



Assessment of Physico-Chemical characteristics of the Soil of Nagchoon Pond Khandwa, MP, India

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Abstract

Soil is an important natural resource on the earth. The soils of pond play a key role in regulating the concentration of nutrient in the pond water and aquatic flora and fauna of an aquatic ecosystem. The present paper deal with the study of physicochemical parameters like pH, specific conductivity, chloride, total alkalinity calcium, magnesium nitrate, sulphate, phosphate sodium and potassium from July 2008 to June 2009. During the study year fluctuation were observed in various parameters. Investigation results showed that the soil alkaline throughout the study year. The productivity of an ecosystem depends upon the quality of soil. Some parameters were above permissible limit and some below permissible limit which affect the quality and productivity of pond soil.

Keywords: Soil quality, chemical parameters, Nagchoon pond, Khandwa.

Introduction

In an aquatic ecosystem, soil is one of the most important part and ecological factor. The Productivity of water body related with soil conditions. Soil serve as a more reliable index for productivity than water qualities. The productivity of any pond depends largely on the quality of bottom soil that is "store house of nutrients." The chemical and biological changes continuously takes place resulting in releases of different nutrients in to the over lying water and their absorption by the soil mass and microbial population. The growth and abundance of different aquatic flora and fauna are greatly dependent upon the presence of essential nutrients in water body in adequate and balanced quantities. Therefore, bottom soil described as the "chemical laboratory of pond." The capacity of soil to retain water for aquatic flora and fauna. The ability of soil to provide various nutrients for biological production are assessed through the analysis of important soil constituents such as pH, specific-conductivity, total alkalinity, calcium, magnesium, chloride, nitrate-nitrogen, phosphate-phosphorus, sulphate, sodium and potassium. Most of the dying out component of our environment are being contaminated by human activities like rapidly urbanization, industrialization population explosion, agricultural waste and anthropogenic activity in and around pond¹.

Study Area: The climate of the Khandwa district is pleasant and healthy. The district fall in drier part of India. Annual rainfall 980.75 mm. distributed an over 86 rainy days. The maximum temperature has been recorded in the month of May is 42°C and minimum temperature has been recorded in the month of December 10°C. The ecoclimate of the area is semiarid, second-degree mega thermal type of summer concentration with winter water deficit². Nagchoon pond is a

perennial rainwater reservoir. It is situated at a distance of 6 kilometer, north-west of Khandwa on 21°49'36" N latitude and 76°20' 65" E longitude. The pond water used for multipurpose especially as a drinking water, irrigation and fishing purposes.

Material and Methods

Nagchoon pond, which is also called Moghat reservoir, is an important source of potable water for Khandwa city. Soil is the most critical factor that governs the productivity of soil. A preliminary survey of Nagchoon pond, to cover whole pond four different stations was selected. Monthly soil sample were collected from four stations and subsequently mixed and samples were brought to the laboratory in polythene bags. Soil samples were oven dried and ground with wooden pestle and mortar. Sample passed through 2mm. thick sieve for physicochemical analysis of Soil by standard methods^{3,4}.

Soil Extract: 50 gm soil dissolved in distilled water, shake it with shaker for 100 times, filter through filter paper. The Soil extract is collected in filtration flask. Soil extract is used for analyzed for different physicochemical parameter, as per the procedures outlined⁵. pH of Soil extract taken by dipping electrode in water through digital pH meter. The specific conductivity measured by Digital conductivity meter in μ mhos/cm. at 25°C. The chlorides measured by Mohr's method (titration), total alkalinity (titration) carbonate and bi-carbonate alkalinity (both). Calcium and magnesium measured by E D T A method⁶. Nitrate estimation by P D A method. Phosphate phosphorus by spectrophotometer. Sulphate by gravimetric method. Sodium and potassium estimated by using Flame photometer.

