Assessment of Seasonal Physicochemical Parameters and Impact of Bikma Pond on Rural Area of Ratanpur in Chhattisgarh

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Abstract

The water quality parameters play an important role in the wetland ecological community in rural areas. A significant innovation in these parameters was observed throughout the study period and monthly comparisons were made as monsoon, pre-monsoon and post-monsoon. The results of the present investigations are compared with literature values and investigation reveals that there is a fluctuation in the physico-chemical characters of the water this will be due to in flow and change in the temperature as season changes Bikma pond is one of largest pond and its 65-acre areas covered in wetland which is situated in Ratanpur near about 30 km from Bilaspur District. It's a historical importance and significant to serve the local people by economic, social and religious value since ancient period. The various parameters that affect the water quality such as Transparency, Temperature, pH, Electrical Conductivity, Total dissolved solid, Alkalinity, Dissolved oxygen, Biological oxygen demand, Nitrate, Phosphate, Calcium, Magnesium, Total suspended solid, were investigated. Water samples were collected from various sampling sites from four direction i.e., north, south, east and west. Sampling sites were selected on the basis of margin length of water reservoirs at interval of 100 meter and 10 meter inside to the ponds. During the present work, Samples were collected from water surface & bottom of the ponds. A total of 08 representative water samples in peripheral sites and 08 samples in inner sites were collected from August 2019 to January 2020. The first measurement done was measuring the depth of light penetration into the body of water using self-made the Secchi disc. During the study period maximum transparency value was recorded in the north marginal sites at the Bikma pond in the rainy season and water of Pond was slightly acidic in nature. Conductivity of water of Bikma ponds was above the permissible limit (350mg/l) and increases during the winter season.A wetland is an area of wet muddy land with wild plants growing in it. The results of the present investigations are compared with literature values and investigation reveals that there is a fluctuation in the physico-chemical characters of the water this will be due to in flow and change in the temperature as season changes.

Keywords: Wetland, Physico-chemical parameters, seasonal variations.

Introduction

Many waste materials are washed by different ways from urban and agricultural lands and are moved the surface of land to water bodies. Many pollutants like particles of soil , fertilizers, pesticides, and oil from moving vehicles are always basic reason for contamination of water.

Wetlands are areas where large part of water covers by the soil and for varying periods of time during growing season in all the year. Many of these wetlands are seasonal and they are dry one or more seasons every year. The quantity of water present in the part of wetland and the timing of its presence in that area regulates the importance of a wetland and its acting in the environment. Water saturation mainly determines how the soil develops and the types of plant and animal communities living in and on the surface of land.

Wetlands always support aquatic as well as terrestrial species. It can recover the quality of water by take out the pollutants from water surface. Sediment Trapping, Nutrient removal and Chemical Detoxification are three important removal processes provided by wetlands.

Wetland have been used to treat a collection of threats to downstream potable water assessment. In the Ratanpur Chhattisgarh region with more than 25 ponds of freshwater resources in the form of lakes and wetlands. These pond waters were distressed by a negative effect of our environment.

Wetlands are areas where water is the key factor for controlling the environment and the associated with life of living being. It's very essential parts of landscapes and playing important roles for the sustainable development of the region, and linking to climate change and adaptation, and impact on ecosystem and the livelihood of rural people. The effects of human and natural change drivers on key landscape characteristics of wetlands may be critical for ecosystem. (Samaneh et.al 2019).

Wetlands provide variety of power like biodiversity, nutrient recycling, purification of water, flood control and ground water recharge. The products obtained from wetlands are forest resources, wildlife, fisheries, agricultural resources, water supply, energy resources etc. It can be positive impact for living environment. But the impact of wastes within the environment is still not fully understood, there is some evidence of their negative effects on aquatic life[2](Di Poi et.al 2018). Therefore, pollutants which is releasing continuously in water needs to be treated before discharging them to water bodies.

Map: Bikma Pond

The present study area, **Bikma** is one of largest pond / wetland (65acre land area) having a historical importance and significant to serve the local people by economic, social and religious value since ancient period. In present day also, this pond is important to fulfil the needs of society in almost various aspect of life providing irrigation water, facility for domestic & daily work and economic aid through large production of fishes, lotus stems (dhens), lotus leaves, lotus flowers, motha grass etc. Besides this large pond, there are so many small water reservoirs, out of which two small ponds such as Nawa Tatab, Pyare ban Talab.

