

A STUDY AND INVESTIGATION OF REMEDIAL MEASURES OF WATER QUALITY ON MARKAPURAM LAKE

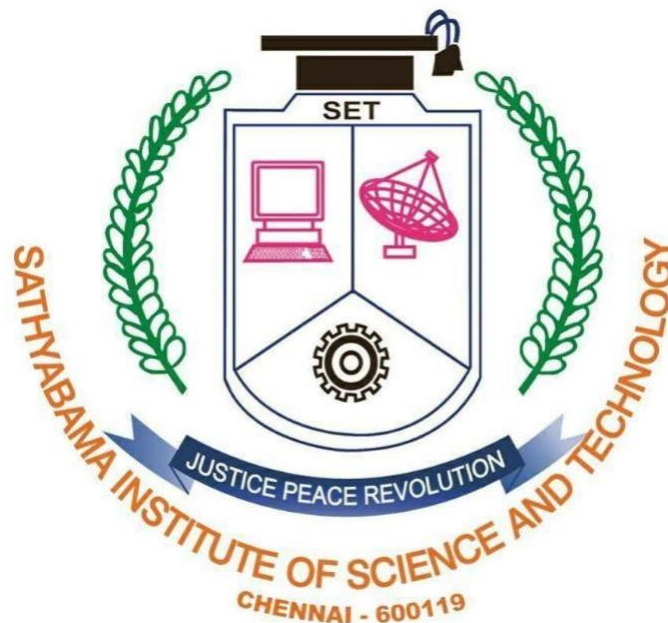
Submitted in partial fulfillment of the requirements for the award of Bachelor of
Engineering degree in Civil Engineering

by

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DEPARTMENT OF CIVIL ENGINEERING

SCHOOL OF BUILDING AND ENVIRONMENT

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

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MAY 2022



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DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafede work of **PALAGIRI LELLA VENKATA DURGA AVINASH (Reg.No.38200022)** and **S.TEJOVANTH(Reg.No.38200037)** who carried out the project entitled "**A STUDY AND INVESTIGATION OF REMEDIAL MEASURES OF WATER QUALITY ON MARKAPURAM LAKE**" under my supervision from Dec 2021 to May 2022.

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Submitted for Viva voce Examination held on_____

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DECLARATION

We, Palagiri leela venkata durga avinash (Reg.No.38200022) and S.Tejovanth reddy(Reg.No.38200037) hereby declare that the Project Report entitled “**A STUDY AND INVESTIGATION OF REMEDIAL MEASURES OF WATER QUALITY ON MARKAPURAM LAKE**” done by us under the guidance of **Mrs. S. PACKIALAKSHMI.**, M.E at Sathyabama Institute of Science And Technology, Chennai is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Civil Engineering.

1.

2.

SIGNATURE OF THE CANDIDATE

DATE:

PLACE:

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ABSTRACT

Markapuram Lake is a body of water about 25 kilometres from Ongole , Andhra Pradesh, India. Ongole City receives its water from one of two rain-fed reservoirs. Currently, Markapuram Lake serves as the city's primary source of water, but because of a lack of distribution infrastructure and poor water quality some areas receive an abundance of water, while others receive very little. Many lakes in the Prakasam district can be used as a source of water during times of shortage. Markapuram Lake's water quality and remedial measures are the focus of this study. Several water bodies in and around the city of Chennai have been subjected to environmental degradations as a result of rapid population growth, industrialization, and urbanization. A buildup of phytoplankton, macro algae, and sometimes colorless heterotrophic protists can discolor the water, resulting in foam. Dissolved Oxygen (DO) levels decrease as a result of this, causing ecological imbalance and eventually eutrophication in water bodies. As a case study, the physical-chemical water quality parameters of the studied area are examined. Various parts of the lake are sampled and subjected to water tests

Keywords:

PH values, water samples, CaCO_3 , nitrate, alkalinity, sulphates test, and wet sieve analysis

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CHAPTER 1

INTRODUCTION

Human life depends on effective management of the world's water resources. The most accurate information must be accessible in order to make sensible judgments that have the most beneficial influence on humanity. For efficient water resource management, accurate and trustworthy data on the water supply system is required. Lakes and ponds in India have long been the principal source of drinking water for the country's inhabitants. People's waste water from their homes and businesses, sewage outlets, solid wastes like detergents and oil wastes from automobiles, and agricultural pesticide residues from fields contribute to the polluting of water in lakes and rivers. Surface and subsurface water contamination has been worsened by rapid urbanisation and industrialisation. The existence of lakes has a significant impact on the local ecology and ecosystem. As a bonus, it replenishes the aquifers under our feet. " All kinds of organisms thrive in the lake's macroclimatic environment. Birds, as well as their habitats, are included in this category, which also includes aquatic and terrestrial creatures. There are various lakes and wetland environments that sustain a wide variety of bird colonies. This serves as a home for a wide range of ecosystem inhabitants. Water quality and composition were the primary goals of this inquiry of Markapuram Lake's water supply. Algae have a far better potential for growth and a faster response time to nitrogen inputs than land-based plant systems. Algae may alter the appearance and quality of water. Municipal water systems are polluted, and pollutants are released into the environment as a result. Algae blooms have a detrimental influence on recreational activities including swimming, boating, and fishing. There is a scarcity of dissolved oxygen due to the decomposition of enormous amounts of plant life. Ammonia, which is released as a byproduct of anaerobic decomposition, will also raise the death rate of fish and algae. In situations with significant silt loading, fish are unable to survive long enough to tell the story. Aquatic life is becoming less diversified as summer temperatures in shallow lakes become more and more consistent.

1.1 GENERAL :

Pollutants, nutrients, and sediments are the most typical causes of lake pollution. Upland agriculture practises provide organic nitrogen and phosphorus to soil particles that account for more than 90% of the total. Non-point and point sources are both possible for nutrients, as opposed to sediment. Sewage, wastewater, agricultural runoff, urban runoff, and atmospheric fallout are all potential sources of nutrients in a typical watershed. Fertilizer and pesticide usage has increased, and soil erosion has increased, making it worse in recent years. When the lake water has a large amount of nitrogen and phosphorus, it produces an algal bloom.

Algae have a significantly greater ability to develop and react quickly to nitrogen inputs, which function as fertilisers, than land-based plant systems. Algae may alter the appearance and quality of water. They contaminate municipal water supplies and emit pollutants into the atmosphere. Algae blooms have a severe influence on outdoor activities including swimming, boating, and fishing. Dissolved oxygen in the water column becomes depleted as decay of dead plants proceeds apace. Ammonia is released during anaerobic decomposition, increasing the death rate of aquatic organisms. Fish cannot live in water with heavy silt loading because of the growing turbidity of the water. The variety of aquatic life is dwindling as summer temperatures in small lakes become more and more consistent.

1.2 CHARACTERISTICS AND TYPOLOGY

Geologists believe lakes to be ephemeral. A pond's life cycle may be stopped by evaporation, changes in hydrology, sedimentation, or the loss of the ponding process.

1.2.1 ORIGINS OF LAKES

Geologists believe lakes to be ephemeral. It's possible for evaporation, hydrological imbalance, sedimentation, or loss of the ponding mechanism to put an end to a pond's life cycle.

a. Glacial Lakes: There are lakes that are coated in ice and/or located in rock basins that have been ice scraped. The second origin has the greatest number of lakes (the glacial scour lakes). Moraine lakes, which include kettle lakes that occur in glacial drift, are numerous in number. Most glacial lakes may be found in mountainous areas, subarctic regions, and Pleistocene surfaces. It includes all of the world's cold and mild temperate lakes, including those in the Canadian Arctic and the South American Andes and New Zealand's South Island.

b. Tectonic Lakes: By way of illustration, large-scale crustal movements have isolated the Aral and Caspian Seas from the Atlantic Ocean. It is well known that rift valley lakes such as the African Rift Lakes and Lake Baikal in Russia are the result of earth faults, folding or tilting. Here you'll find some breathtakingly ancient lakes. There are many examples, such as Lake Baikal (which we can see now), which was created 25 million years ago.

c. Fluvial Lakes: Oxbow lakes and levee lakes are examples of this kind of lake. Other examples include those generated by river meandering in flood plains and those formed by fluvial damming due to sediment deposition, such as delta lakes and meres.

d. Shoreline Lakes: Spits formed by sediment accretion owing to long-shore sediment flow, for example, cut off Egypt's coastal lakes from the sea.

e. Dammed Lakes : Lakes are formed by landslides, mudslides, and screes. In steep areas, these lakes are quite important.

f. Volcanic Lakes: There are lakes in craters and calderas, as well as those formed by damming volcanic flow. They're prevalent in places like Japan, the Philippines, Indonesia, and Cameroon, as well as parts of Central America and Western Europe.

g. Solution Lakes: Lakes form in water-soluble rocks like gypsum and limestone as a result of percolating water. The term "karst lake" is used to describe a kind of lake that may be found in a variety of geological conditions. Some evidence suggests that some smaller bodies of water were produced in this way, even though most large ones are assumed to have done so (e.g. Lake Ohrid, Yugoslavia).

It isn't the only way to create lakes: meteorite impacts and beaver dams may also do the trick.

1.3 WATER BALANCE

A lake's water balance may be stated in the following way:

Evaporation - Groundwater - Input (main river + lake tributaries + precipitation) - Output

Seasonal climatic variations, such as rainfall and solar heating, alter the water balance and cause a predictable seasonal fluctuation in water levels. Man-made control systems have been established to prevent water level fluctuations and assure year-round water supply in a large number of lakes. In temperate regions, temperature swings such as dry and warm years against cold and rainy years affect lake levels over the long run. Wetland destruction and floods are just a few effects that might result from these long-term cycles. Water turnover time (or residence time) is an important subject to understand when it comes to this. Divide the lake volume by the total outflow rate to arrive at the residence time. The average length of time people spend on a lake is anything from a few days to many decades. It's unlikely to happen very frequently, though, since it depends on the lake water being uniformly mixed, the theoretical residence period. There may be many water masses present at any one moment due to the lakes' thermal structure, deep water mixing, and water circulation patterns. These water masses might change seasonally and even year to year.

1.4 WATER QUALITY ISSUES

Numerous newly polluted lakes may now be found across the emerging globe. Water turnover time (or residence time) is an important subject to understand when it comes to this. Divide the lake volume by the total outflow rate to arrive at the residence time. The average length of time people spend on a lake is anything from a few days to many decades. It's unlikely to happen very frequently, though, since it depends on the lake water being uniformly mixed, the theoretical residence period. There may be many water masses present at any one moment due to the lakes' thermal structure, deep water mixing, and water circulation patterns. seasonal and sometimes even yearly.

being degraded at the same time as rural, urban, and industrial development. Contrast this with the development of advanced civilizations throughout time. This will need more costly and complicated evaluations, implementation, and data interpretation in developing countries with many water quality challenges.