Results and Discussion

The sedimental characteristic of an aquatic ecosystem largely depends upon their geography, particular location, siltation rate, concentration of total suspended solids and the suspended load inflow, outflow ratio etc. In India however, very little work has been carried out to explore the sedimental characteristic of aquatic bodies. In this field Saha, et.al., Rao, and Burve, Dave were made some contribution^{7,8,9}. The physico-chemical characteristics of soil at Nagchoon pond recorded in the table 5.2.A based on qualitative analysis of soil. The authors found the basic aspects of an aquatic environment during the year of study. The 11 physico-chemical characteristics of soil in the aquatic environment were considered during the present observation period (July 2008 to June 2009). In the present investigation of soil, the color of soil appeared black from rainy season to winter season, while brown during the summer season.

pH: The Nagchoon pond has pH in alkaline range throughout the period of investigation (July 2008-June 2009). The data table 5.2.A suggested that in the study period 2008-09 the maximum pH recorded 8.92 in the month of December and 7.15 recorded month October. pH value revealed that the maximum pH were recorded in summer season and minimum pH value were recorded in winter season. Shaikh also reported same results at Bilawali Tank Indore maximum in summer 9.1 and minimum in winter 8.2¹⁰. The pH value coincide with the soil quality standard¹¹. Soil characterized in to acidic, neutral and alkaline, according to its reaction or the concentration of H-ions. The soil pH influenced by transformation of soluble phosphate, response of different nitrogenous fertilizer absorption and releases of nutrients at the soil water interface including bacterial activity in soil and maximum at neutral pH (7.0). While, wide variations in soil pH of lake and pond has been encountered under different agro climatic conditions. Soil pH in the range of 6.5 to 7.5 is considered ideal for any lake or pond reservoir.

The organic matter and organic carbon is the most important component of soil. Humus or organic matter present in the soil more varied and complex in nature compared to mineral-to-mineral constituent of the soil. This is also colloidal in nature, exhibits colloidal properties, similar to clay properties in soil which is the most active portion of soil. Bacterial activity depends upon the carbon content of the soil utilizing on the carbon content of the soil utilizing it as a source of energy. In pond, the process of sedimentation and decomposition of organic matter takes place and as a result of which various nutrients released from complex organic forms to simple inorganic compound. The higher value of pH in summer indicating its dependence on photosynthetic activity. According to Hutchinson, any value above 9.0 indicates an extreme shift from equilibrium of carbon dioxide, bicarbonate and carbonate system to the right due to removal of carbon dioxide¹².

Summer season > rainy season > winter season

Specific-Conductivity: Specific conductivity offers very quickly and convenient way for determining the total amount of ionisable salts in soil. These substances are the ions, which act as a good conductor. The nature of various substances their concentration and ionic strength vitally effect the conductance. The outcome from the table 5.2.A that in the study period 2008-09 the maximum specific conductivity recorded 760 μ mohs in the month of May and the minimum specific conductivity recorded 510 μ mohs in the month of July. Specific conductivity value blazon that the maximum specific conductivity recorded in summer season and minimum specific conductivity value recorded in rainy season. Shrivastava and Mendhe, observed similar finding at Pipalya-pala, Bilawali Tank, that the conductivity value in superficial sediments ranged from maximum in June and minimum in September. The higher conductivity due to higher concentration of salts content in water^{13,14}.

Total alkalinity: They are water-soluble anion. During investigation period, the data observed in the table 5.2.A it ranged from 110.00mg/ lit. to 44.00 mg/lit. the maximum value of total alkalinity observed 110.00 mg/lit. in the month of June. Total alkalinity value of the study year unfold that the maximum total alkalinity values recorded in summer and minimum values recorded in rainy. Values of bicarbonates were high in summer months during the year of study and minimum bicarbonate in rainy season. The value of bicarbonates minimum due to the dilution of water. Pandit reported similar observations in Ransager reservoir¹⁵.

Calcium: Calcium in soil results from passage through deposit of lime stones, gypsum etc. It plays a pre-dominant role in the composition of cell wall and protoplasm. It has been associated with carbohydrates and various organic acids. The results registered in the table 5.2.A revealed during the study period, calcium value ranged from 76.80mg/lit. to 43.00 mg/lit. In the year of study 2008-09, the maximum calcium value observed 76.80mg/lit. in the month of June the minimum calcium value observed 43.20 mg/lit. in the month of August outcomes of the study it revealed that the maximum calcium values recorded in summer season and minimum calcium values recorded in rainy season. Saha et.al. reported in the soil of perennial fresh water pond a maximum content of calcium 0.36% and minimum 0.22%⁷. Shaikh, also reported 0.35% in winter season and 0.40% in rainy season at Bilawali tank¹⁰. Three results coincide with the authors findings.

Summer season > winter season > rainy season.