Vegetations are the positive thinking for wetland due to all growing plant on wetland areas plays a key role in the removal of wastes like organic matter, metal pollutants, and pathogens. Root, stem, and leaves of vegetation act as a substrate upon which usually microorganisms can grow and break down organic matter and metal pollutants by one of the five actions: rhizofiltration, phytoextraction, Phyto stabilization, rhizosphere bioremediation, or phytotrons formation.

According to research the effect of planting density and aeration with two separate plants Jincus effuses and Canna flaccida was reported that plant uptake accounted for more than 25% of Phosphorous and aeration enhances N and P uptake with Juncus plant (Garcia Chance, L. M., & White, S. A. (2018) (Liu, H., Hu, Zhang et.al (2018). The root of I. pseudacorus plant development promoted the hydraulic conductivity of the substrate and also accounted for uniform flow behaviours in the planted system. By the mixed vegetation means mesocosms planted with the ornamental plant Z. aethiopica can treat polluted river water, and the results reported that the phosphate removal efficiencies were significantly higher with the mixed vegetation. (Hernández, M. E., et.al (2018) (Gulzar, F et al (2018)

Study Area

In the present work Bikma Pond situated in the remote area in Ratanpur. People residing near these sites use water for domestic's uses such as bathing, washing clothes and for other activities. These samples were analysed for 13 Physico-Chemical parameters to evaluate their

suitability for domestic application. The various parameters that affect the water quality such as Transparency, Temperature, pH, Electrical Conductivity, Total dissolved solid, Alkalinity, Dissolved oxygen, Biological oxygen demand, Nitrate, Phosphate, Calcium, Magnesium, Total suspended solid, were investigated. Water samples were collected from various sampling sites from four direction i.e., north, south, east and west. Sampling sites were selected on the basis of margin length of water reservoirs at interval of 100 meter and 10 meter inside to the ponds (Table no1). Considering the depth, the samples were collected from water surface & bottom of the ponds. A total of 08 representative water samples in peripheral sites and 08 samples in inner sites were collected from August 2019 to January 2020.

SOUTH PART

NORTH PART

WEST PART

EAST PART

DIRECTIONS OF BIKMA POND

NORTH VIEW OF BIKMA POND IN RAINY SEASON

Table no 1- Sampling Sites: Bikma Pond

POND WATER	PERIPHERAL LENGTH		SAMPLING SITES		
	Direction	Length (Approx. in Meter)	Marginal sites	INSIDE	
				Depth (In Feet)	Inner sites
BIKMA	NORTH	430	Bn-1, Bn-2,	03 half wetland	Bn-S, Bn-B
	EAST	340	Be-1, Be-2	06	Be-S, Be-B
	SOUTH	680	Bs-1, Bs-2	08	Bs-S, Bs-B
	WEST	260	Bw-1, Bw-2	Complete wetland	Bw-S, Bw-B

Methodology

Seasonal variation plays an important role in determining the physico-chemical as well as microbial characteristics of water. The tabulated data shows this seasonal variation. Since there is variation in monthly climate over different seasons, therefore the average values of the parameters have been also been tabulated.

Water samples collected different direction of pond in early morning in high quality of plastic bottles, on the spot done test such as Temperature (°C) and pH recorded by using thermometer and digital pH meter. The TDS (mg/l) and DO (mg/l) will be performed at the selected site during sampling. Other parameter like Alkalinity (mg/l), Total Hardness (mg/l), Ca (mg/l), Mg (mg/l), BOD (mg/l), PO4(mg/l), No3(mg/l), will be analysed in the laboratory.

The methods adopted for analysing the various physico-chemical parameters are listed in **Table No.2**

Table no 2: Methods used for determination of physicochemical parameters:

S.NO	**Parameters**	**Abbreviations**	**Units**	**Method used**
1	**Temperature**	Temp.	0C	Fish finder with temp and depth and water analyzer kit model no 371
2	**pH**			Water analyzer kit (systronic) model no 371
3	**Electrical Conductivity**	EC	Us/cm	Water analyzer kit (systronic) model no 371
4	**Total dissolved solid**	TDS	mg/l	Water analyzer kit (systronic) model no 371
5	**Dissolved oxygen**	DO	mg/l	Water analyzer kit (systronic) model no 371
6	**Biological oxygen demand**	BOD	mg/l	5 days incubation at 20 0C and titration of initial and final DO
7	**Transparency**	Trans.	cm	By Secchi disk
8	**Alkalinity**	--------	mg/l	Titrimetric method (WITH .01 N H2SO4)
9	**Nitrate**	NO3-	mg/l	Spectrophotometer
10	**Phosphate**	Po4-3	mg/l	Spectrophotometer
11	**Calcium ions**	Ca2+	mg/l	EDTA (.05N) Titrimetric method
12	**Magnesium ions**	Mg2+	mg/l	EDTA (.05N) Titrimetric method
13	**Total suspended solid**	TSS	mg/l	Gravimetric method

