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Studies of water analysis of Government College, Ajmer Campus

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Abstract

Water is important component of all living beings. It also performs unique and indispensible activities in earth ecosystem, biosphere and biogeochemical cycles. Physiochemical parameters were conducted to gain knowledge on the ponds. In this paper, chemical and physical characters are analysed using standard procedures for the pond water samples collected from the ponds in Government College, Ajmer. Properties of pond water evaluated in this analysis include pH, chloride, phosphates, total hardness, free carbon dioxide, total alkalinity, dissolved oxygen, BOD, COD.

Keywords: Earth Ecosystem, Biosphere and Biogeochemical Cycles, BOD, COD.

Contents

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1. Introduction

Ajmer is situated in south west position at latitude 25 and longitude of 76 east. It is surrounded by Aravali hills. GCA College, Ajmer. Water is the principal need of life on earth, and is an essential component for all forms of lives, from microorganism to man. The world's water resources are under pressure and must be managed for human survival. It is, therefore, necessary to have most relevant information for arriving at rational decisions that will result in the maximum benefit to most people. Accurate and reliable information on the water resource system can, therefore, be a vital aid to strategic management of the resources. Ponds have been used since time immemorial as a

traditional source of water supply in India. However, the water of the ponds, lakes and river are polluted mainly due to discharged waste water from residential areas, sewage outlets, solid wastes, detergents, automobile oil wastes, fishing facilities and agricultural pesticide from farmlands .Pollution of surface and ground water is largely a problem due to rapid urbanization and industrialization.

Sample Collection and Handling Guidelines

A sample should be collected so that it is representative of the condition being investigated, and in a manner consistent with the collection, handling and preservation principles enunciated in Standards Association of Australia (1998) AS/NZS 5667.1:1998, and APHA (1998) section 1060. If there is any inconsistency between these references, Standards Association of Australia (1998) prevails. The water samples were collected from different sites in plastic bottles and transported immediately to the laboratory in bottles to avoid unpredictable changes in different physico-chemical parameters. Samples were collected from these ponds over a depth of about 10 cm below the water surface in the upper layers of the pond water using polyethene containers, because maximum photosynthetic activity of primary fish food organisms were observed in these layers and hence this zone should be given more attention for the purpose of dissolved oxygen (DO) estimation.

Water samples were collected in 8 spots at equal distance along the diagonal of the pond. Except for DO estimation, samples of water were collected only in the centre of the pond. Each sample collection was carried out in the early morning hours because DO and free CO_2 values are likely to remain in critical concentrations. The containers were dipped slowly in water without disturbing the surface and development of any air bubbles were avoided in the near vicinity as well as in the container. Each sample was poured in to poly ethylene bottle (exception DO estimation sample) after rinsing it several times with that water sample and securely sealed.

2. Methods of Analysis

Physical characteristics

pH

pH is technically defined as the negative base 10 logarithm of the effective hydrogen ion concentration (Eq. 1) in gram equivalents per litter (Puvaneswaran, 1987).

pH = -log10[H+] (1)

A substance is said to be neutral when it has a pH value of 7 (greater than 7 is less acidic or more basic, and less than 7 is more acidic or less basic). The pH value of water is important in water treatment and industrial processes (Velauthamurthy, 2001). pH can be measured by p^H M6 pH meter or by a potentiometer. In this study Jenway p^H M6 pH meter was used to measure the p^H.

Chemical characteristics

Chloride

The chloride content of the pond water was determinate by Mohr's method.10.0 ml of the pond water sample was pippetted out into the titration flask, then 2 drops of $K2CrO_4$ indicator solution was added to it. The resulting solution was titrated with the standard $AgNO_3$ (0.05M) solution to the equivalence point.

Dissolved Oxygen (DO)

All gases of the atmosphere are soluble in water to some degree. Oxygen is classified as poorly soluble, and its solubility is affected both by atmospheric pressure, and physical and chemical properties of water such as temperature, salinity, pollutants, etc. The solubility of atmospheric oxygen in fresh waters ranges from 14.6 mg/L at 0^0 C to about 7 mg/L at 35^0 C under 1 atm. of pressure.

Most of the critical conditions related to dissolved-oxygen deficiency, both in natural waters and biological wastewater treatment, occur during the warmer months when temperatures are high and solubility of oxygen is at a minimum. The low solubility of oxygen is a major factor limiting the purification capacity of natural waters. In aerobic biological treatment processes, the limited solubility of oxygen is also of great importance, because it governs the rate at which oxygen will be absorbed by the medium and therefore the cost of aeration. Hence, DO analysis is a key test both in natural waters and water pollution control practice.