Magnesium: Magnesium value always less than the calcium value. Magnesium is a water-soluble cation and it is necessary for chlorophyll pigment in green plants. A close peruses of recorded data in the table 5.2.A showed that during the study period, magnesium value ranged from 51.80 mg/lit. to 28.80 mg/lit. In year 2008-09, the maximum magnesium value perceived 51.80 mg/lit. in the month of June the minimum magnesium value perceived 28.80 mg/lit. in the month of September. The results of the study year revealed that the

maximum magnesium value recorded in summer and minimum magnesium recorded in rainy season. In Nagchoons pond, value of calcium and magnesium resemble the general trend reported from Indian water bodies. The value of magnesium always lower than the calcium (figure 1).

Chloride: At the study sites, Nagchoon pond the chloride content recorded in the table 5.2.A It ranged from 40.00 mg/lit. to 8.00 mg/lit. during the study year the maximum chloride content in soil observed 40.00mg/lit. in the month of March the minimum chloride content in soil observed 8.00mg/lit. in the month of August. The chloride content of soil revealed that maximum chloride values recorded in summer season and minimum chloride values recorded in rainy season. The maximum concentration of chloride because of high temperature, evaporation, recedes water and minimum concentration due to dilution of pond water. Choubey reported chloride value of 17.9 to 30.9 mg/lit¹⁶. The chloride level indicates pollution level.

Nitrate-Nitrogen: In Nagchoon pond, the soil examines during the period of study year and data registered in the table 5.2.A indicate that the nitrate-nitrogen value extended from 1.92mg/lit. to 0.90mg/lit. The observation recorded during study year 2008-09, the maximum value of nitrate 1.92 mg/lit. in the month of June on one hand, the minimum value 0.90 mg/lit. in the month of July. The nitrate content of soil blazoned that maximum nitrate values recorded in summer season and minimum nitrate values recorded in rainy season.

Nitrate-nitrogen occurs in various dissolved forms as dissolved molecular nitrogen, inorganic nitrogen as ammonia nitrite, nitrate and organic nitrogen as amino acid proteins etc. The major source of nitrogen in soil due to is bacteria and cyanobacteria which fix atmospheric nitrogen, Precipitation, surface and ground water drainage. The nitrate nitrogen of soil ranged from 0.90 mg/lit. to 1.92 mg/lit. Maximum value in summer season and minimum in rainy season of nitrate nitrogen this might be due to dilution of pond water.

Phosphate-Phosphorus: Phosphate is an element required for all aspects of cellular metabolism, respiration, cell division, growth, synthesis of protein and incorporation in all living tissues. Both organic and inorganic phosphorus occurs in soil, inorganic form considered important for production. Phosphorus occurs in soil in very low amount, due to its reactive nature during the year of investigation, table 5.2.A showed that the quantity of phosphorus has been found ranged from 0.60mg/lit. to 0.07 mg/lit. in year 2008-09, the maximum phosphate value observed 0.60mg/lit. in the month of June the minimum phosphate value observed 0.07 mg/lit. in the month of July the minimum value of phosphate recorded in rainy season. The concentration of phosphate phosphorus low as compared to concentration of other major elements because of reactive nature. The value revealed that the maximum phosphate value recorded in summer season and minimum nature of phosphate ions. The phosphate and nitrate are the chief nutrients for the

growth of aquatic flora (figure 2) and phosphorus has often suspected to be the limiting nutrient in primary production in fresh water so called as 'sub optimum' element. Summer season > winter season > rainy season

Sulphate: All sulphate from organic matter released in the form of H₂S and later, may be converted in to element sulphur or sulphates which depending upon pH and oxygen regime. In Nagchoon pond, the Sulphate value display in the table 5.2.A which ranged from 13.56 mg/lit. to 5.34 mg/lit. The observation recorded during study year 2008-09, the maximum value of sulphate 13.56 mg/lit. in the month of December and during the minimum value of sulphate 5.34mg/lit. recorded in the month of July. The sulphate content of soil revealed that maximum sulphate values recorded in winter season whereas minimum sulphate values recorded in rainy.

Sulphate are naturally occurs anions in all kinds of natural waters. In Nagchoon pond soil, the maximum value recorded in winter season and minimum value recorded in rainy season due to dilution factor. High concentrations of sulphate stimulate the action of sulphur reducing bacteria, which produces a gas highly toxic to fish life.

