	8.2	284	5.3	4.2	185	312	59	0.57	0.60	21.3
Oct	22	23	7.8	279	5.5	4.1	190	242	28	0.51	0.58	20.0
Nov	18	22	7.6	277	6.3	3.8	202	241	55	0.47	0.55	19.1
Dec	17	20	7.3	263	6.2	3.7	209	225	48	0.47	0.52	18.5

Table 1. Monthly variations of physico-chemical parameters of pond water





This shows that the pond has a high capacity for assimilation and is suitable for aquatic biota survival. January had the lowest free carbon dioxide concentration (3.1 mg/L), and August & June had the highest (4.3 mg/L). Total alkalinity had a minimum value of 155 mg/L in March and a maximum value of 209 mg/L in December. According to Chakravarty et al. (2016), the alkalinity in various ponds around the east Godavari district ranged from 120 to 500 mg/L. Minimum value of total hardness was found in January(223mg/L) while maximum value was found in September (312mg/L). Total Hardness, which ranges from 223 to 312 mg/L, is crucial for both residential and industrial uses. The maximum desired level for overall hardness has been determined by ICMR at 300ppm. Hardness generally has no detrimental effects on human health. Water with a hardness of more than 200 mg/L may lead to scale buildup in the water distribution system and increased soap usage. Water with a hardness rating of less than 50 mg/L is referred to as soft water. Chloride was measured with a minimum value in January (43 mg/L) and a maximum value in July (64 mg/L). The water's chloride content was within the ideal range of 250 mg/L, making it suitable for fish cultivation. Total dissolved solids had minimum and maximum values of 263mg/L (December) and 321mg/L (July), respectively. The addition of dissolved solids in the water runoff may be the cause of the relationship between TDS quantity and pollution level. The greater total dissolved solids number suggests a significant influx of sewage that could harm the macro benthic fauna and pond production. Phosphorus levels ranged from 0.47 mg/L at their lowest point in the winter (November & December) to 0.63 mg/L at their highest point in the rainy season (July). When phosphate levels are above 0.5 mg/L, eutrophication is in progress. The increased readings could be a result of detergents being included in the sewage waste dumped into the pond. Silicate levels ranged from a minimum of 17.2 mg/L in January to a maximum of 21.3 mg/L in September. The mean value of 0.525 mg/L indicates a significant pollution load, whereas nitrate values ranged from 0.46 to 0.62 mg/L. Nitrate levels rise when sewage enters natural water sources. Phosphate and nitrate concentrations were found to be significantly higher. The pond acquired nutrients from sewage as well as human activities like bathing and washing, which were significant contributors to the pond's high concentration of nutrients and potential for eutrophication. Pond ecosystems depend significantly on sediment. One of the most crucial factors determining nutrient quality, quantity, and microbial activity is the pH of the soil. Sediment soil had a typical electrical conductivity of 0.60-0.65 and was slightly alkaline (7.27-7.41). Investigation revealed greater levels of nitrogen, phosphate, and potassium as well as organic carbon (1.65-1.78%).

Organic carbon is crucial because it helps the soil release nutrients, acts as a buffer, and stabilises the sediment soil structure. In actuality, these characteristics, along with pH, organic carbon, nitrogen, phosphorus, and potassium, were thought to be important indicators of an ecosystem's health.

Conclusion

The pond absorbs organic contamination from human activities, according to observations supported by the physico-chemical characteristics of the water and sediment. To preserve the pond's delicate ecosystem, adequate planning is necessary as the water quality slowly reaches an alarming level.

Recommendation

It may be possible to minimise the organic burden on the pond ecology in order to maintain its capacity for productivity.

1. Town sewage discharge needs to be limited.
2. Human actions like dumping livestock, submerging idols, washing garments, etc., should be strongly prohibited.
3. Its perennial character and productivity can be restored with regular renovations that remove silt.
4. Planting will prevent soil erosion near ponds, which typically happens during monsoon.

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