"STUDY OF PHYSICO-CHEMICAL PARAMETERS OF WATER FROM MHASOBA KHAN, HALASAVADE, TEHSIL-KARVIR, DIST.-KOLHAPUR"

SUBMITTED TO

DEPARTMENT OF ZOOLOGY

VIVEKANAND COLLEGE, KOLHAPUR

(EMPOWERED AUTONOMOUS)

(स्वायत्त) कोल्हापूर

IN THE PARTIAL FULFILMENT OF BACHELOR OF SCIENCE IN ZOOLOGY

IN THE YEAR: 2023-2024

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CLASS B. Sc. III

UNDER THE GUIDANCE OF

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DECLARATION

We the undersigned students, declare that the project entitled is submitted by **Patil Snehal Yalgonda and Patil Omkar Vijay** under the supervision of **Miss. Namrata A. Jadhav** Assistant Professor, Department of Zoology, Vivekanand College, Kolhapur (Empowered Autonomous).

It is our original work. The empirical findings in this project are based on the data collected by us and it is authenticable to the best of our knowledge. The presented matter is not copied from any other source.

Place: Kolhapur

Date: 20 / 3 / 2024

Student sign

Patil Snehal Yalgonda

Patil Omkar Vijay

CERTIFICATE

This is to certify that the project entitled **"Study of Physico-Chemical Parameters of Water From Mhasoba Khan, Halasavade, Tehsil-Karvir, Dist.- Kolhapur"** being submitted herewith for the Degree of Bachelors of Zoology to the Zoology Department of Vivekanand College, Kolhapur (Empowered Autonomous) affiliated to Shivaji University, Kolhapur, under the faculty of Science is the result of the original work completed by **Patil Snehal Yalgonda and Patil Omkar Vijay** under my supervision and guidance and to the best of my knowledge and belief, the work embodied in this project has not formed earlier.

Place: Kolhapur

Date: 20/03/24

Project Supervisor

Dr. G. K. Sontakke

HEAD
DEPARTMENT OF ZOOLOGY
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(EMPOWERED AUTONOMOUS)

Examined by

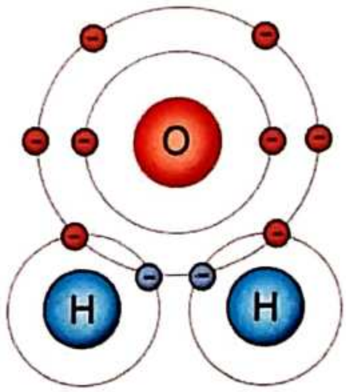
Examiner

INDEX

CHAPTER : 1

INTRODUCTION

Water is needed by all living things to survive on earth that is why it is one of the most important component on the earth. It is composed of chemical elements -hydrogen and oxygen and its chemical formula is H_2O, exists in gaseous, liquid and solid states. It is a tasteless and odorless liquid at room temperature. It is one of the most plentiful natural resources on the earth and available to mankind, but now-a-days, India is facing a serious problems of insufficiency of natural resources, especially that of water in view of population growth and economic development. Availability of clean and potable water has become a key issue in several developing countries. Better quality of water is described by its physical, chemical and biological characteristics. But some correlation is possible among these parameters and the significant one would be useful to indicate quality of water. Most of fresh water bodies all over the world are getting polluted, thus decreasing the potability of water.



Water - H_2O

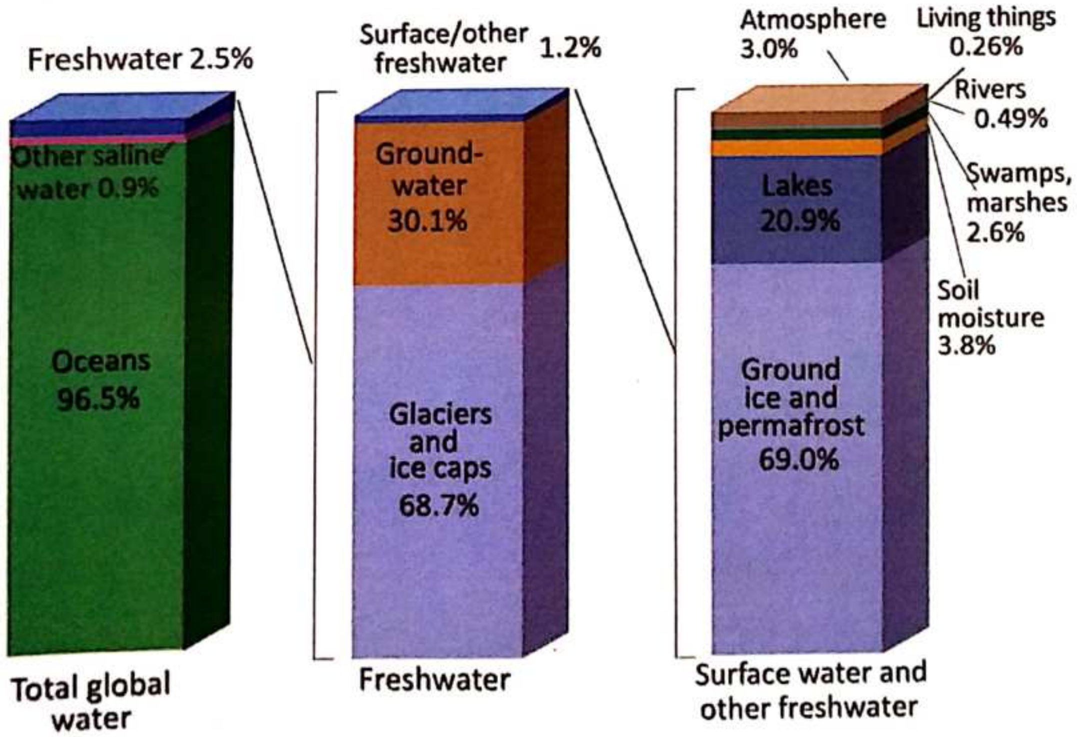
EARTH'S WATER-

The world's total water supply of about 332.5 million mi^3 of water, over 96.5% is saline. Of total freshwater, over 68% is locked up in ice and glaciers. Another 30% of freshwater is in the ground. From surface freshwater, only 20.9% is in the lakes. Fresh surface-water sources, such as rivers and lakes, only constitute about $1/150^{th}$ of 1% of total water. Yet, rivers and lakes are the sources of most of the water people use everyday. Detailed explanation of where Earth's water is given below in the table and diagram.