1.5 CURRENT ISSUES:

Lake water quality is influenced by a wide range of variables. Cities with a higher concentration of urban residents are more likely to experience these issues. A number of contemporary problems with lake water quality are described in the following sections.

There are a number of factors contributing to lake salinization and acidification, including: Eutrophication, health-related problems, organic wastes, contaminants, bioaccumulation, and amplification.

A.Eutrophication: Eutrophication happens when a body of water is too fertilised, resulting in an overpopulation of the most basic plant species. It's an indicator of this process if algae and plankton in a water body are growing unnaturally fast. Eutrophication raises two key environmental issues: degradation of water quality and reduction in the amount of dissolved oxygen in the water. There is a risk that eutrophic waterways would become "dead zones," locations where no living organisms can thrive.



Fig(1.1) Eutrophication

b. Health related issues and organic wastes: Cities with large populations, such as New York and Los Angeles, have a tendency to pollute their lakes with human and animal waste. People who drink the water are at greater risk of sickness as a consequence of it being unsuitable for human consumption.

c. Contaminants: People are mostly responsible for introducing harmful chemicals into lakes. Many areas have substantial concentrations of dangerous metals due to the weathering, transportation, and deposition processes of rock substrates, yet this seldom causes health concerns for people. An increase in the rate of erosion of naturally existing elements or a change in their chemical form due to human activity (mine and industrial

usage) might put aquatic ecosystems and individuals at risk.

Fig (1.2) Contaminants

d. Bioaccumulation and Bio magnification: It is typical for both bioaccumulation and biomagnification to occur at the same time. Toxins accumulate in individual species via bioaccumulation, but when they move up the food chain from one trophic level to the next, the process is known as biomagnification (and thus grow in concentration).

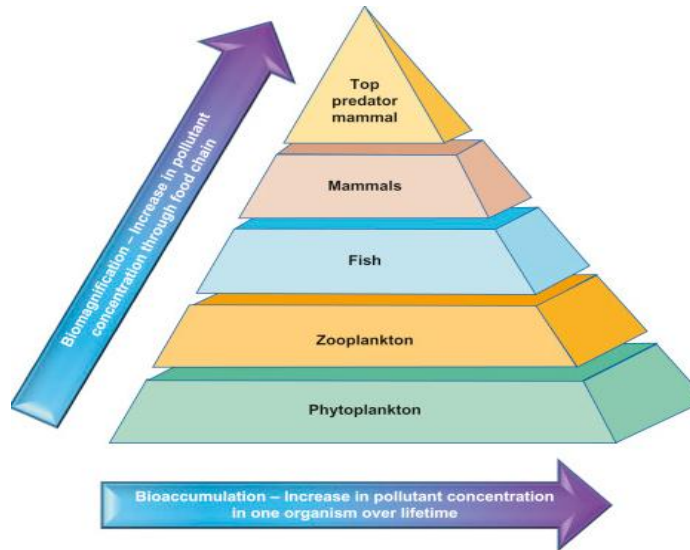


Fig (1.3) Bioaccumulation and Bio magnification

e. Lake Acidification: Increasing carbon dioxide concentrations are making lakes more acidic at a pace three times that of oceans. Acidification of the seas is caused by the chemical reaction between excess carbon dioxide in the atmosphere and seawater. Acid deposition from air pollution may harm both land and aquatic ecosystems (e.g. nitrates and sulphates). As a consequence of the harm acidified water may do to aquatic organisms' bones and exoskeletons, the eggs they lay may be fragile or feeble.

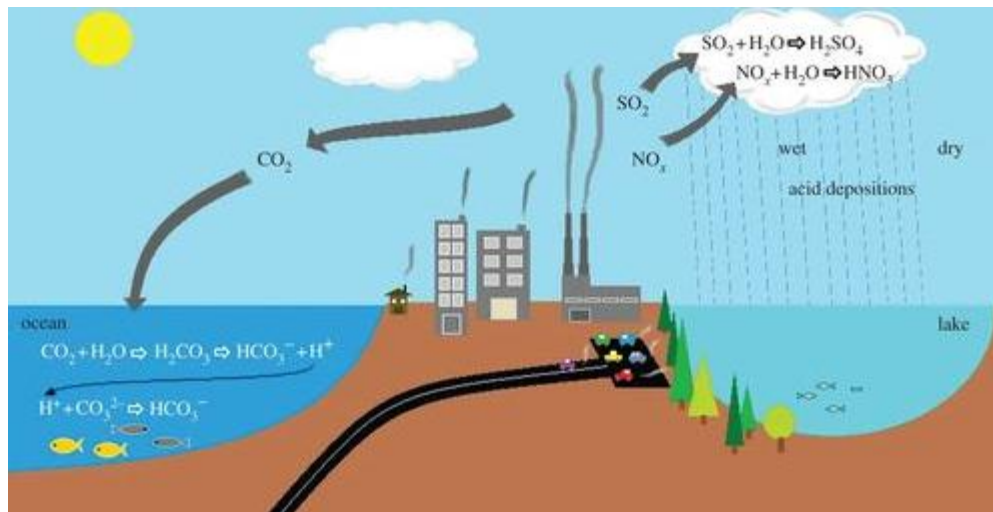


Fig (1.4) Lake Acidification

f. Salinization: The salinization of inland rivers is a major environmental problem. A vast range of salts include chloride, the most prevalent natural form of chlorine. Biota, sediments, and groundwater that enter watersheds and inland lakes may retain substantial amounts of chloride. Increased usage of road salt and salt buildup in humid locations may now be contributing to increased salinization of vital human drinking water sources and aquatic environments.

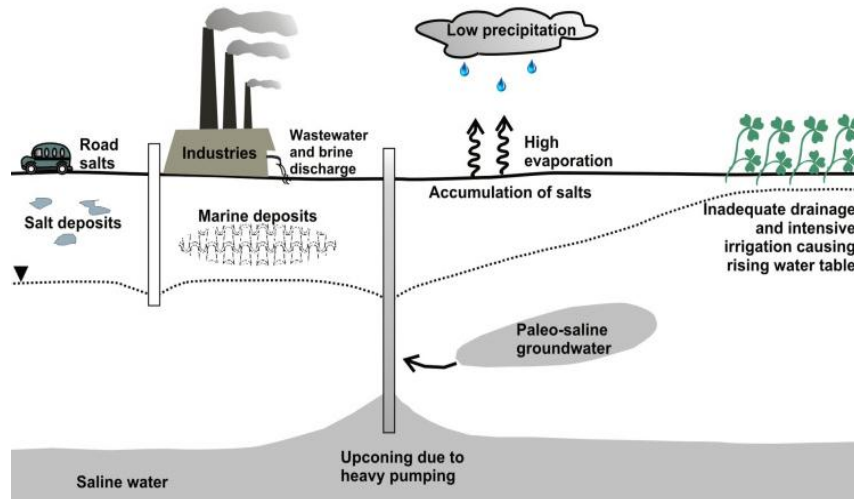


Fig (1.5) Salinization

CHAPTER -2

LITERATURE REVIEW

Consumption and Supply Management of Drinking Water in the City of Chennai There is a serious water shortage in the chennai metropolitan region, which includes water strain, water shortage, and water catastrophe. Water shortage may be caused by a combination of natural and human factors. The availability and demand for drinking water in Chennai's metropolitan area are the primary subject of this study. It was possible to compare and contrast various authors' perspectives on Chennai's water crisis as a consequence of this review study. There was a review of 20 publications on the water problem in Chennai, population growth, groundwater sources, drinking water quality, and knowledge of rainwater collection.

2.2 : Shanmugasundharam.A, et al (2015) , Groundwater quality assessment in the districts of Vellore and Krishnagiri in Tamil Nadu, India. For drinking, residential, agricultural, and industrial reasons, the quality of groundwater is critical. In the northern and eastern parts of Krishnagiri district, the southern and western parts of Vellore district, and the areas bordering Andhra Pradesh state in India, groundwater suitability has been evaluated. 31 groundwater samples were taken in the research region. The physicochemical parameters such as pH, EC, TDS, HCO_3^- , Cl^- , SO_4^{2-} , Ca^{2+} , Mg^{2+} , Na^+ , and K^+ have been evaluated in order to determine the quality of the groundwater in the area. Ca^{2+} and Mg^{2+} make up the majority of the cations, whereas Na and K make up the majority of the cations and anions, respectively. Wilcox diagram is used to assess water quality, and the findings show that the vast majority of samples are appropriate for irrigation. Groundwater's appropriateness for drinking and irrigation has been determined based on these characteristics.

2.3: K.Ambiga, et al(2013) In and around Ranipet, Vellore District, Tamilnadu, a groundwater pollution assessment was conducted. Due to the addition of waste water released from home, industrial, and agricultural sources, drinking water gets polluted either via the pipe distribution system or directly through groundwater. Physico-chemical aspects of subsurface water quality in Ranipet are the focus of this investigation. The groundwater quality was studied in July 2012 by collecting water samples in boreholes and digging wells in various locations. Samples were taken from bore wells that are often utilised for drinking water. TDS, Total hardness, Calcium, Magnesium, Sulphate, Chloride, Fluoride, and Nitrate have been found to be outside of the acceptable limit according to BIS drinking standards. As a result, it is recommended to conduct regular water quality checks to prevent groundwater pollution.

2.4: Thanga Gurusamy.B, et al(2018) , **STATISTICAL INVESTIGATION OF GROUND WATER QUALITY ACROSS COOVUM WATERSHED** : During the pre-monsoon and pre-2015 flood season, this research examines the geographical variance in ground water quality throughout the Chennai-Coovum watershed and compares it to that of the post-monsoon and post-2015 flood season. For this investigation, only chemical indicators of

water quality were taken into account. The observed data has been analysed using basic statistical techniques. Water Resources Department, Chennai, Tamil Nadu, provided the data used for this research. The results of both summary statistics analysis and correlation-based analysis have been provided in a graphical and tabular manner, respectively. Correlation Coefficient analysis and other Measures of Dispersion and Measures of Central Tendency have been used to describe water quality spatial distribution features using SPSS software. A comparison of the quality of the pre- and post-flood water has been made. Most chemical water quality measures have shown strong flood sensitivity in Pudupet, Thirumazhisai, and Mugappair West.

The quality of the ground water near the hostels in Vepery and Chepauk is regularly unfit for human consumption in the absence of treatment. It has been shown that TDS and EC have a strong association with Ca, Mg, Na, k and Cl. However, metrics such as PH, NO₃, SO₄, CO₃, F, and HCO₃ do not seem to have a strong association with other variables. HCO₃'s distribution has been shown to have zero skewness, which is close to that of a normal distribution. Numerous variables, including as TDS, Hardness, and Fluorides, had positive skewness and leptokurtic distributions.