Total alkalinity

The alkalinity of natural water is mainly represented by its content of carbonates, bicarbonates and hydroxides. It is determined by titration with a standard solution of a sulphuric acid, using methyl orange as an indicator. 25.0 ml of filtrated pond water was pipetted in to the titration flask and two drops of methyl orange indicator was added to it. The resultant solution was titrated with the standard H2SO4 (0.015M) to the equivalence point.

Total amount of hardness

The amount of dissolved calcium and magnesium in water determines its "hardness". Water hardness can be calculated as shown in the equation (Navaratharajah, 1994).

Hardness (ppm) = 2.5 [Ca^{2+} (ppm)] + 4.1 [Mg^{2+} (ppm)] (3)

Table-1 shows the different type of water having different range of hardness.

Table 1: Hardness scale.

Type of water	Range of hardness (ppm)
Soft	0-50
Moderately Soft	0-100
Moderately Hard	100-200
Hard	200-400
Very Hard	400-600
Extremely hard	> 600

Phosphate

Phosphate content of the water sample was measured by the calorimetric method. 5.0 ml of pond water sample was pipetted out into the test tube and 5.0 ml of vandamalybdate composite reagent was added to it. It was shaken well and the resulting solution was allowed to stand for 30 minutes. The absorbance was measured at 400 nm. A similar method was used for the standard solutions. By using the standard curve the concentration of the test solution was determined.

Free Carbondioxide

Fre CO_2 reacts with Na_2CO_3 or with NaOH to sodium carbonate. Take 100 ml of sample and add few drops of phenolphthalein indicator, colour change pink shows absence of free CO_2. In case colourless, titrate it with 0.005N NaOH.

Chemical Oxygen Demand

Add 20 ml sample, add 20 ml distilled water and add 0.4 gm H_2SO_4. In it add 10 ml of 0.025 N or 0.25N $K_2Cr_2O_7$ and then add 30 ml conc. H_2SO_4+ Ag_2SO_4 reagent and mix thoroughly. Cool and wash through the condenser with distilled water. Dilute for a maximum of 150 ml , Cool to room temp. and titrate excess $K_2Cr_2O_7$ remaining after refilli9ng c. Corresponding standard ferrous ammonium sulphate using ferrion as an indicator (8-10 drops). Sharp colour change from blue green to wine red indicates the end point of titration.

Biochemical Oxygen Demand

The BOD test is essentially a bioassay procedure involving the measurement of oxygen consumed by living organisms (mainly bacteria) while utilizing the organic matter present in a waste, under conditions as similar as possible to those that occur in nature. The requirements of the environmental conditions for the test can be summarized as follows:

Sufficient nutrients, e. g. N, P, S, K, Na, and certain trace elements.

a. Free from toxins.
b. Presence of a mixed culture of microorganisms (seed).
c. Dissolved oxygen must be available in the sample throughout the period of the test.
d. No interference due to re-aeration.
e. 20 ^{o}C incubation.

It is possible to interpret BOD data in terms of organic matter, as well as the amount of oxygen used during its oxidation. This concept is fundamental to an understanding of the rate at which BOD is exerted. Prepare dilution water by adding the following per litre of required dilution water, then aerate to oxygen saturation (approx. 1 hour),

a. 1 mL phosphate buffer,
b. 1 mL magnesium sulfate solution,
c. 1 mL calcium chloride solution,
d. 1 mL ferric chloride solution,
e. 2 mL of sample.

Set up three seeded dilution water blanks. Always siphon dilution water into BOD bottles to avoid entrapping air bubbles.

Note, BOD of seeded dilution water should range between 0.6~1.0 mg/L.

Prepare three dilutions for each sample. Measure the initial DO of each diluted sample and blank using a calibrated DO probe. Incubate blanks, the remaining samples at 20 ^{o}C for five days.