Water source	Water volume, in cubic miles	Water volume, in cubic kilometres	Percent of freshwater	Percent of total water
Oceans, Seas, & Bays	321,000,000	1,338,000,000	--	96.54
Ice caps, Glaciers, &Permanent Snow	5,773,000	24,064,000	68.7	1.74
Groundwater	5,614,000	23,400,000	--	1.69
Fresh	2,526,000	10,530,000	30.1	0.76
Saline	3,088,000	12,870,000	--	0.93
Soil Moisture	3,959	16,500	0.05	0.001
Ground Ice & Permafrost	71,970	300,000	0.86	0.022
Lakes	42,320	176,400	--	0.013
Fresh	21,830	91,000	0.26	0.007
Saline	20,490	85,400	--	0.006
Atmosphere	3,095	12,900	0.04	0.001
Swamp Water	2,752	11,470	0.03	0.0008
Rivers	509	2,120	0.006	0.0002
Biological Water	269	1,120	0.003	0.0001

(Source- Internet)

Where is Earth's Water?



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources. (Numbers are rounded).

- **Properties of Water-**

1) Physical Properties of Water:

1. Density: Water is denser in its liquid state than in its solid state (ice), which is why ice floats on water.

2. Boiling Point: The boiling point of water at standard atmospheric pressure is 100 degrees Celsius (212 degrees Fahrenheit).

3. Freezing Point: The freezing point of water at standard atmospheric pressure is 0 degrees Celsius (32 degrees Fahrenheit).

4. Specific Heat Capacity: Water has a high specific heat capacity, meaning it can absorb and retain a significant amount of heat before its temperature changes. This property is important for temperature regulation in living organisms and climate moderation on Earth.

5. Surface Tension: Water has a relatively high surface tension, allowing small objects to float on its surface.

6. Solvent Properties: Water is a universal solvent, dissolving many substances due to its polar nature.

7. Transparency: Water is transparent, allowing light to pass through, which is crucial for aquatic ecosystems and supports life underwater.

8. Conductivity:

Conductivity is a measure of how well water can pass an electrical current. It is an indirect measure of the pressure of inorganic dissolved solids such as chloride, nitrate, sulphate, phosphate, sodium, magnesium, calcium, iron, aluminium. The presence of these substances increases the conductivity of a body of water. Organic substances like oil, alcohol, and sugar do not conduct electricity very well, and thus have a low conductivity in water.

Inorganic dissolved solids are essential ingredients for aquatic life. They regulate the flow of water in and out of organism's cells and are building blocks of the molecules necessary for life. A high concentration of dissolved solids, however, can cause water balance problems for aquatic organisms and decrease dissolved oxygen levels.

Selected Physical Properties of Water	
Molar Mass	18.0151 grams per mole
Melting Point	0.00 °C
Boiling Point	100.00 °C
Maximum Density (At 3.98 °C)	1.0000 grams per cubic centimetre
Density (25 °C)	0.99701 grams per cubic centimetre
Vapour Pressure (25 °C)	23.75 torr
Heat of Fusion (0 °C)	6.010 kilojoules per mole
Heat of Vaporization (100 °C)	40.65 kilojoules per mole
Heat of Formation (25 °C)	−285.85 kilojoules per mole
Entropy of Vaporization (25 °C)	118.8 joules per °C mole
Viscosity	0.8903 centipoise
Surface Tension (25 °C)	71.97 dynes per centimeter

(Source: Internet)

2) Chemical Properties of Water:

1. pH:

pH is stands for potential of hydrogen. It is an important limiting chemical factor for aquatic life. If the water in a stream is too acidic or basic, the H^+ or OH^- ion activity may disrupt aquatic organisms by harming or killing the stream organisms.

pH is expressed in a scale which ranges from 1 to 14. A solution with a pH value greater than 7 has more OH activity than H', and is considered basic. The pH scale is logarithmic, meaning that as you go up and down the scale, the values change in factors of ten. A one-point point change indicates the strength of the acid or base has increased or decreased ten.

2. Dissolved Oxygen:

Dissolved oxygen (DO) estimation measures the amount of dissolved oxygen present in water. Water bodies receive oxygen from the atmosphere and from aquatic plants. Running water, such as that of a swift moving stream, dissolves more oxygen than the still water of a pond or lake.

All aquatic animals need DO to breathe. Low levels of oxygen (hypoxia) or no oxygen levels (anoxia) can occur when excess organic materials, are decomposed by microorganisms. During this decomposition process, DO in the water is consumed. Low oxygen levels often occur in the bottom of the water column and affect organisms that live in the sediments. In some water bodies, DO levels fluctuate periodically, seasonally and even as part of the natural daily ecology of the aquatic resource. As DO levels drop, some sensitive animals may move away, decline in health or even die.

Dissolved oxygen is one of the most important indicators of water quality. It refers to microscopic bubbles of gaseous oxygen that are mixed in water and available to aquatic organisms for respiration. DO levels in environmental water depend on the physicochemical and biochemical activities in water body and it is important in pollution and waste treatment process control. Most commonly used method for estimation of DO is iodometric method which is a titration-based method and depends on oxidizing property of DO. It recorded in units of mg/L (milligram per litre).