Sodium: Sodium is a soluble cation, observations recorded in the table 5.2.A during study year, amount ranged from 1.80 to 1.10mg/lit. in the year, 2008-09 the maximum value of sodium were recorded mg/lit. in the month of April. the minimum value of recorded 1.10 mg/lit. in the month of July. The sodium content of Nagchoon soil revealed that maximum sodium values recorded in summer season and minimum sodium values recorded in rainy season during the present investigation sodium concentration of soil at Nagchoon pond ranged from 1.10mg/lit. to 1.80 mg/lit. maximum value in summer and minimum value recorded in rainy season. Choubey reported sodium value 3.98 Kg/hac to 8.96 Kg/hac. in Gandhisagar reservoir¹⁶. The sodium content of water is very important to decide its quality for irrigation; salts ultimately affect the soil quality and plant growth¹⁵.

Potassium: Potassium is also a soluble cation. Though the amount of potassium was low than the sodium. Observation noted in table 5.2.A during the study year. The amount of Potassium ranged from 2.50mg/lit. to 1.10 mg/lit. In the first study year, 2008-09 the maximum value of Potassium recorded 2.50 mg/lit. in the month of July and the minimum value of Potassium recorded 1.10 mg/lit. in the month of November. The potassium content of Nagchoon soil revealed that maximum potassium values recorded in rainy season while, minimum sodium values recorded in summer season. Potassium concentration in pond soil ranged from 1.10 mg/lit. to 2.60 mg/lit. during the year of study maximum in rainy season and minimum in winter season. Choubey, reported potassium value 160.00 K/ hac to 170.80 K/hac. in Gandhisagar reservoir¹⁶. During rainy season that denoted flood inputs of potassium probably from the agricultural fields from the results of mineral content and their values, help in increasing productivity of pond.

Table-5.1 A
Soil Analysis of Nagchoon Pond During 2008-09

S.N.	Parameters	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
1	pH	7.50	7.80	7.80	7.15	7.8	8.92	8.57	8.44	8.00	8.13	8.15	8.40
2	Electrical Conductivity micro mohs	510.00	520.00	545.00	542.00	614.00	655.00	694.00	699.00	760.00	721.00	760.00	520.00
3	Total Alkalinity/lit. mg/lit.	48.00	44.00	74.00	78.00	80.00	80.00	82.00	89.00	93.00	91.00	98.00	110.00
4	Calcium mg/lit.	48.00	43.00	46.80	52.20	54.60	54.60	55.80	60.60	64.80	66.60	66.60	76.80
5	Magnasium mg/lit.	31.80	32.00	28.80	31.20	34.00	36.40	36.50	37.20	40.40	43.20	44.40	51.80
6	Chloride mg/lit.	8.00	8.00	8.00	10.00	13.00	22.00	36.00	36.00	40.00	38.00	34.00	38.00
7	Nitrate - mg/lit.	0.90	0.92	1.04	1.20	1.16	1.14	1.00	1.60	1.64	1.80	1.84	1.92
8	Sulphate mg/lit	5.343	6.165	7.809	10.275	10.686	13.563	10.275	6.165	7.820	6.980	6.980	7.800
9	Phosphate- mg/lit.	0.07	0.08	0.09	0.10	0.14	0.22	0.24	0.28	0.34	0.56	0.56	0.60
10	Sodium mg/lit.	1.10	1.30	1.40	1.70	1.70	1.70	1.70	1.80	1.80	1.80	1.80	1.80
11	Potassium mg/lit.	2.50	2.40	2.50	2.00	1.10	1.90	1.80	1.70	1.80	2.00	2.00	2.00