After five days incubation, measure DO in each bottle by DO probe, and calculate BOD_5 as follows:

Pf) BB( )DD(L/mgO as BOD212125 =

where:

D_1 = initial DO of sample, mg/L

D_2 = Final DO of incubated sample after 5 days, mg/L

C_1 = DO of seed control before incubation, mg/L

C_2 = DO of seed control after incubation, mg/L
B_1 = DO of dilution blank before incubation, mg/L
B_2 = DO of dilution blank after incubation, mg/L
P = Decimal volumetric fraction of sample used
f = %speed in D_1 / % speed in C_1
Seed correction = $(C_1-C_2)F$
BOD= $(D_1-D_2) – (B_1-B_2)$ 100 / % sample
Note: Only consider dilutions where: (1) depletion is ≥ 2.0 mg/L, and (2)finalDO≥ 1.0 mg/L

3. Results

Sr No.	Parameter	Pond water sample	Tap water sample	Drinking water sample as per WHO (maximum permissible limits)
1	Taste	Normal agreable	Normal	Normal
2	Colour	Nil	Nil	Nil
3	PH	7.8	6	6.5- 8.5
4	Odour	-	-	-
5	Temperature	32^0	30^0	-
6	DO	12.5mg/l	18.75mg/l	-
7	BOD	7.28mg/l	3.2mg/l	-
8	COD	0.031mg/l	0.016mg/l	-
9	Chloride	42.6mg/l	298.20mg/l	250mg/l
10	Phosphate	-	-	200mg/l
11	Total Hardness	1056mg/l	684mg/l	500mg/l
12	Free Carbondioxide	66mg/l	Absent	Absent
13	Methylorange Alkanity	53mg/l	70mg/l	-
14	Phenolphthalein Alkanity	Absent	Absent	-

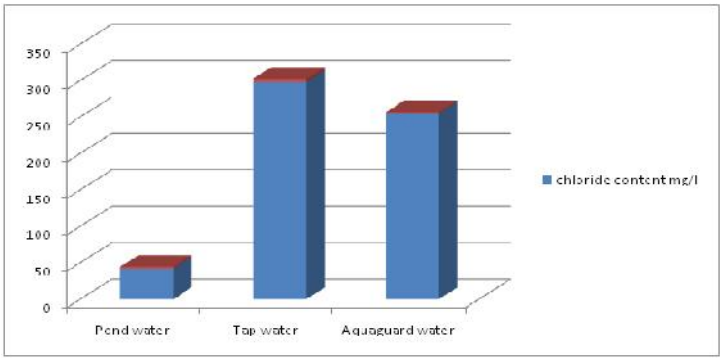

Figure 1

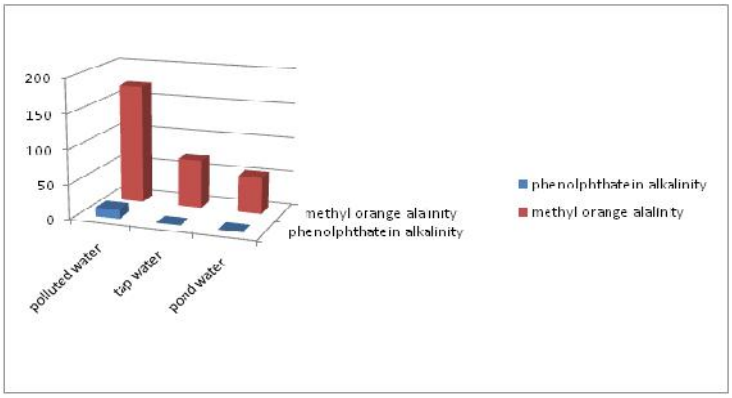

Figure 2

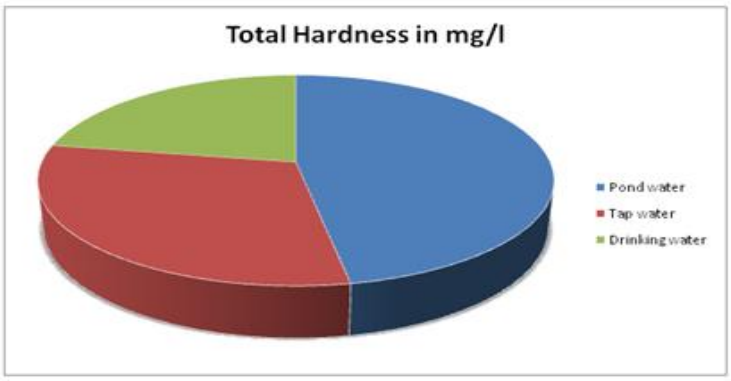

Figure 3

4. Conclusion

Understanding the quality of water is as important as that of its quantity, since, it is the main factor determining the suitability of water for drinking, domestic, agricultural and industrial purposes. The present investigations conclude that the quality of water samples subjected to study was hard, slightly alkaline in nature and was unfit for drinking. The COD and BOD values were found to be high. Thus the water from the pond is not good enough to be used for cooking and drinking purposes.

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