3. Biological Oxygen Demand:

The Biological Oxygen Demand (BOD) is the amount of oxygen consumed by bacteria/organisms in the decomposition of organic material. Aquatic organisms absorb molecular oxygen from water and use it to oxidize organic compounds and release energy for doing biological work. It also includes the oxygen required for the oxidation of various chemicals in the water, such as sulphides, ferrous iron and ammonia, while the dissolved oxygen is being consumed.

BOD is determined by measuring the dissolved oxygen level in a freshly collected sample and comparing it to the dissolved oxygen level in sample that was collected at same time but incubated under specific condition for a certain number of days. The difference in the oxygen readings between the two samples in the BOD is recorded in units of mg/L.

4. Total Hardness:

Total hardness of water is the amount of dissolved calcium and magnesium in the water. Hard water is high in dissolved minerals, largely calcium and magnesium. Polyvalent ions of some other metals like strontium, iron, aluminium, zinc and manganese etc. are also capable of reciting the soap and thus contributing to the hardness. However, the concentration of these ions is very low in natural water, therefore, hardness is generally measured as concentration of only calcium and magnesium, as calcium carbonate, which are for higher in quantities over other hardness reducing ions. Hardness is frequently used as an assessment of the quality of water sample. It recorded in units of mg/L (milligram per litre).

5. Total Alkalinity-

Alkalinity is the capacity of water to resist changes in pH that would make the water more acidic. Alkalinity is the strength of a buffer solution composed of weak acid and their conjugate bases. It is measured by titrating the solution with a monoprotic acid such as HCl until its pH changes abruptly or it reaches a known endpoint where that happens. It recorded in units of mg/L (milligram per litre).

6. Chlorides-

The chloride ion is the anion Cl^-. It is formed when the element chlorine gains an electron or when a compound such as hydrogen chloride is dissolved in water or other polar solvents. chlorides are widely distributed in nature as salts of sodium, potassium, and calcium. Usually chlorides are leached from various rocks into soil and water due to weathering. Chlorides are resent in both fresh and salt water and are essential elements of life

- ## History of Study Area-

The Study area- Mhasoba Khan is located in Halasavade, tehsil- Karvir, District Kolhapur.

Lat. 16.63306488217474
Lon. 74. 32679828256369

It is a man-made Khan, named by villagers of Halasavade. It engraves in 1980. Mhasoba Khan is named on the name of their local god. The depth of Khan is nearly 70 feet and spreaded nearly 70*50 respectively. This Khan has small two to three streams which provide water to it. This Khan is used for basic water needs.

- **Water Pollution-**

Water pollution is the release of substances into subsurface groundwater or into lakes, streams, rivers, estuaries and oceans to the point that the substances interfere with beneficial use of the water or with the natural functioning of ecosystems. In addition to the release of substances, such as chemicals, trash, or microorganisms, water pollution may include the release of energy, in the form of radioactivity or heat, into bodies of water.

Water pollutants come from either point sources or dispersed sources. A point source is a pipe or channel, such as those used for discharge from an industrial facility or a city sewerage system. A dispersed (or nonpoint) source is a very broad unconfined area from which a variety of pollutants enter the water body, such as the runoff from an agricultural area. Point sources of water pollution are easier to control than dispersed sources, because the contaminated water has been collected and conveyed to one single point where it can be treated. Pollution from dispersed sources is difficult to control and despite much progress in the building of modern sewage-treatment plants, dispersed sources continue to cause a large fraction of water pollution problems.

- **Water Quality Assessment-**

Water quality assessment involves evaluating three main classes of parameters: Biological, Chemical, and Physical.

Physical Parameters: Total Suspended Solids (TSS), Total Dissolved Solids (TDS), temperature, color, and odor fall under this category. These parameters address the physical characteristics of the water.

Chemical Parameters: This includes critical measures like Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), total hardness, total alkalinity, chlorides and pH. These parameters reflect the chemical composition of water.

Biological Parameters: This category focuses on the number and types of organisms present in the waterbody, providing insights into its ecological health.

The EPA (Environmental Protection Agency) establishes drinking water standards categorized into Primary and Secondary standards.

Primary Drinking Water Standards:

These regulations focus on safeguarding against organic and inorganic chemicals, microbial pathogens, and radioactive elements that may compromise the safety of drinking water.

Secondary Drinking Water Standards:

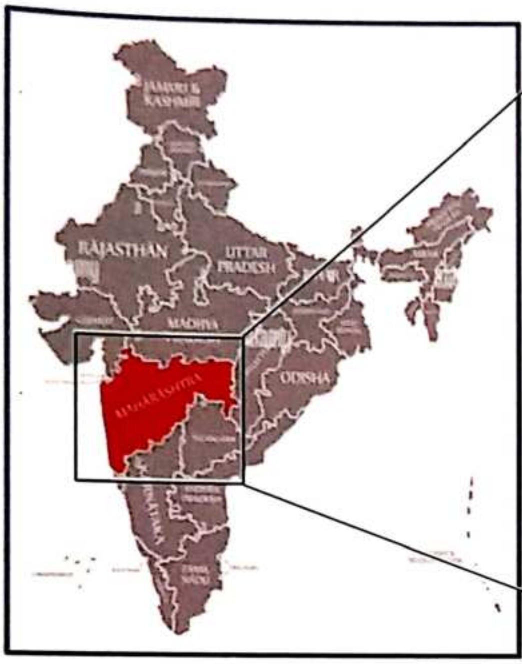
These standards target chloride, color, copper, corrosively, foaming agents, iron, manganese, odor, pH, sulfates, total dissolved solids, and zinc. They aim to maintain qualities such as taste, odor, color, and appearance in drinking water.