2.5: N. Ramakrishnan, (2003) , Water Quality Assessments in TIRUVANNAMALAI, Tamil Nadu in India using BIO-MONITORING APPROACHES. A lack of drinking water is a problem in many places of Tamil Nadu because of disputes over water use and deterioration. More than standard chemical procedures, bio-monitoring technologies can quantify the degree of deterioration of water resources. Due to the fact that bio-monitoring, the use of live organisms to track water quality is mostly restricted to western nations alone, the goal here is to see how well it works in evaluating our local water resources. Phytoplankton, periphyton, microphytobenthos, and aquatic macrophytes have all been considered in this study, as well as water temperature, pH, alkalinity, free CO₂, dissolved oxygen, nitrate, phosphate, and calcium assessments of water quality in two freshwater bodies at Tiruvannamalai, Tamil Nadu, from April 2000 to March 2001. A number of pollution indices, including the Saprobic Index, Nyggard's Index and the Palmer Algal Pollution Index, as well as the Shannon-Weiner Index, were developed from the basic biological data in order to measure water quality.

2.6: S. Manimegalai , (2019) , A GROUNDWATER QUALITY STUDY OF THE TAMILNADU REGION OF USILAMPATTI, Water is essential to all living things and makes up 60-95 percent of a cell's weight. In recent years, however, as the human population has grown, industry, urbanisation, and bad sanitary conditions have developed, water from many sources has become contaminated. Groundwater contamination is mostly caused by the discharge of waste from agriculture, industry, and towns. Groundwater samples from the Usilampatti area of Tamilnadu, India, were analysed in this study. Water samples from the Usilampatti region of Madurai District were tested for temperature (T), pH, Specific conductance, Total alkalinity (TA), Total dissolved solids (TDS), Total hardness (TH), Dissolved phosphates, Dissolved oxygen (DO), Chloride (Cl), Fluoride (F⁻), Iron (Fe), Calcium (Ca), BOD and COD. The findings showed that the turbidity, specific conductance, hardness, TDS DO, chloride, fluoride, iron, COD, and BOD values of all the samples (S1,S2,S3,S4, and S5) were within the allowed limits. This is in contrast to other parameters such as phosphate and calcium, which were found to be over acceptable levels by WHO and BIS. All of the ground water samples were found to be unsuitable for drinking or domestic use. Thus, rainwater collection was shown to be one of the ways to reduce the content of inorganic chemicals in ground water. Monitoring the quality of the ground water on a regular basis is indicated as a critical step in preventing additional pollution.

2.7: Arivarasi. R . et al (2017) , Kancheepuram area, Tamil Nadu, India: Seasonal change in ground water quality and its suitability for drinking and agricultural - case study , Researchers in the Indian state of Tamil Nadu set out to examine the impact of seasonality on the quality of the groundwater in the Kancheepuram area. 68 groundwater well data were collected and analysed for various physico-chemical parameters, such as electrical

conductivity (EC), pH, total dissolved solids (TDS), total hardness (TH), Na⁺, Ca²⁺, Mg²⁺, Cl⁻, SO₄²⁻, HCO₃⁻ and F⁻, in order to evaluate the seasonal ground water quality for drinking and irrigation. pH, TDS, TH, Ca²⁺, Mg²⁺, Cl⁻, SO₄²⁻, HCO₃⁻, and F⁻ were among the nine parameters used to compute the Water Quality Index (WQI) for drinking. To determine irrigation water quality, EC and SAR were the two most essential measures. We used GIS mapping to look at the geographical distribution of water quality parameter values (GIS). More than half of the water samples were found to be of high quality, while just 1% of the samples were found to be unfit for human consumption. A whopping 33% of samples are deemed unfit for human consumption. Salinity danger exists at 23% to 42% of sample sites in the research region, indicating that agricultural productivity in the area is still questionable. Industrialization and urbanisation have had a negative impact on the quality of water in the studied region, compared to agricultural areas. As a result, it is recommended that appropriate steps be taken to reduce pollution caused by urbanisation and industrialisation.

2.8:Muthukumar S,etal(2011),Assessment of water quality in Trichy City, Tamil Nadu, India: Human economic activities, notably the impact of anthropogenic pressure, have resulted in an ever-increasing demand for fresh water from the Earth and its ecosystems. Climate and geology have a big role in determining where it may be found. Hydrogeochemistry of the area's groundwater was investigated using a methodical approach in this research. Agriculture and industry have made the area more populated. Weathering minerals contained in rocks was found to be the primary factor in determining the water chemistry in this area... The long-term management of water was determined by making an assessment of the available resources and the resulting demand. As water quality and quantity continue to decline, it may be blamed on overexploitation and poor water management, which necessitates an urgent response. According to hydrogeochemical investigations of the area, current conditions are within acceptable norms, save from a few samples.

2.9: AMEETH BASHA.I , et al(2016) , Analysis of the water quality in the town of Chinna Kanchipuram in Tamil Nadu, India Samples of water have been gathered from several locations around Chinna Kanchipuram, Tamilnadu, India, and tested for a variety of water quality criteria. It has been studied how city sewage, agricultural runoff, and dyeing effluents affect water quality. Kanchipuram is a booming city due of its temples, silk industry, and textile businesses. Water samples will be analysed to determine their physical and chemical properties as part of this investigation. Due to its geographical characteristics, the ground water has always been very hard. The water was determined to have a slightly alkaline pH. The pollutant load was assessed by comparing the measured results to the reference standards. According to the water quality criteria, the majority of the samples tested within a few features were found to be within acceptable limits. s.

2.10: Dinesh Kumar G , et al (2017) , Study of seasonal water quality assessment and fish pond conservation in Thanjavur, Tamil Nadu, India : Water is essential to all life on Earth. To sustain life, water is a vital component of the natural world. From July 2015 to June 2016, the water quality of ponds in Thittai panchayath village, Thanjavur District in Tamilnadu state was reviewed seasonally. Many physical and chemical parameters of the water were examined, including its colour, odour, turbidity, temperature range, pH, dissolved oxygen, bicarbonate of soda, carbon dioxide concentration, salinity, total alkalinity, and total hardness, to name a few. The parameter tested has the following possible values: Temperatures between 7.1 and 8.5 (26.9-31.90C) It has a capacitance of 290.30-405.10s per centimetre. CO₂, BOD, COD, calcium, magnesium, sodium, nitrate, and chloride concentrations are all included in the dissolved oxygen (DO) test, which measures the concentration of dissolved oxygen at 6.5-7.9 mg/L, as are BOD and COD concentrations at 4.8-7.0 mg/L, 4.8-7.0 mg/L, and 4.8-7.0 mg/L, respectively. Different physico-chemical characteristics of water samples were found to be mostly within the WHO and ICMR standard limits in this study. The findings of this research will help fish farmers understand how to utilise water from this source more efficiently in their operations.

2.11: S. Krishna Kumar, et al(2015) , Hydro-geochemistry and application of water quality index (WQI) for groundwater quality assessment, Anna Nagar: a district in the

Indian state of Tamil Nadu, The geochemical parameters of groundwater and the quality of drinking water were investigated in this research. Phosphorus (pH), electrical conductivity (conductivity of electricity via water), total dissolved solids (TDS) and hardness (total hardness) were all measured in 24 samples of groundwater. In order to assess the quality of the samples, the findings were compared to those of the WHO and BIS. Researchers found fresh-to-brackish, moderately high-to-hard groundwater in the samples they tested. Na and Cl are the most common cation and anion ions, respectively. Except for a few samples, the concentrations of chloride, calcium, and magnesium ions are within the permissible range. Rock–water interaction and evaporation dominance fields are where the majority of samples fall, according to Gibbs diagram. Na–Cl and mixed Ca–Mg–Cl groundwater samples are shown in the following trilinear diagram The WQI findings show that the vast majority of the samples are excellent or good, making them appropriate for human consumption.

2.12: U Gayathri, et al(2018) , Analysis of Bore Water in Nagapattinam Area of Tamil Nadu, India : To assess the quality of the bore water from the various water supply sources. From a variety of locations, bore water samples were taken and analysed for differences in character. There are several reasons why the environment pollutes the groundwater. As a result, those who drink dirty water suffer from a variety of health issues. This research, "Examination of bore water," was based on the collection of water samples from the Nagapattinam region and the qualitative analysis of various physico-chemical characteristics of ground water in the study area.

2.13: K.Ambiga , et al (2013), USE OF GEOGRAPHICAL INFORMATION SYSTEM AND WATER QUALITY INDEX TO ASSESS GROUNDWATER QUALITY IN AND AROUND RANIPET AREA, VELLORE DISTRICT, TAMILNADU : In the Ranipet region in Vellore District, a water quality index has been used to investigate the quality of the ground water. Groundwater quality may be rated using this approach, which can be used to monitor changes in water quality across time and space. During the monsoon and post-monsoon seasons of 2012, 35 samples of groundwater were taken from open and tube wells. The 35

groundwater samples taken were analysed using established techniques of physico-chemical analysis. The water quality index was estimated using the Tiwari and Mishra technique using the data provided. Measures were taken to determine the general water quality of the region. pH, total dissolved solids, total hardness, calcium, magnesium, sulphates, chlorides, fluorides, and nitrates are some of the characteristics taken into account while computing the index. In the monsoon season, the average water quality index of the samples was 142.59, whereas in the post-monsoon season, it was 115.4. Post-monsoon samples with greater concentrations of dissolved solids show worse water quality than those taken during the monsoon season. A post-monsoon increase in seepage and ground water flow might explain this.

2.14: M. Prabakar , (2017) , ASSESSMENT OF GROUND WATER QUALITY BY USING MULTIVARIATE STATISTICAL TECHNIQUES IN KARUR TALUK This ground water was tested for its appropriateness for drinking, agriculture, home use, and other uses in order to better understand the contamination processes caused by the numerous contaminant sources present in the area. A total of 12 sites in Tamilnadu's Karur Taluk gathered ground water samples in 2017. Physicochemical characteristics such as colour, smell and turbidity were measured, as well as the concentrations of various minerals and ions, such as Ca^{2+} and Mg^{2+} , Fe^{2+} and Na^{2+} and K^{+} and Mn^{2+} , NH_3 , NO_2^{+} and NO_3^{-} , Cl and F and SO and PO_4^{2-} . The findings were compared to Indian Standard (IS) and World Health Organization (WHO) drinking water recommendations (WHO). SPSS (version 19.0) was used to conduct multivariate statistical studies of Descriptive analysis, Correlation coefficient (r) analysis, Factor analysis, and Clustering analysis to identify the different forms of pollution creation in Karur Taluk.

CHAPTER: 3

AIM AND SCOPE OF THE STUDY OF SAMPLE PROPERTITES

3.1 AIM OF THE STUDY

- To study the Markapuram Lake
- To identify the water source for Markapuram lake
- To study and identify the water distribution network to city from Markapuram lake

3.2 SCOPE OF THE STUDY

- Utilization of local and in situ **materials**.
- A large number of waste materials can be utilized by increasing their strength.
- To collect water samples from different location around the lake
- To examine the water sample test results.
- To provide the remedial measures to improve the water quality on lake.