These samples were analysed for 13 physico-chemical parameters to evaluate their suitability for domestic application. The various parameters that affect the water quality such as Temperature, pH, Electrical Conductivity, Total dissolved solid, Dissolved oxygen, Biological oxygen demand, Transparency, Alkalinity, Nitrate, Phosphate, Calcium, Magnesium, Total suspended solid were investigated. Parameters such as pH, Temperature, EC, TDS, DO were measured at the sample collection sites using Water Quality Analyzer Kit (Systronic model no 371). Determination of other parameters were carried out by standard methods as prescribed by APHA (Amer. Public Health Assoc.16th New York (1985))., Manivaskaman (Pragati Prakash an, Merrut (2000).NEERI (manual on water and waste water analysis). The sample were collected from each sites at peripheral (about 100-150 meter and inner (10 m from the shore) locations. Water was sampled in to 1L polyethylene containers. Samples of surface water were collected for chemical analysis from peripheral areas, inner surface and bottom of the pond once a month during a period from Aug 2019 to

January 2020. Minor ponds around some major ponds were also chosen for the present study. All water samplings were completed from 10 to 3 o'clock.

The first measurement done was measuring the depth of light penetration into the body of water using the Secchi disc. The low-cost disc was fabricated and designed by the members of the ongoing project, as its price quoted by manufacturers was high. Secchi disc depth gives a rough approximation of how turbid the water is.

Secchi Disk Measurement

Result and Discussion

The transparency of water body is affected by the factors like plank tonic growth, rainfall, Suns position in the sky, angle of incidence of rays, cloudiness, visibility. The maximum transparency value was recorded in the north marginal sites at the Bikma pond in the rain During the present study pH of Bikma pond water was slightly acidic in nature. Conductivity of water of Bikma ponds was above the permissible limit and increases during the winter season.

Total alkalinity, Dissolved oxygen, $Ca^{2+}$and TSS of Bikma pond was always found in higher side. The values were higher in the west side. The values of BOD was much above the permissible limit and increases during the winter season. During the investigation, concentration of Total dissolved solids, Nitrates and Magnesium observed within the permissible limits in the ponds.

Conductivity depends on the ionic concentration and water temperature. The EC values of the study area had a maximum in the winter season in all directions.

Dissolved oxygen and BOD values were always above the WHO permissible limit of 4mg/l at all sampling stations, it is a physical phenomenon and depends upon the solubility of oxygen, which in turn is influenced by water temperature. Minimum value of DO was observed in the Rainy season. This means DO decreases with high humidity and a rise in water temperature. Maximum mean BOD was found at in the winter season. The mean value of BOD decreases in the rainy season indicating decrease in organic load values.

Calcium is the major component of natural waters. Rocks are the major source of calcium ions and associated with rocks, sediments and also with natural activities. Rocks in the surrounding, catchments area and in contact with water are its major source. Domestic effluents also contribute towards calcium contents of any water body. Maximum value of Calcium was observed at Bikma in the South Peripheral in the winter season.it is more than permissible units.

During the study the highest mean concentration of total nitrogen during winter season was observed at Bikma in East peripheral and in the winter season due to nitrogen fertilizers are applied in very large amounts in field crops. Nitrogen, in the forms of nitrate, nitrite, or ammonium, is a nutrient needed for plant growth. Since the plants cannot utilize all the nitrogen applied to the fields, some is left in the soil and it can leach into ground water. In addition, not all the applied nitrogen gets into the soil and it can leach into ground water. In addition, not all the applied nitrogen gets into the soil and some is washed off the fields in the form of run off and it flows into surface water. Increased level of nitrate-nitrogen in water bodies causes nutrient enrichment, which results in excessive growth of aquatic filamentous green algae, leading to eutrophication. This huge algal growth creates unesthetic conditions in the water body.

Phosphate phosphorus concentration is always above the permissible limit at all sampling points and during the winter season. The higher values indicate that waters are polluted or "eutrophic". Control of undesirable blue green algae can often be obtained only at phosphorus levels below 0.02 mg/l

The main aim of this research to investigate the quality of pond water for rural areas. The maximum transparency value of 28.0±0.13 was recorded at S-1in the south marginal sites and 20.4±0.26 at the East inner sites in the rainy season.