CHAPTER : 2

MATERIALS AND METHODS

- **STUDY AREA:**

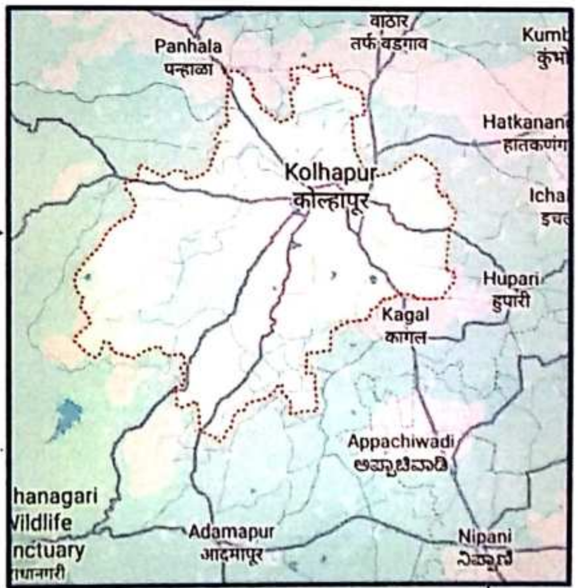
Mhasoba Khan : The study area selected for the present physico-chemical analysis of water samples is Mhasoba Khan, Halasavade, Kolhapur, Maharashtra, India 416202. (Latitude- 16.63306488217474, Longitude- 74.32679828256369). Water samples were collected during morning hours, weekly for the month of January and February, 2024.



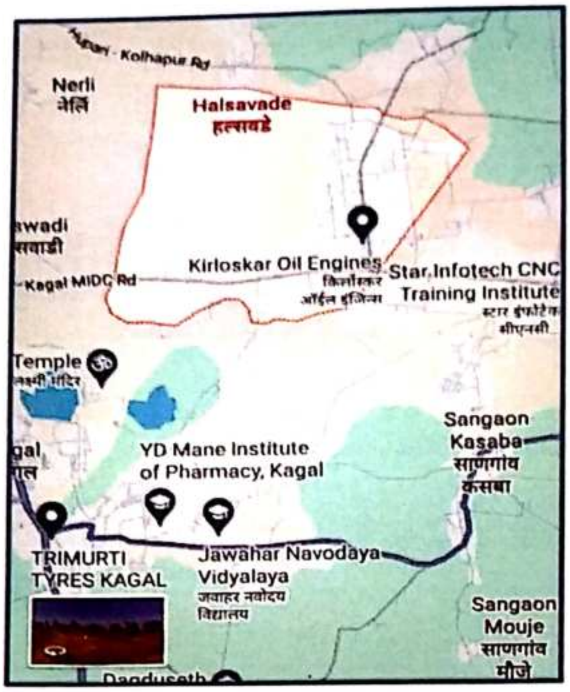
Map of India

Map of Maharashtra

Map of Kolhapur



Map of Karvir



Map of Halasavade

• Materials & Methods-

1) Temperature:

Thermometer was used to measure temperature of water samples in °C.

2) Dissolved Oxygen:

Materials:

BOD bottles, burette, pipette, conical flask, measuring cylinder, water sample, etc.

Chemicals:

A. Sodium thiosulphate, 0.025N: Dissolve 24.82 g of $Na_2S_2O_3.5H2O$ in boiled distilled water and make up the volume to 1 liter. Add 0.4 g of borax or a pallet of NaOH as stabilizer. This is 0.1 N stock solution (250- 1000ml). Keep in a brown glass stoppered bottle.

B. Alkaline potassium iodide solution : Dissolve 100g of KOH and 50g of KI in 200ml of boileddistilled water.

C. Manganous sulphate solution: Dissolve 100g of $MnSO_4.4H_2O$ in 200ml of boiled distilled water and filter.

D. Starch solution: Dissolve 1g of starch in 100ml of warm (800C-900C) distilled water and add a few drops of formaldehyde solution.

E. Concentrated Sulphuric acid (H_2SO_4)

Procedure: (Winkler's –Iodometric Method)

1. Fill the sample in a glass stoppered bottle (BOD Bottle) of known volume (100- 300ml) carefully, avoiding any kind of bubbling and trapping of the air bubbles in the bottle after placing the stopper.
2. Pour 1 ml of each $MnSO_4$ and alkaline KI solutions well below the surface from the walls. The reagents can also be poured at the bottom of the bottle with the help of special pipette syringes to ensure better mixing of the reagents with the sample. Use always separate pipette for these two reagents. A precipitate will appear.
3. Place the stopper and shake the content well by inverting the bottle repeatedly. Keep the bottle for some time to settle down the precipitate. If the titration is to be prolonged for few days keep the sample at this stage with the precipitate.
4. Add 1 to 2 ml of conc. H_2SO_4 and shake well to dissolve the precipitate.
5. Remove 50 to 100 ml in a conical flask for titration. Prevent any bubbling to avoid further mixing of oxygen.
6. Titrate the content within one hour of dissolution of the precipitate against sodium thiosulphate solution using starch as an indicator. At the end point initial blue colour changes to colourless.

Calculation:

When only a part of the content has been titrated,

$$\text{Dissolved Oxygen, mg/L} = \frac{(Ml \times N)\ of titrant \times 8 \times 1000}{v2\left(\frac{v1-v}{V1}\right)}$$

Where,

V1= volume of sample bottle after placing the stopper

V2= volume of the part of the contents titrated

V= volume of $MnSO_4$ and KI added

3) Biological Oxygen Demand:

Materials:

BOD bottles, burette, pipette, conical flask, measuring cylinder, BOD incubator, water sample, etc.