NEED FOR PRESENT STUDY:

Health risk assessments of water usage are critical and timely. Creating water that can be used by people, generating water that has a nice flavour, and creating facilities that can be developed at a reasonable cost are all significant aspects of water treatment. In terms of standards, guidelines (GL) and maximum acceptable concentrations (MAC) are the two most prevalent numbers that are offered (MAC). Towards those aiming to reach the GL, it's a good benchmark to aim for. The diffused water must not have a concentration greater than the MAC. The raw water must be treated if its concentration exceeds the MAC. Even if a facility is well-designed, managers must be flexible to ensure compliance. Every year, new water safety rules are issued. Biofilms, corrosion, and pollution in distribution systems should be prevented by system design and operation. A standard must be established for analytic approach, frequency, and kind. Water softening standards provide minimum levels for total hardness and alkalinity.

CHAPTER 4

EXPERIMENTAL MATERIALS AND METHODS USED

4.1 METHODOLOGY

Health risk assessments of water usage are critical and timely. Creating water that can be used by people, generating water that has a nice flavour, and creating facilities that can be developed at a reasonable cost are all significant aspects of water treatment. In terms of standards, guidelines (GL) and maximum acceptable concentrations (MAC) are the two most prevalent numbers that are offered (MAC). Towards those aiming to reach the GL, it's a good benchmark to aim for. The diffused water must not have a concentration greater than the MAC. The raw water must be treated if its concentration exceeds the MAC. Even if a facility is well-designed, managers must be flexible to ensure compliance. Every year, new water safety rules are issued. Biofilms, corrosion, and pollution in distribution systems should be prevented by system design and operation. A standard must be established for analytic approach, frequency, and kind. Water softening standards provide minimum levels for total hardness and alkalinity.

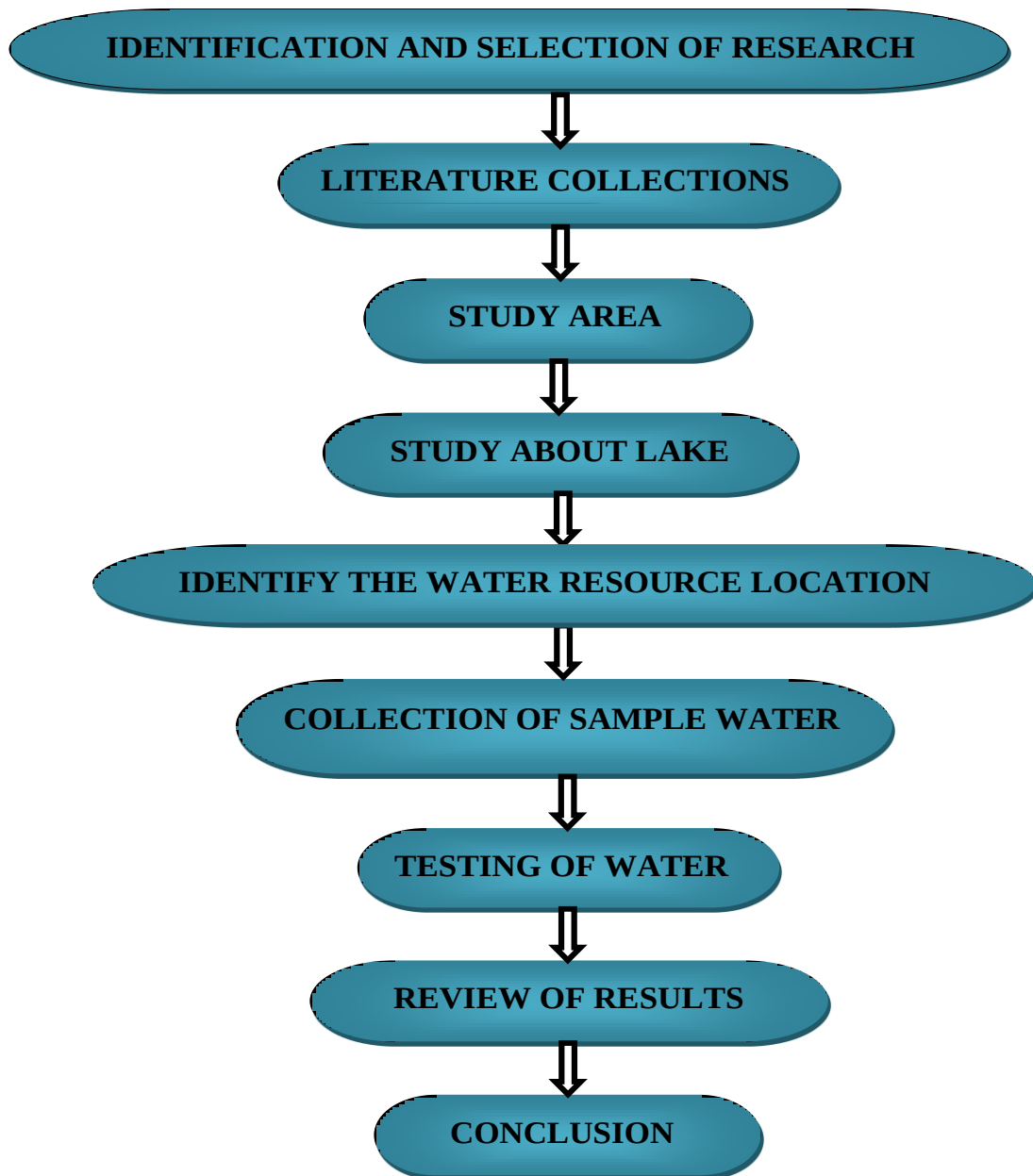


Fig 1:Flow Chart

Water pH is measured by combining and stirring it properly with the assistance of a glass rod.

Water that is equivalent to 40ml (5ml more or less) is supplied to the beaker by using a watch glass. Setting the design to stand for an hour allows the water temperature to stabilise. In the midst of this moment, stirring may be accomplished. After an hour, the temperature of the water is recorded and the pH metre is calibrated accordingly. As a result, the pH metre indicates a temperature that is in line with the sample. Before the test is completed, all of the adjustments to the equipment must be made and maintained in a consistent manner. Some pH metres include temperature settings that can be controlled by a computer. In these circumstances, the manufacturer's instructions must be followed.

□

Modern choices help standardise the pH meter's performance. This is also where the temperature is regulated in accordance with the aforementioned process.

□

After that, the electrodes are put into the water sample to be tested. The beaker is shaped and fine-tuned to ensure that the electrodes are in precise contact with the water.

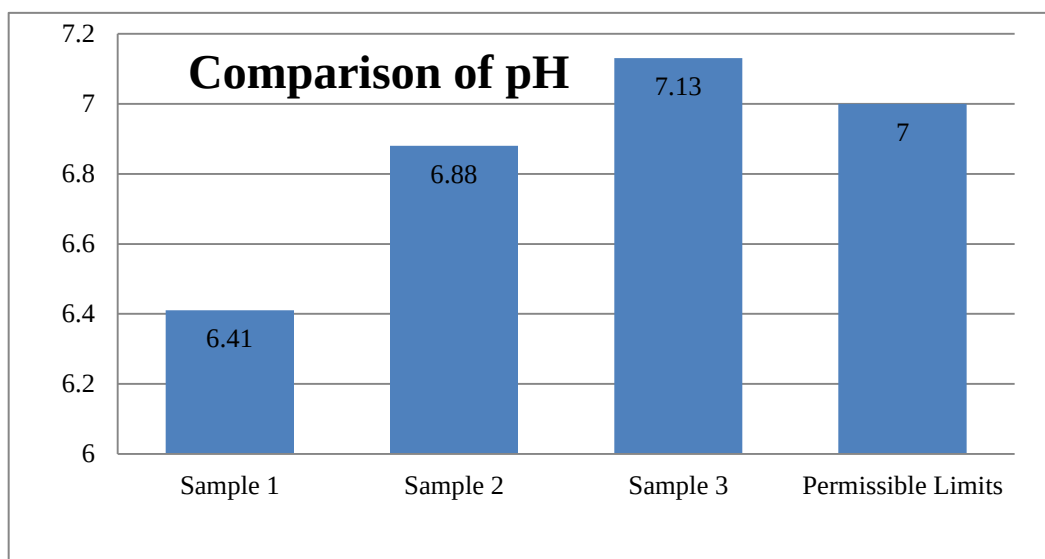
After 30 seconds, the electrodes may begin reading. This amount of time is necessary for the metre to stabilise and provide an accurate reading. When a pH meter's computerised analysis system has been stabilised, a notice will appear to let the user know.

Once the research has been presented, it should be done down to the tenths of a percent. The cost must be rounded off if it specifies a centesimal range. If the one hundredth area is less than or equal to 5, the tenth digit is left. It is rounded to one unit for values more than five decimal places. A centesimal area equal to 5 is rounded up to a closest even range.

□

After each usage, the equipment should be cleaned and inspected. The electrodes are thoroughly cleaned with distilled water before each usage. The electrodes need to be cleaned if there are any traces of film around them. In order to avoid polarisation and a slow reaction in the experiment, it's best to avoid wiping the electrodes.

pH value	
Sample 1	6.41
Sample 2	6.88
Sample 3	7.13
Permissible Limits	7



4.2 DETERMINATION OF TOTAL HARDNESS: The term "hard" refers to water that has a high concentration of naturally occurring calcium and magnesium. Calcium and magnesium concentrations in milligrammes per litre (mg/L) are used to calculate total hardness.

Total Hardness(mg/l)	
Sample 1	10
Sample 2	488
Sample 3	1180
Permissible Limits	200

4.3 DETERMINATION OF CALCIUM ION CONCENTRATION:

An EDTA solution has been poured into the burette.

Concentrations of 0.010 mol L⁻¹ are often used.

There is plenty hard water in the conical flask.

To transfer the water pattern into a flask, such as a 50.0 mL one, switch pipettes may be utilised.

Before testing, a droplet of indicator water is applied to the sample.

After additional EDTA is added, Patton and Reeder's Indicator will become crimson, and then turn blue.

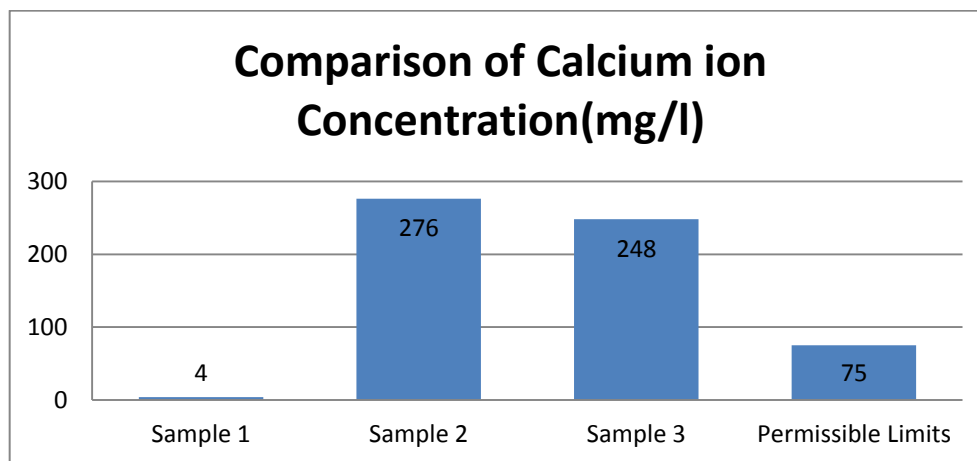
After injecting EDTA into the conical flask, we wait for the indicator to change colour before determining whether or not the endpoint has been reached.