The maximum mean value of pH was found to be 8.4±0.31at S-1(north peripheral) in the summer season. The alkaline nature of the pond water values may be due to agricultural fields. The EC values of the study area had a maximum mean of 468.2±14.5 (north peripheral) at S-2 in the summer season and 482±21.2 (West inner) at S-b in the rainy season, its indicates the load of salts in a water body is directly related to its conductivity. DO and BOD values were always above the WHO permissible limit of at all sampling stations. Maximum mean BOD 32±3.1was found at S-2(West peripheral) at in the summer season. Due to organic load in water, the mean value of BOD found maximum in the summer season. In the present investigation. maximum calcium and magnesium ions observed from 77.8±12.8 at S-2, South Marginal in the summer season and for inner sites it varied between 19.6±.2.3 (S-1 South marginal in the rainy season) and 66.7±2.1 (S-1 west marginal in the summer season). During the study the highest mean concentration of total nitrogen during summer season was observed as 47.5±11.2at S-2 North peripheral and a maximum of 48.5±12.2 at S-s south inner in the summer season. The tabulated data shows this seasonal variation. The study shows that water of Bikma pond is found to be polluted as this pond is surrounded on all sides by residential localities and sewerage from residences is continuously flowing into the pond. A number of instances of skin diseases in the people who were in contact with the pond water living nearby has been reported. Thus, results have to be recommended for the treatment of the Bikma pond water.

As water from a stream channel or surface runoff enters a wetland, the water spreads out and flows through dense vegetation. The velocity of the flow is reduced, allowing suspended material in the water to settle to the wetland surface. The roots of wetland plants can then bind the accumulated sediments. As much as 90 percent of the sediments that are present in runoff or in stream flow may be removed if the water passes through wetlands. Also, because pollutants, such as heavy metals, are attached to soil particles, the settling of sediments in wetlands further improves water quality.

Nitrogen and phosphorus from agricultural and lawn fertilizers, pet waste, sewer and septic systems, and other sources can act as plant fertilizers in natural water bodies and stimulate excessive plant, algae, and cyanobacteria growth. Such growth may produce toxic chemicals and choke out natural vegetation and wildlife. When runoff and stream flow pass through wetlands before entering a water body, these nutrients may be taken up by wetland plants and accumulate in less harmful chemical forms. When wetland plants die and decay, nutrients are recycled within the wetland. Wetlands are so effective at removing excess nutrients from water that many municipalities have built wetlands specifically for treating effluent from secondary sewage treatment plants(Jinkwan Son1et.al 2020) Natural wetlands are not suited for this purpose and for each wetland there is a limit to how much can be added before the natural plant and chemical processes are overloaded and break down.

Some of the toxic chemicals carried into a wetland in runoff are trapped along with settled soil particles. Some of these pollutants may be buried in the sediments, while others may be converted into less harmful chemical forms by biological processes or by exposure to sunlight for extended periods. Still other pollutants may be taken up by the plants.

Conclusion and Suggestions

Wetlands are essential for the public health and environment protection. Wetlands perform functions that have positive environmental influence and social and economic significance. For example, wetland manages water for free by holding backwater during floods and releasing it during dry periods. In a dry area it is crucial and helps to prevent soil erosion.

Although wetlands are important for people's life and environment, there are a number of land use activities that are still practised which have adverse negative impacts.

In some areas where a wetland is found, there are no strategies enforce to mitigate the impacts of different land use activities. In some other areas, very little is done to minimise the problems of land use change on wetlands. It is therefore important that local communities take action on the management of wetlands ecosystem.

The study shows that water of Bikma pond is found to be polluted as this pond is surrounded on all sides by residential localities and domestics waste from residences is continuously flowing into the pond. A number of instances of skin diseases in the people who were in contact with the pond water living nearby has been reported. Thus, measures have to be adopted for the treatment of the Bikma pond water.

Environmental education is the way of awareness to people about environment. So, people need to be educated on the necessary of the wetland. This strategy may help reduce the problem of land use change in and around the wetland. People have to be aware that wetland provides many benefits which have important values to the community. As plants that are found within wetland provide oxygen which is crucial for the survival of humans.[11] Wetland plants also help prevent the problem of soil erosion. we should do more and more plantation on wetland areas of pond. We can take some pollutants removal plants with ornamental

plants for protection of the ponds. The main aim of group for environmental education should be awareness in school level, college level at rural areas and at all workplace. It can also be spread through media and by newspapers.

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