Chemicals:

A. Sodium thiosulphate, 0.025N: Dissolve 24.82 g of $Na_2S_2O_3.5H2O$ in boiled distilled water and make up the volume to 1 liter. Add 0.4 g of borax or a pallet of NaOH as stabilizer. This is 0.1 N stock solution (250- 1000ml). Keep in a brown glass stoppered bottle.

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2. Pour 1 ml of each $MnSO_4$ and alkaline KI solutions well below the surface from the walls. The reagents can also be poured at the bottom of the bottle with the help of special pipette syringes to ensure better mixing of the reagents with the sample. Use always separate pipette for these two reagents. A precipitate will appear.
3. Place the stopper and shake the content well by inverting the bottle repeatedly. Keep the bottle for some time to settle down the precipitate.
4. Add 1 to 2 ml of conc. H_2SO_4 and shake well to dissolve the precipitate.
5. Keep BOD bottle in BOD incubator at 20°C for 5 days.
6. Determine the dissolved oxygen content in another BOD bottle immediately by following method.
7. Add 1ml of MnSO4 and 1ml. of alkaline KI solution in BOD bottle. Shake the content

well by placing stopper.

8. Keep the bottle for sometime to settle down the brown coloured ppt. after some time add 1-2 ml of conc. H_2SO_4, till the ppt. get dissolved.
9. Remove 50-100 ml of solution in conical flask for titration and add 1-2 drops of starch solution.
10. Titrate this content against the 0.025N sodium thiosulfate until the blue colour disappear.
11. Repeat the same procedure (step 7-10) for sample in BOD bottle placed in BOD incubator at 20°C after 5 days.

Calculation:

When only a part of the content has been titrated,

$$\text{Dissolved Oxygen, mg/L} = \frac{(\text{DO initial} - \text{DO Final}) \text{ X N } of titrant \times 8 \times 1000}{v2\,((v1-v)/V1)}$$

Where,

V1= volume of sample bottle after placing the stopper

V2= volume of the part of the contents titrated

V= volume of $MnSO_4$ and KI added

4) Total Hardness:

Materials:

Conical flask, pipette, beaker, burette, measuring cylinder, burette stand, water sample, etc.

Chemicals:

A. EDTA solution, 0.01 M: Dissolve 3.723 g of disodium salt of EDTA in distilled water to prepare 1 litter of solution. Store in a polyethylene or Pyrex bottle.

B. Buffer solution:

a) Dissolve 16.9 g ammonium chloride (NH_4Cl) in 143 ml of concentratedammonium hydroxide (NH_4OH)

b) Dissolve 1.179 0f disodium EDTAand 0.780 g of $MgSO_4.7H2O$ in 50 ml distilled water. Mix both (a) and (b) solutions and dilute to 250 ml with distilled water.

C. Eriochrome Black T Indicator: Mix 0.40 g of Eriochrome Black T, with 100 g NaCl.

D. Sodium sulphide solution: Dissolve 5.0 g of Na_2S, $9H_2O$, or 3.7 g Na_2S, $5H_2O$ in 100 ml of distilled water and tightly close the bottle to prevent oxidation.

Procedure:

1. Take 50 ml sample in a conical flask. If sample is having higher calcium,take a smaller volume and dilute to 50ml.
2. Add 1 ml of buffer solution.
3. If the sample is having higher amounts of heavy metals add 1 ml of Na2S solution.
4. Add 100-200 mg of Eriochrome Black T indicator, the solution turns wine red.
5. Titrate the contents against EDTA solution. At the end point colour changes from wine red to blue.

Calculation:

Hardness as mg/L $CaCO_3$ = $(ml\ EDTA\ used\ x\ 1000)/V$

Where,

V = Volume of water sample used for titration.

1000 = Conversion factor

5) Total Alkalinity:

Materials:

Conical flask, pipette, beaker, burette, measuring cylinder, burette stand, water sample, etc.

Chemicals:

A. Hydrochloric acid: 0.1 N Dilute 12N concentrated HCl 12 times (8.34 – 100 ml) to prepare 1.0 N HCl. Dilute it further to make 0.1 N HCl (100 – 1000 ml). Standardize it against sodium carbonate solution.

B. Methyl orange indicators, 0.05%: Dissolve 0.5 g of methyl orange in 100 ml of distilled water.

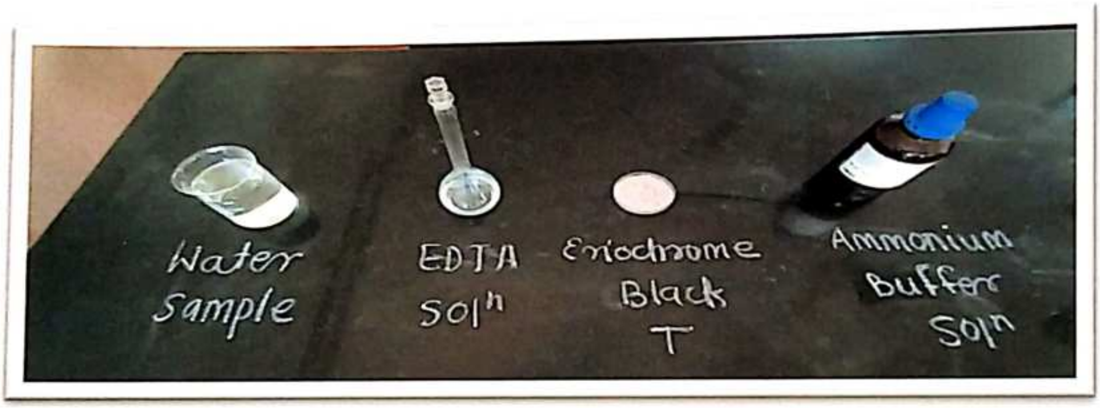
C. Phenolphthalein indicator: Dissolve 0.5 g Phenolphthalein in 50 ml of 95% ethanol and add50 ml of distilled water. Add 0.05 N CO2-free NaOH solution dropwise, until the solution turns faintly pink.