There is a record of EDTA usage.

If three concordant titres, i.e., three EDTA volumes that are all within 0.05 mL of each other, are not attained, then the previous processes must be repeated.

A common concordant titre is used to assess the water's calcium ion content.

Calcium ion Concentration (mg/l)	
Sample 1	4
Sample 2	276
Sample 3	248
Permissible Limits	75

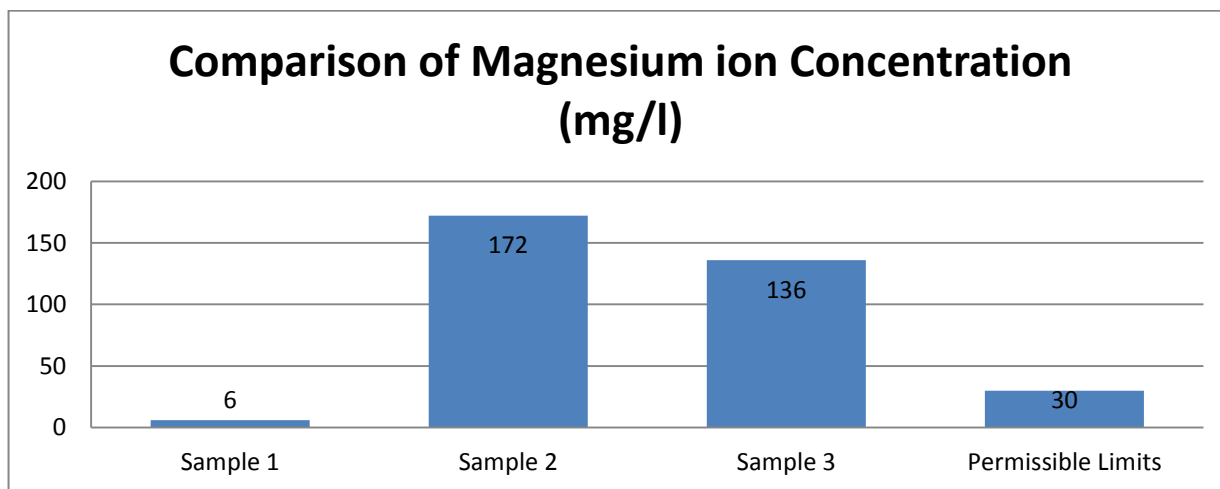


4.4 DETERMINATION OF MAGNESIUM ION CONCENTRATION:

Reagents

A pH 10 buffer (2000 mL) has been prepared by dissolving a hundred and forty grammes of NH_4Cl in 650 millilitres of deionized water, containing 1136 millilitres of concentrated ammonia, and diluting to 2000 millilitres. In a little amount of 6M HCl (around 15 mL), the proper quantity (1.3 g) of pure zinc was dissolved. A two-liter volumetric flask had the soluble zinc put to it and diluted to the desired concentration. This 0.01% of a million (solution serves to standardise the EDTA solution).

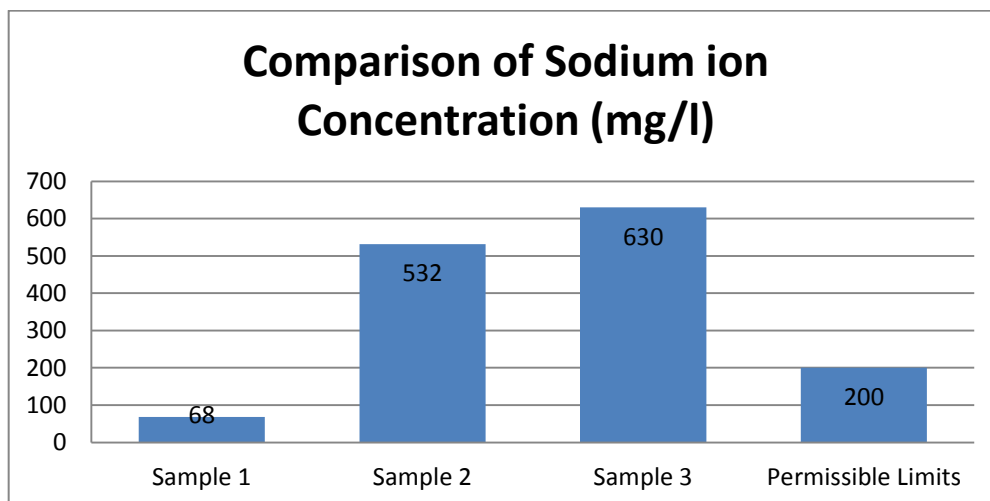
Magnesium ion Concentration	
Sample 1	6
Sample 2	172
Sample 3	136
Permissible Limits	30



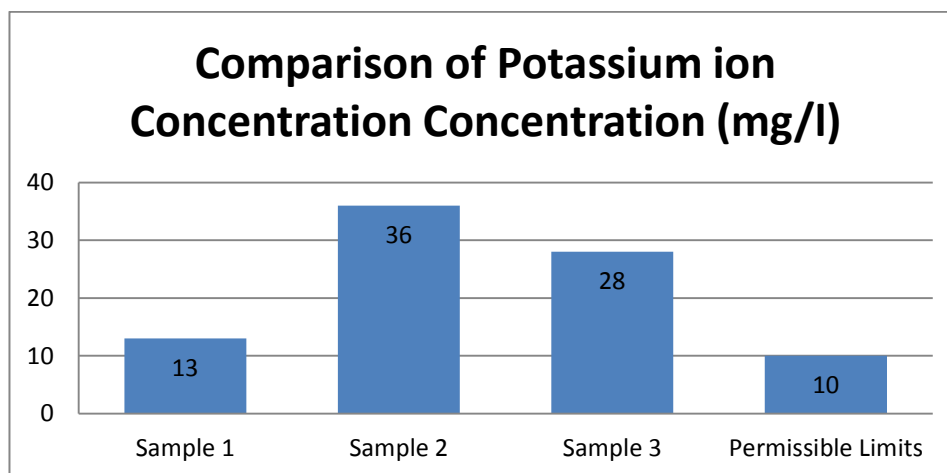
4.5 DETERMINATION OF SODIUM (Na^+) & POTASSIUM (K^+) ION CONCENTRATION:

Flame Photometer: The emission flame photometry method is a common and simple method for determining sodium and potassium in organic fluids. According to this, when an alkali metallic salt is heated in a non-luminous flame, the atoms get excited and subsequently decay back to their unexcited ground state. Once this happens, the alkali salt ionises and emits a faint attribute wavelength. The more the understanding of the problem in the solution, the greater the depth of emission. Flame photometry is based on this basic principle. Mild may be detected and converted into an electrical signal by using photovoltaic cells, which can be recorded. As a consequence, the emission of Na^+ and K^+ (and, therefore, their amounts) may be specifically monitored in an equal pattern utilising brilliant coloured filters.

Sodium ion Concentration	
Sample 1	68
Sample 2	532
Sample 3	630
Permissible Limits	200



Potassium ion Concentration	
Sample 1	13
Sample 2	36
Sample 3	28
Permissible Limits	10



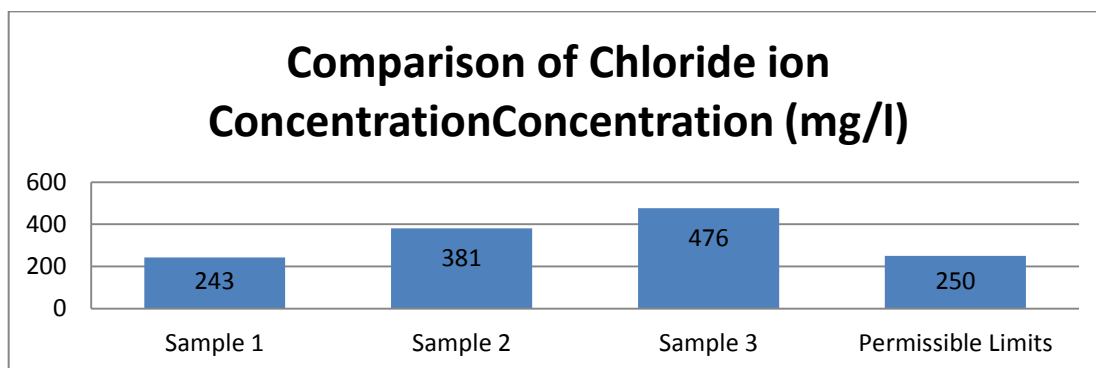
4.6 DETERMINATION OF CHLORIDE (Cl^-) ION CONCENTRATION:

The Mohr titration technique employs silver nitrate (normality 0.0041). This is equivalent to 1 mg of chloride in 0.0141 ml of solution. A sodium chloride standard chloride solution is used to standardise the silver nitrate (NaCl). White silver chloride precipitates when chloride ion is titrated.

The indicator (potassium chromate) is used to demonstrate the presence of excess silver

ions at the end point. The solubility product of silver chromate is surpassed in the presence of excess silver ions, resulting in a reddish brown precipitate.

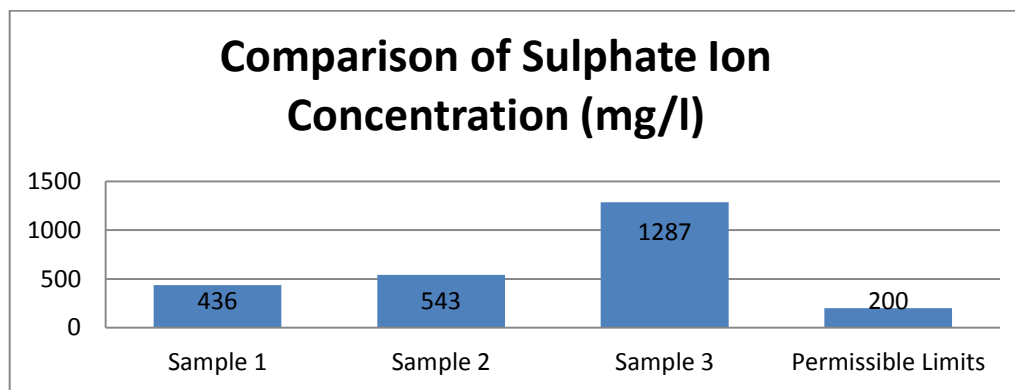
Chloride ion Concentration	
Sample 1	243
Sample 2	381
Sample 3	476
Permissible Limits	250



4.7 Determination of Sulphate (SO_4^{2-}) ion concentration:

An acidic cushion enhances the tendency of colloidal barium sulphate to form after the expansion of barium chloride, as shown in the turbidimetric approach (comprises of magnesium chloride, potassium nitrate, sodium acetic acid derivation, and acidic corrosive). Filtration (via a channel) should be used to separate these hastens before the test is dissected for sulphate. This is a rapid method that may be used for testing when the concentration of sulphate fixation is more than 10 mg/L. (examples can be weakened and afterward it tends to be investigated).