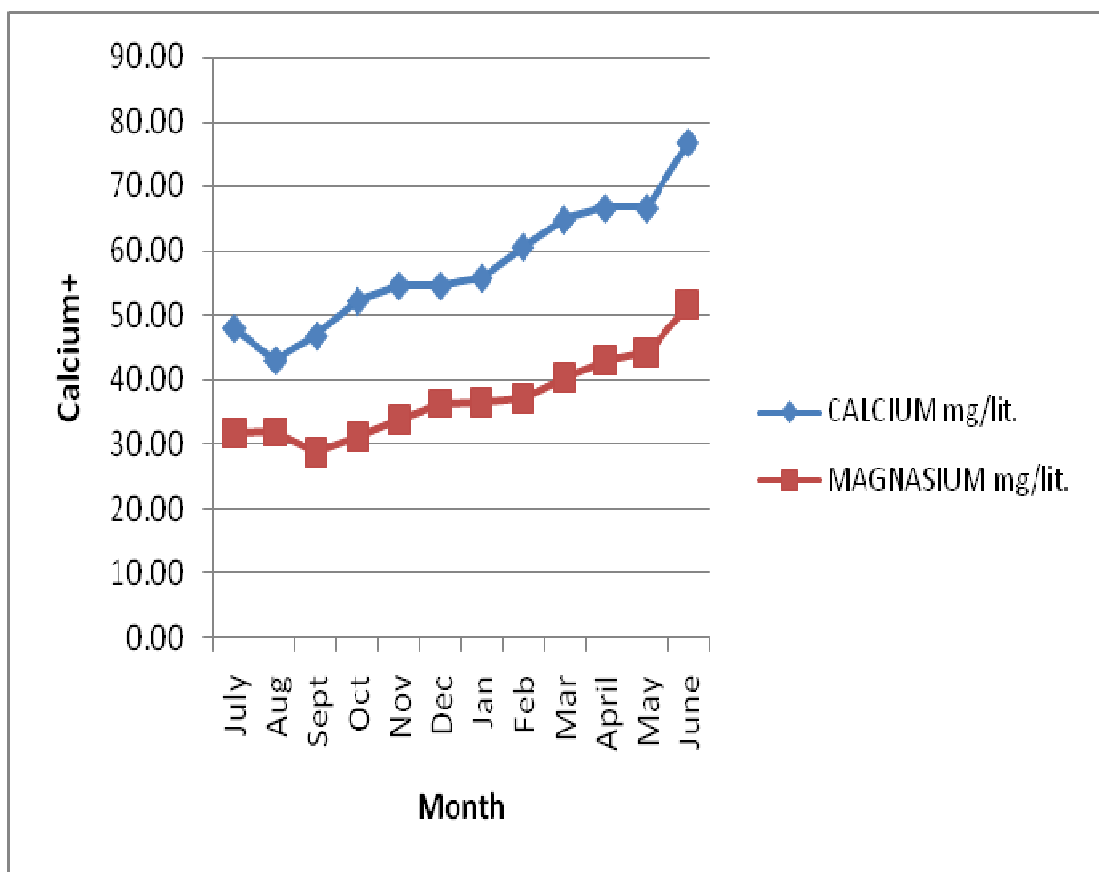


Figure-1
 Monthly variations in Calcium and Magnesium in soil during (2008-09)

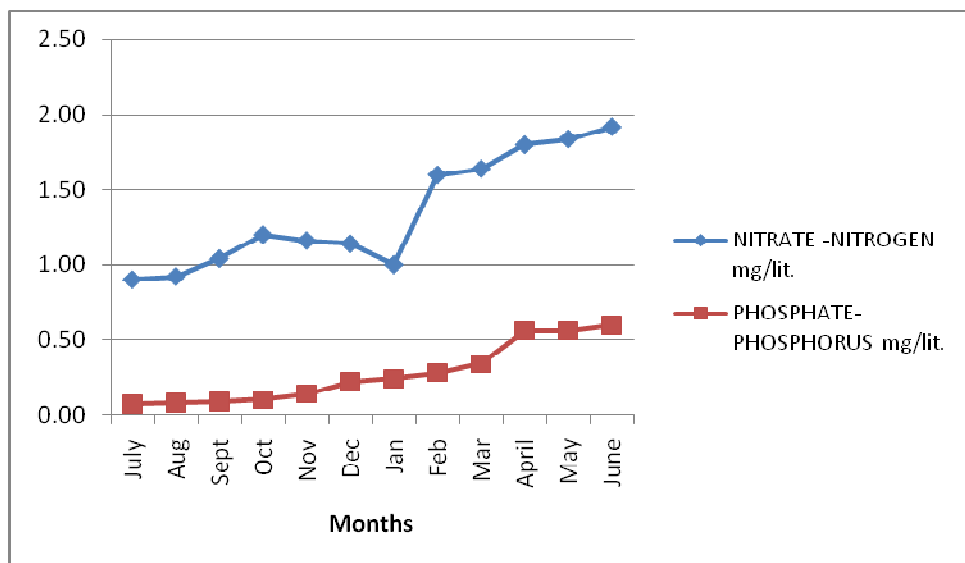


Figure-2
Monthly variations in Nitrate and phosphate in soil during (2008-09)

Conclusion

It is concluded that eleven physicochemical parameters were analyzed that the soil nature alkaline, conductivity high in summer due to high concentration of salts in soil. On other hand chloride concentration slightly higher than the permissible limit. The nitrate and phosphate concentration in soil affected due to agricultural runoff and anthropogenic activity in and around Nagchoon pond, Sulphate, sodium and potassium are under considerable value.

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