Collection of Water Sample

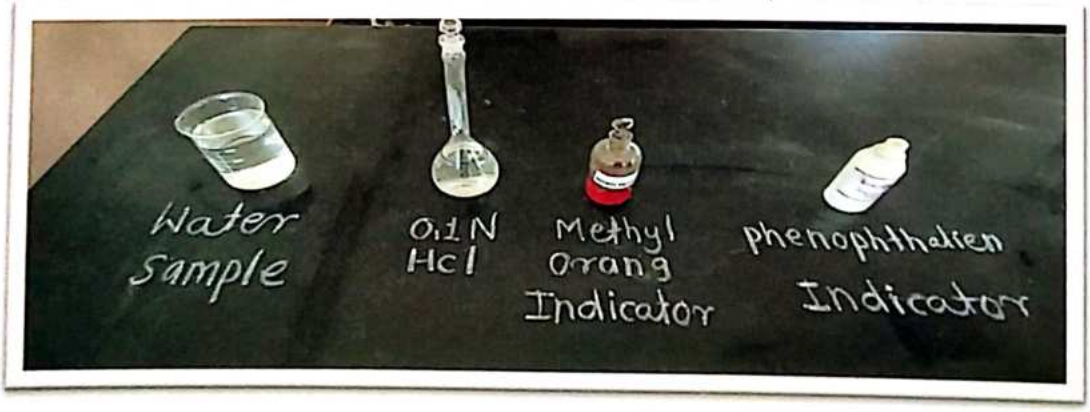
Materials used for estimation of DO and BOD