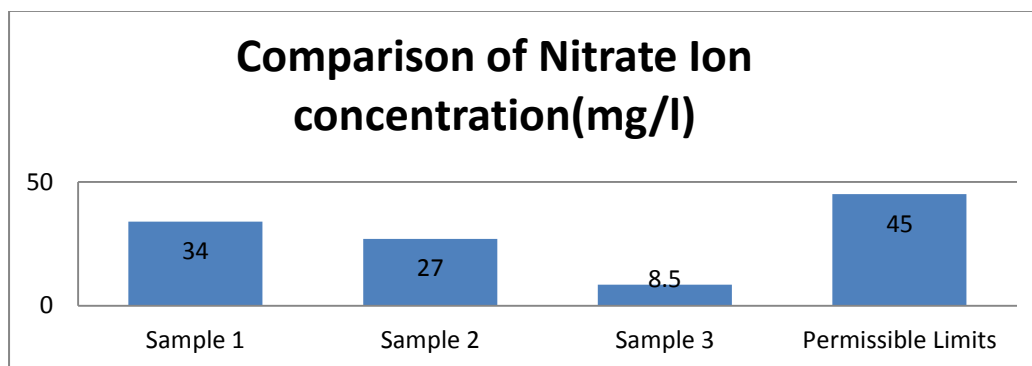
Sulphate ion Concentration	
Sample 1	436
Sample 2	543
Sample 3	1287
Permissible Limits	200



4.8 DETERMINATION OF NITRATE (NO₃) ION CONCENTRATION:

For the determination of nitrate in water, spectrometric methods are used. Detection limits range from 0.01% to 1% of a milligramme per litre of water (ISO, 1986, 1988). Potable water, raw water, and wastewater may be analysed using molecular absorption techniques. The detection limit is between 0.005 and 0.01 mg/l (ISO, 1984). For concentrations of nitrite ranging from 0.05 to 5 mg/l and for nitrite/nitrate concentrations ranging from 1 to 100 mg/l, a continuous-flow spectrometric method is applicable at each in the undiluted pattern for the willpower of nitrite, nitrate or the sum (ISO, 1996). Liquid chromatography may also be used to determine nitrate and nitrite concentrations in water, down to 0.1 mg/l for nitrate and 0.05 mg/l for nitrite (ISO, 1992).

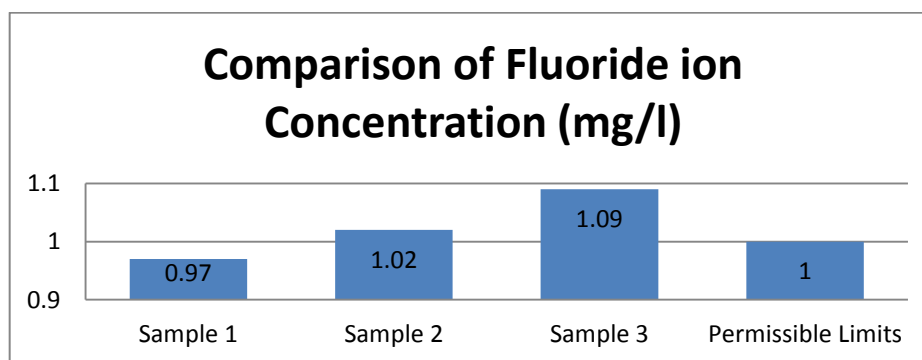
Nitrate ion Concentration	
Sample 1	34
Sample 2	27
Sample 3	8.5
Permissible Limits	45



4.9 DETERMINATION OF FLUORIDE ION CONCENTRATION:

An ion-selective electrode is often used to determine fluoride concentrations, making it possible to determine the total amount of free and complex-bound fluoride dissolved in a solution. If the water contains at least 20 micrograms per litre, the method may be used (Slooff et al., 1988). Rainwater with fluoride concentrations of 10 g/litre had a detection limit of 1 g/litre, according to previous guidance (Barnard & Nordstrom, 1982). An ion analyzer and a fluoride-selective electrode have been developed to determine fluoride concentrations between 0.05 and 0.4 mg/litre (Liu et al., 1987).

Fluoride ion Concentration	
Sample 1	0.97
Sample 2	1.02
Sample 3	1.09
Permissible Limits	1

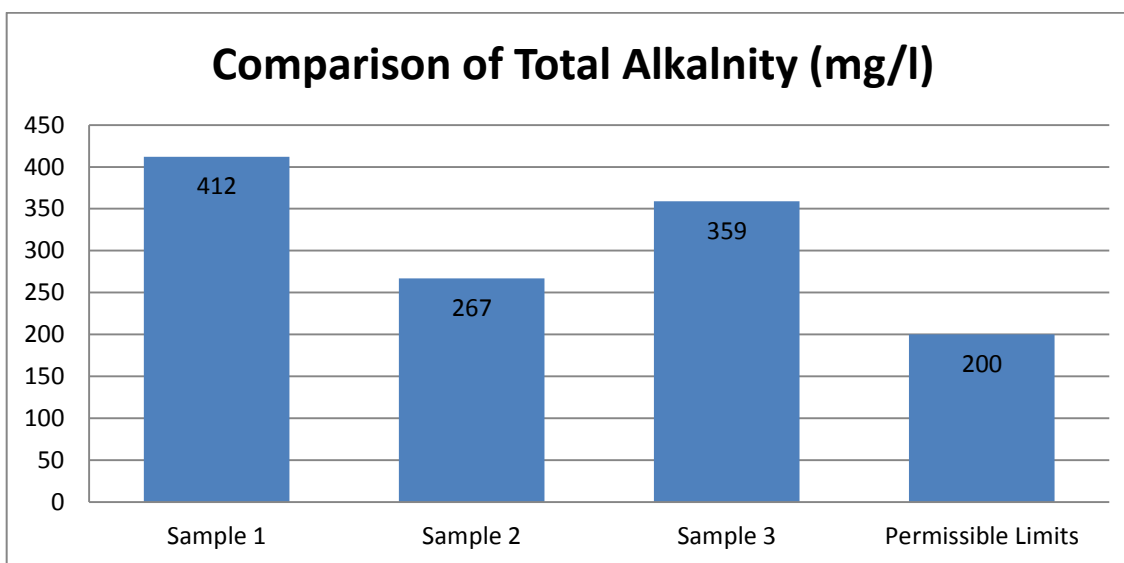


4.10 DETERMINATION OF TOTAL ALKALINITY:

There are two ways to assess alkalinity: buffering potential and the ability of acids to be neutralised. A stream's ability to counteract acidic air pollution from rainfall or wastewater may be determined by measuring its alkalinity. Alkalinity no longer relates to pH, but rather to water's capacity to deal with pH fluctuations. Acids are neutralised in the water by the presence of buffering substances. In specifically, these buffering chemicals include bicarbonates and carbonates (HCO_3^- and CO_3^{2-}), as well as hydroxides (OH^-), borates, silicates, phosphates, ammonium and sulphides, as well as natural ligands

A water body's pH may be altered by alkalinity, but so can its steel concentration. Because they precipitate out of solution, bicarbonate and carbonate ions in water help remove toxic metals including lead, arsenic, and cadmium.

Total Alkalinity	
Sample 1	412
Sample 2	267
Sample 3	359
Permissible Limits	200



4.11 DETERMINATION OF BICARBONATE (HCO_3) CONCENTRATION:

Bicarbonate Hardness	
Sample 1	224
Sample 2	251
Sample 3	234
Permissible Limits	200

In Makapuram Lake in Andhra Pradesh, India, around 40 kilometres from my home town, the water samples were collected. The lake is between 13° 0' 22" North and 80° 3' 35" East. Markapuram City is supplied with water from one of two rain-fed reservoirs. This lake serves as a source of drinking water for the city of Ongole. The entire lake capacity is 3,645 million ft³ (103 million m³), and the full tank level is 85.40 feet (26.03 metres). The full tank level in feet is 75.60 feet (23.04 m).



ANDHRA PRADESH

PRAKASAM

Fig (4.1) Map of the Study Area



MARKAPURAM

Fig (4.2) Sampling Location of the Study area

4.13: EXPERIMENTAL SECTION:

There were three places in the lake where the water samples were obtained and carried to the laboratory in plastic bottles, so that the chemical parameters and the sample locations would not be affected by any unexpected changes. Physicochemical properties of water samples were compared to standard values and the results were analysed.

PARAMETERS FOR ASSESSING WATER QUALITY STANDARDS

4.15 GENERAL:

As the population, industry, and urbanisation of the area grew, so did the quantity of sewage and industrial effluent poured into the lake. Over the last two decades, a number of agencies have undertaken water quality evaluations and implemented pollution control measures to help recover the lake..

4.16 WATER QUALITY PARAMETERS INCLUDED IN LAKE ASSESSMENTS

4.16.1: pH VALUE: The acidity of a water solution may be measured by its pH. The pH scale ranges from 0 to 14. A logarithmic scale is used, rather than a straight line. A pH 6 solution, for example, is ten times more acidic than a pH 7 solution. Water with a pH of 7 is considered neutral. As a rule of thumb, acidic water has a lower pH than basic or alkaline water.

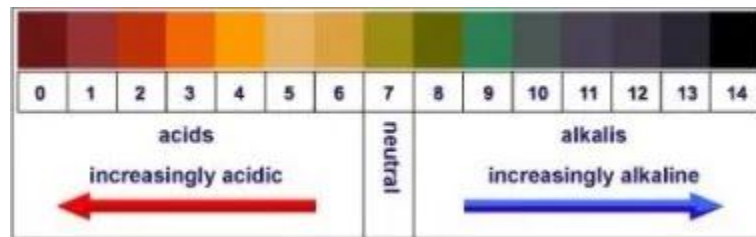


Fig 6.1 Standard pH Chart

4.16.2: Total hardness as CaCO_3 : The total hardness of calcium and magnesium is assessed in terms of calcium carbonate; our bodies need both calcium and magnesium in order to function properly. While calcium levels of less than 20 mg/L have been recommended in certain countries, this has not been universally accepted. Scale buildup on pipes and drains is the most significant hazard linked with excessive levels of hardness. Many soaps and detergents lose some of their cleaning power when the water is too hard (the soap may not clean as well as it could), and the water's flavour suffers as well.

4.16.3: Calcium Hardness :is determined by the quantity of calcium (or lime) dissolved in the water. The words "hard water," "soft water," and "total hardness" refer to the quantity of calcium hardness present in the water, as well as the presence of other minerals such as magnesium.

4.16.4: Magnesium: Magnesium, sulphide, and calcium concentrations beyond a certain threshold are required for water to become permanently hard. It is considered permanent hardness since it cannot be dissolved by boiling.

4.16.5: Sodium: Most of the foods and beverages we regularly eat include sodium salts. On average, they contain salt values of less than 20 mg/L, however this might vary greatly from place to place. The present state of data makes it difficult to draw any definitive conclusions concerning the probable connection between salt in drinking water and any adverse health effects. Because of this, there is no recommendation for health-based recommendations. Drinking water with sodium contents more than 200 mg/litre, on the other hand, may have an unpleasant taste.

4.16.6: Potassium: Potassium permanganate may be used in the treatment of drinking water. Compared to water softeners that use potassium chloride, potassium levels in drinking water are low. While 10 mg/l of potassium is the maximum concentration that may be added to a solution, most solutions have concentrations far lower than that.

4.16.7: Chlorides: Chlorides are salts that are created when chlorine and a metal are mixed together. There are a variety of common chlorides, two of the most well-known of which are (MgCl₂). It is standard practise to disinfect with chlorine as Cl₂, despite its significant danger. When mixed with salt, it becomes life-sustaining. Both plants and animals need on minute concentrations of chlorides to get the job done. The maximum permissible chloride concentration in public drinking water is 250 milligrammes per litre. While the limit for acute exposure is 1200 mg/L, the long-term (chronic) exposure level is less than 600 mg/L.

4.16.8: Sulphates: They may be found in minerals, soil and rocks. Sulphates are naturally occurring substances that can be discovered. Air, soil, plants, and food all contain them. Sulphonate is the most common usage for it in the chemical industry. Sulphates are released into the water due to industrial waste and atmospheric deposition. It is estimated that seawater contains 2,700 mg/L of sulphuric acid. 3 to 30 mg/L concentrations are usual, but may exceed 1000 mg/L in rare locations.

4.16.9: Nitrate: In industrial areas, rainfall nitrate concentrations have been observed to reach up to 5 mg/l. As a result, rural areas tend to have lower populations. As agricultural runoff, rubbish dump runoff, or contamination with human or animal wastes occur, the nitrate concentration in surface water may grow from 0 to 18 mg/l. The concentration of

nitrate in a river supplied by a nitrate-rich aquifer may grow.

4.16.10: FluoridesLarger :quantities of fluoride have been connected to underground sources, however traces may be found in a broad range of water sources. Researchers have found a fluoride content of 1.3 mg/liter in seawater. Where fluoride-containing minerals are abundant, well water fluoride concentrations may rise to as much as 10 mg/L. The highest natural concentration of 2800 mg/liter was discovered. To a certain extent, fluoride contamination in rivers may be blamed on industrial discharges. As the kind of rock through which the groundwater flows, fluoride amounts vary, although they seldom exceed 10 mg/liter.

4.16..11: Total Alkalinity: Total alkalinity is a measure of water's capacity to neutralise acids (TA). Hydroxides and carbonates remove hydrogen ions (H^+) from water to raise the pH. Total alkalinity may be determined by determining the quantity of acid required to raise a sample's pH to 4.2. At this time, all of the alkaline compounds have been used up. Alkalinity is the only way to tell whether water can neutralise the acidic and corrosive effects of waste water and other sources, such rainfall.

4.17: WATER QUALITY CRITERIA:

Table 4.17.1 Designated Best Use Water Quality Criteria as per Central Pollution Control Board

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20C 2mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l

CHAPTER 5

RESULTS AND DISCUSSION WITH PERFORMANCE ANALYSIS

5.1 TEST PROCEDURE:

5.1.1. pH Testing Procedure

The pH value of water may be determined using one of two ways. Colorimetric Method is the first of these:

In addition to the Electrometric Method,

-

Colorimetric Method for pH of Water

Take the water to be tested and the pH standard solution. Here's some colorimetric paper for your consideration. This paper should be dipped in the water sample. Using the usual table, we may determine the colour we've achieved and note the corresponding pH value. Based on the sample's pH, we can determine whether it is acidic or alkaline.

Electrometric Method for pH of water

The electrometric technique is one of the most generally acknowledged methods for determining the hydrogen ion concentration (pH). This is a very precise procedure that is often used in laboratories and by academics. The pH value has a precision of 0.1 to 0.0001.

Procedure for pH Determination

Using a glass rod, the water sample is combined and swirled to ensure that the pH of the water is accurately determined.

A 40-milliliter sample of water (5 millilitres more or less) is poured into the beaker using a watch glass. Place the sample stand in the water for an hour to enable the temperature to settle. In the midst of this moment, stirring may be accomplished. After an hour, the temperature of the water is recorded and the pH metre is calibrated

accordingly. Thus, the pH metre displays a temperature that matches the sample's. Before the test can begin, all of the adjustments to the equipment must be made and instructions must be followed in these circumstances.

□

The pH metre is calibrated using standard solutions. The approach described above is used to alter the temperature here as well.

The electrodes are then put into the water sample. Beaker is spun to ensure electrodes are properly submerged in liquid.

□

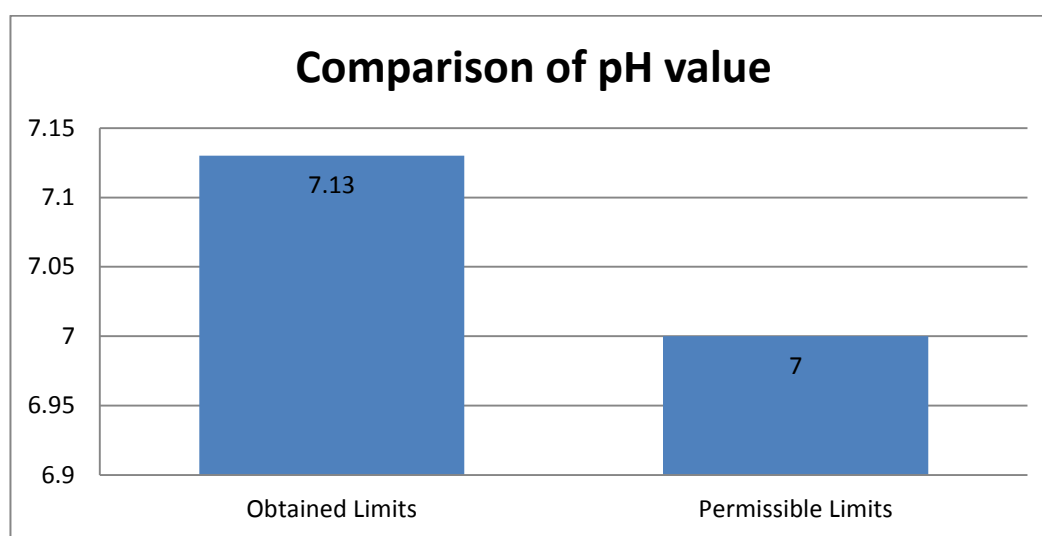
Prior to beginning the experiment, the electrodes must be submerged for at least 30 seconds in the solution. The metre must be properly stabilised throughout this time period to provide accurate readings. A signal will be issued to indicate that the metre has stabilised in a pH metre with an automated reading mechanism.

□

It must be read to the tenth of the total number after the reading is presented. The value must be rounded off if it reaches the 100th place. Digit 10 is left out of the 100th-place number that's smaller than 5. It is rounded to one unit for values more than five decimal places. For example, if the 100th place equals 5, the closest even integer is used as the rounded value. A thorough cleaning and inspection is required after each usage of the equipment. Distilled water is used to completely clean the electrodes. The electrodes must be cleaned if there is any kind of coating surrounding them. Wiping the electrodes will cause polarisation, which will slow down the experiment's reaction time.

PH value

Sample 1	6.41
Sample 2	6.88
Sample 3	7.13
Permissible Limits	7



5.1.2 Determination of Total Hardness: The term "hard" refers to water that has a high concentration of naturally occurring calcium and magnesium. Calcium and magnesium concentrations in milligrammes per litre (mg/L) are used to calculate total hardness.

Reagents:

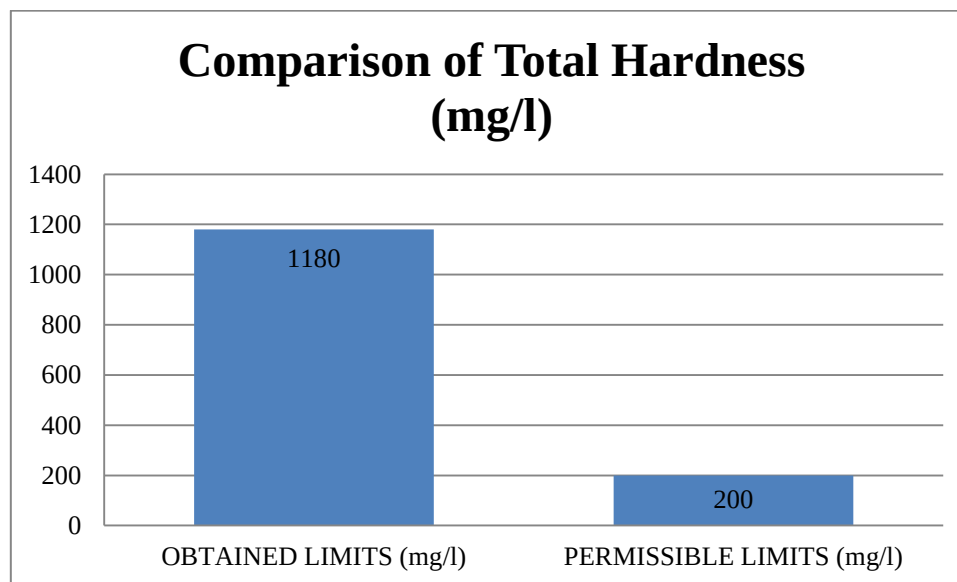
1. Standard EDTA titrant (0.01 M)
2. Eriochrome black T indicator
3. Ammonia buffer solution

Procedure:

1. Dilute 25 mL of sample (V) to about 50 mL with distilled water in an Erlenmeyer flask.
2. Add 1 mL of buffer solution.
3. Add two drops of indicator solution. The solution turns wine red in colour.
4. Add the standard EDTA titrant slowly with continuous stirring until the last reddish tinge disappears from the solution. The colour of the solution at the end point is blue under normal conditions.
5. Note down the volume of EDTA added (V_1).