Materials used for estimation of Hardness and Alkalinity

Chemicals used for estimation of DO and BOD



Chemicals used for estimation of Hardness



Chemicals used for estimation of Alkalinity

Before addition of $MnSO_4$ and alkaline KI in water sample for estimation of DO

After addition of $MnSO_4$ and alkaline KI in water sample for estimation of DO

Titration of DO

Titration of BOD

Titration of Hardness

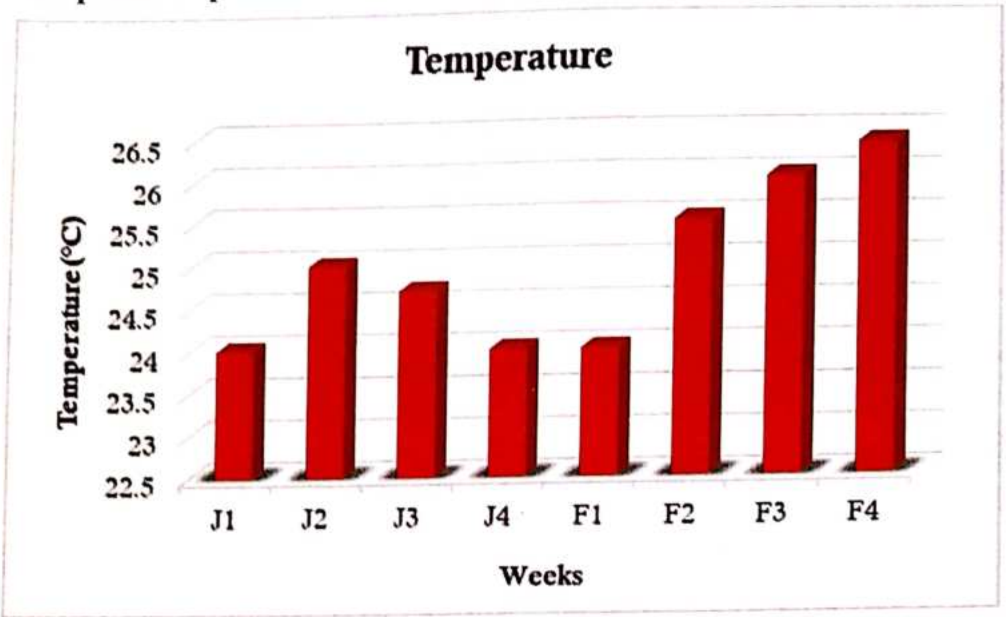
Titration of Alkalinity

CHAPTER : 3

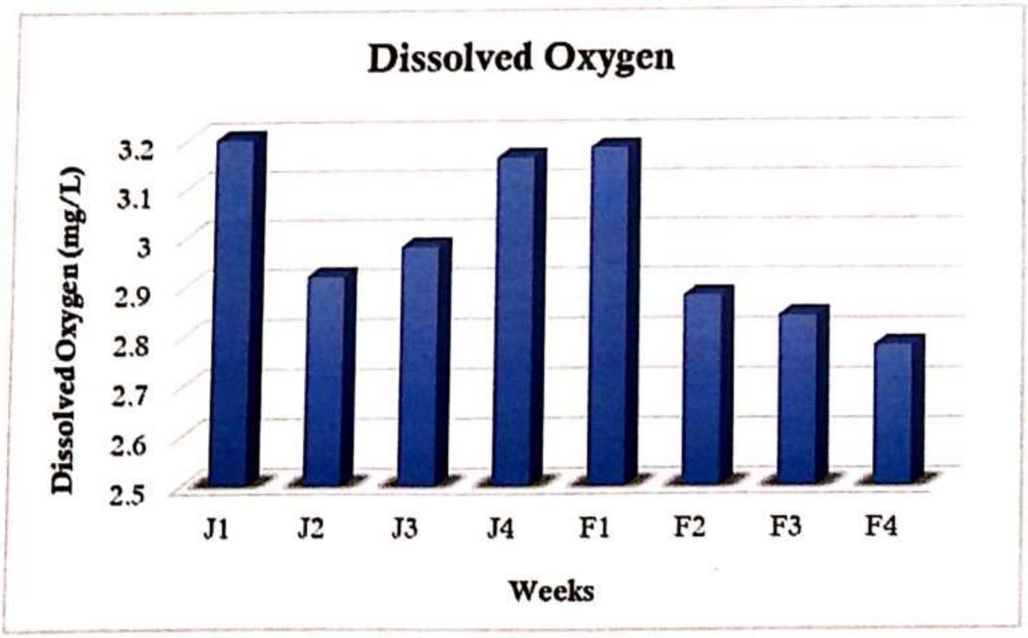
RESULTS

AND DISCUSSION

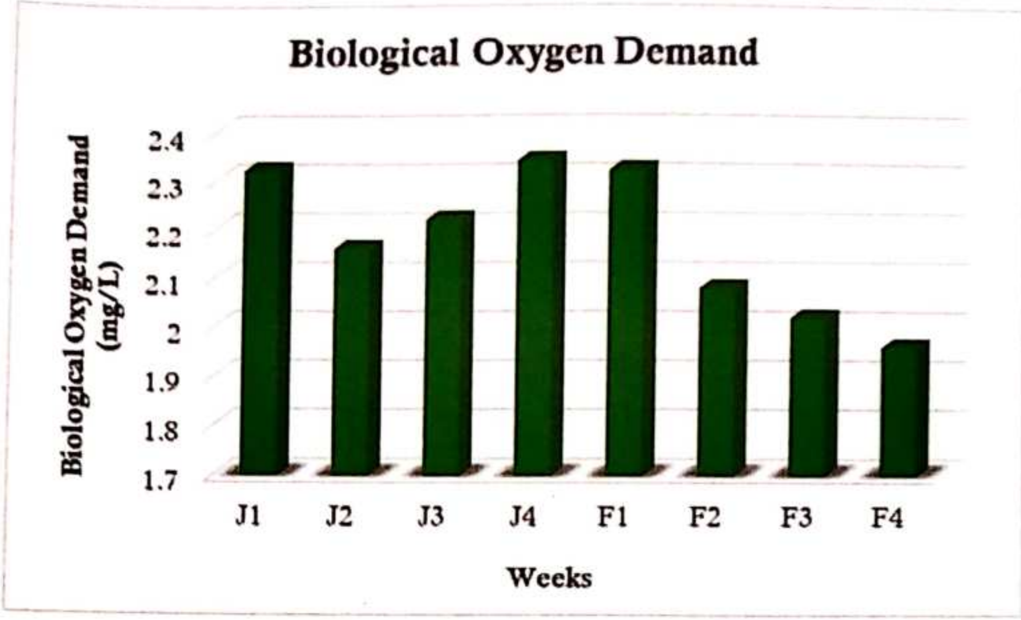
- **Graphical Representation:**



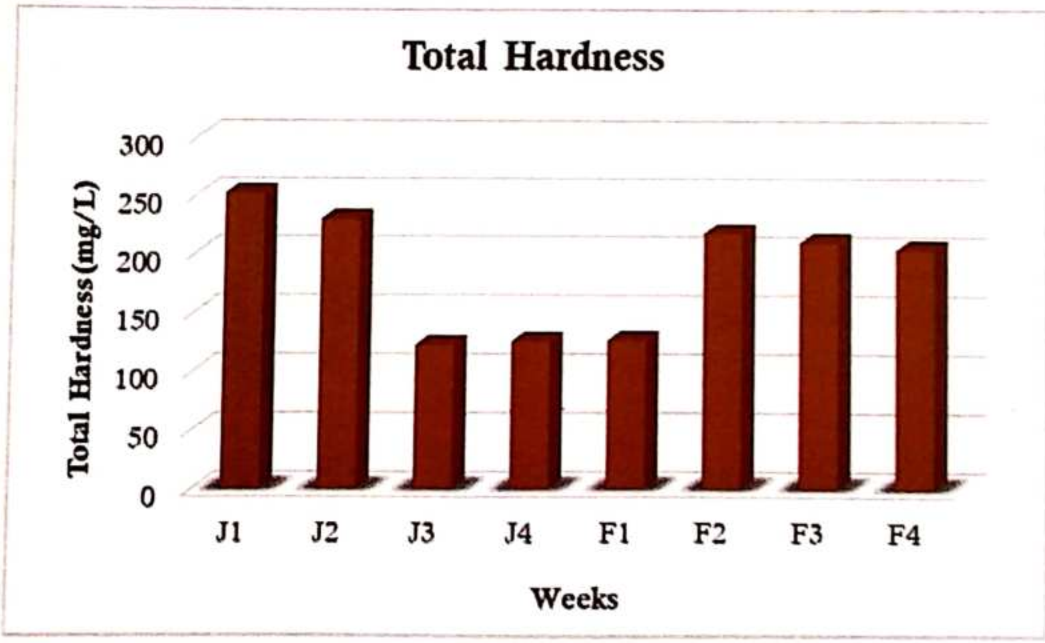
Graph No. 1: Weekly Temperature of Water Sample



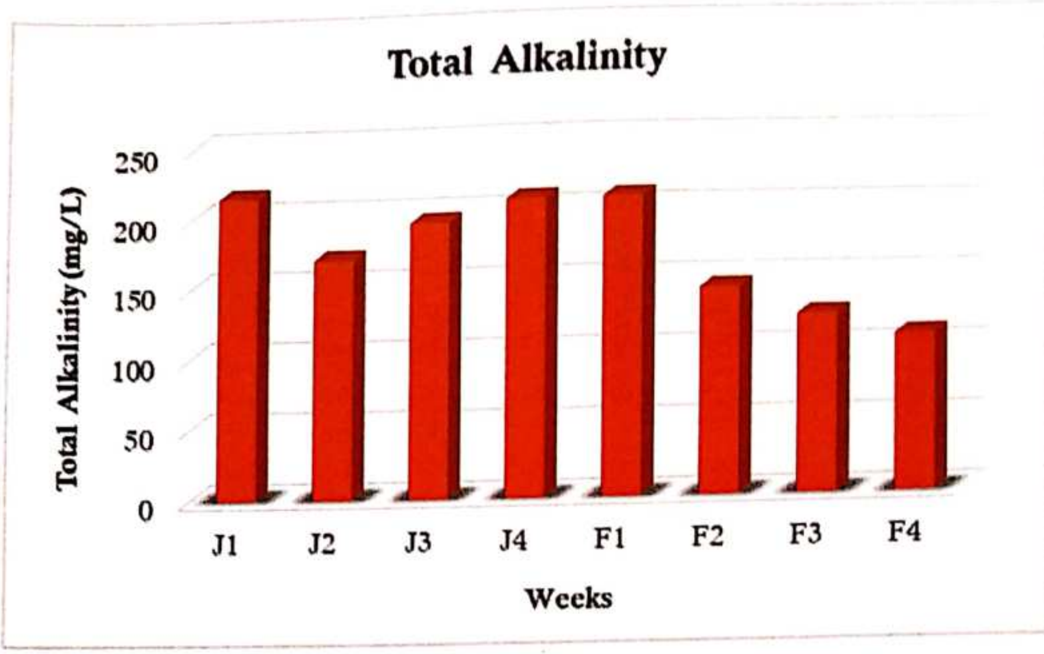
Graph No. 2: Weekly Dissolved Oxygen of Water Sample



Graph No. 3: Weekly Biological Oxygen Demand of Water Sample



Graph No. 4: Weekly Total Hardness of Water Sample



Graph No. 4: Weekly Total Alkalinity of Water Sample

Temperature: Temperature is strong and important factor for aquatic ecosystem as it affects the physical and chemical characteristics of water as well as organisms (Delince, 1992). During the present study, water temperature ranges from 24^0 C to 25^0 C in the month of January, 2024, whereas water temperature is increased in the range of 24^0 C to 26.4^0 C in the month of February, 2024. The average temperature of water from Mhasoba Khan is 24.95^0 C.

Dissolved Oxygen: Dissolved Oxygen (DO) is an important characteristic used to check the quality of water. Its concentration in waterbody gives direct and indirect information about bacterial activity, photosynthesis, availability of nutrients, stratification, etc. Low DO concentration (< 3 mg/L) in fresh water aquatic system indicates higher pollution causing negative effects on aquatic ecosystem (Jadhav *et al.*, 2012). In the present study, the concentration of DO ranged from 2.92 to 3.2 mg/L in the January, 2024 and 2.78 to 3.18 mg/L in the February, 2024. The average dissolved oxygen of water is 2.99 mg/L which is approximately 3 mg/L- low DO concentration indicating - polluted water. It is observed that dissolved oxygen decreased with increase in temperature during study period. High dissolved oxygen at low temperature could be due to increased rate of photosynthesis by increased density of phytoplankton in relatively stable environmental condition (Devi, 2007).

Biological Oxygen Demand (BOD): It is an important index for monitoring organic pollutants in water. BOD is directly proportional to the amount of organic matter from sewage and other discharges present in the given water sample. In the present work, BOD varied from 2.16 to 2.34 mg/L in January, 2024 and 1.96 to 2.32 mg/L in February, 2024 with an average 2.18 mg/L. As temperature increases, the rate of microbial activity also increases, leading to a faster breakdown of organic matter and a lower BOD value.

Total Hardness: In the present investigation, the total hardness was observed in the range of 122 to 252 mg/L in January, 2024 and 126 to 218 mg/L in February, 2024 with an average 185.87 mg/L. High values are probably due to regular addition of large quantities of sewage, detergents and large scale human use (Bhandarkar and Bhandarkar, 2013). The total hardness above 200 mg/L is not suitable for domestic use like drinking and cleaning and as per above values, this water is not suitable for drinking.

. **Total Alkalinity:** Alkalinity represents buffering capacity of water. High alkalinity values are indicative of the eutrophic nature of the water bodies and unsafe for ecosystem as well as for potable use. The higher value of alkalinity indicated the presence of bicarbonate, carbonate and hydroxide in the water bodies (Jain *et al.*, 2000). In the present study, total alkalinity of the water was varied from 170 to 215 mg/L in January, 2024 and 110 to 210 mg/L in February, 2024. The average total alkalinity is 172.5 mg/L. Here, total alkalinity values of the water sample are high, near the acceptable limit 200 mg/L.

The main aim of this work was to study the physico-chemical parameters of water from Mhasoba Khan, Halasavade, Kolhapur. Water samples from Mhasoba Khan has low dissolved oxygen indicating water is polluted. Fluctuations in BOD values were observed with respect to temperature. It is attributed to biological activity due to high organic decomposition. As per the values of total hardness of water, it is not suitable for drinking. The total alkalinity values are higher indicating presence of bicarbonate, carbonate and hydroxide in the water. So, from these results of present investigation, it is concluded that due to merging of runoff from nearby areas, discharge of wastewater from nearby areas, bathing, washing clothes, washing cattles, dumping of waste materials, Khan water has become polluted and cannot be used for drinking purpose.

Though, values of physico-chemical parameters are within permissible limit, as per Indian standard drinking water- BIS (Bureau of Indian standards) and WHO (World Health Organization), the ongoing practices in Khan may come out as major cause of water pollution. So it is the foremost thing to spread awareness among people about the need for protecting this Khan from pollution.

CHAPTER : 5

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