Total Hardness

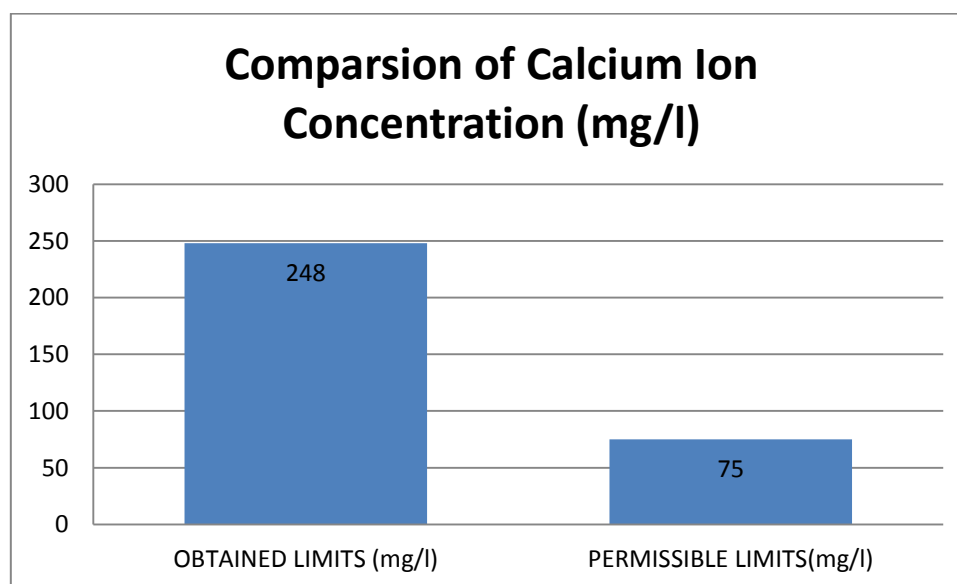
Sample 1	10
Sample 2	488
Sample 3	1180
Permissible Limits	200



5.1.3 Determination of Calcium Ion Concentration:

- The burette is filled with an EDTA solution of known concentration.
- Concentrations of 0.010 mol L^{-1} are commonly used.
- A suitable aliquot of hard water is placed in the conical flask.
- For example, a 50.0 mL transfer pipette can be used to put the water sample into the flask.
- A drop of a suitable indicator is added to the water sample. (Patton and Reeder's Indicator will be *red* in the hard water sample and *blue* when excess EDTA has been added.)
- EDTA is added from the burette to the conical flask until the indicator changes colour, indicating that the endpoint has been reached.
- The volume of EDTA used is recorded.
- The steps above are repeated until three concordant titres are obtained, that is, three volumes of EDTA that agree to within a drop, or 0.05 mL, of each other.
- The average of these concordant titres is then used to calculate the concentration of calcium ions in the hard water.

CALCIUM ION CONCENTRATION (mg/l)	
Sample 1	4
Sample 2	276
Sample 3	248
Permissible Limits	75



5.1.4 Determination of Magnesium Ion Concentration:

Reagents

- EDTA ($\text{Na}_2\text{H}_2\text{Y} \cdot 2\text{H}_2\text{O}$)
- pH 10 buffer (2000 mL has been prepared by dissolving 140.0 g of NH_4Cl in 650 mL of deionized water, adding 1136 mL of conc. ammonia and diluting to 2000 mL)
- Eriochrome Black T (ground 1:10 with NaCl)
- P Hydrion paper

Six millilitres of 6M HCl have been used to dissolve an exact amount (1.3g) of pure zinc

in a tiny volume (15 mL). In order to achieve the desired concentration, the dissolved zinc was weighed out and transferred to a 2 L volumetric flask. This 0.01% of a million (solution serves to standardise the EDTA solution).

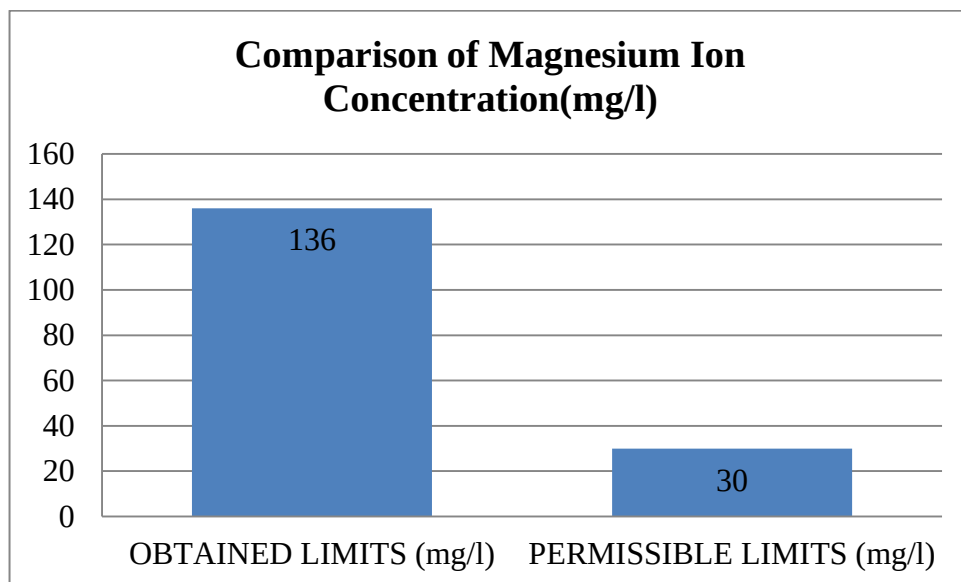
Standardization of the EDTA Solution

1. Pipet exactly 25 mL of standard Zn solution into each of three Erlenmeyer flasks. Add 20 mL of pH 10 buffer (in the hood), 15 mL of water, stir, and add a few crystals of the Eriochrome Black T indicator. It is critical to add only enough indicator to produce a light wine-red colour.
2. Titrate with your EDTA solution until the colour changes from wine-red to a clear blue.
3. Use these results to determine the molar concentration of the EDTA solution for use in the titration of your unknown Mg solution

Determination of unknown Magnesium

- Transfer exactly 10 mL of the prepared unknown solution into 3 or 4 Erlenmeyer flasks.
- Add approximately 15 mL of pH 10 buffer in the hood and 20 or 25 mL of distilled, deionized water to each flask.
- Add a few crystals of Eriochrome Black T indicator -- it is crucial that you only add enough indicator to produce a light, wine-red colour.
- Titrate each solution with your standardized EDTA solution to a clear blue colour.

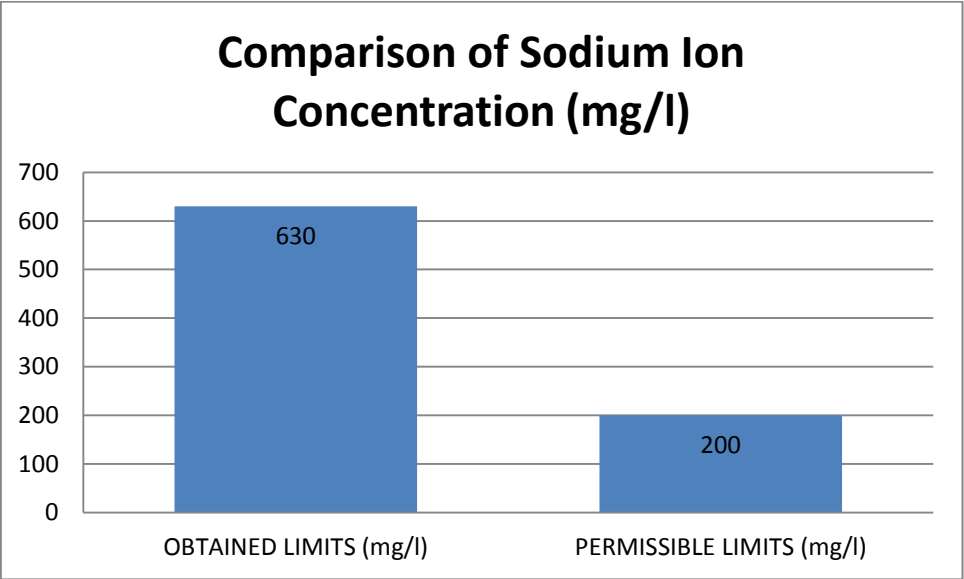
MAGNESIUM ION CONCENTRATION	
Sample 1	6
Sample 2	172
Sample 3	136
Permissible Limits	30



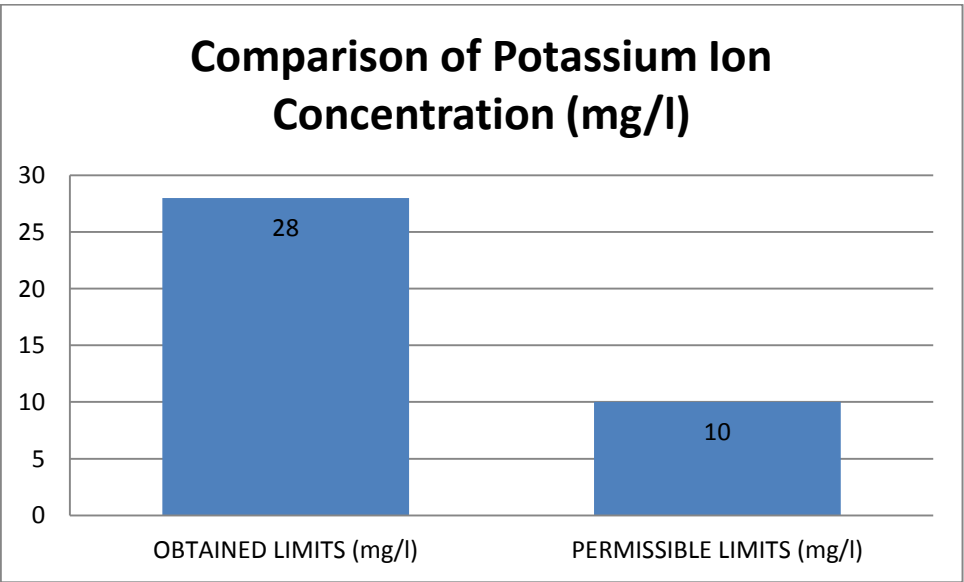
5.1.5 Determination of Sodium (Na^+) & Potassium (K^+) Ion Concentration:

Flame Photometer: □ Methods for detecting sodium and potassium in biological fluids using emission flame photometry are simple and straightforward. An alkali metal salt is heated in a non-luminous flame, which causes the salt to ionise and absorb the flame's energy, which in turn causes it to produce light with a certain wavelength when the excited atoms return to their unexcited ground state. The higher the concentration of the element in the solution, the more intense the emission will be. Flame photometry is based on this fundamental premise. It is possible to record the voltage generated by the emitted light by using a photocell. Colored filters may be used to separate the light emitted by Na^+ and K^+ in the same sample and so detect their concentrations, as Na^+ and K^+ have distinct wavelengths (colours).

SODIUM ION CONCENTRATION (mg/l)	
Sample 1	68
Sample 2	532
Sample 3	630
Permissible Limits	200



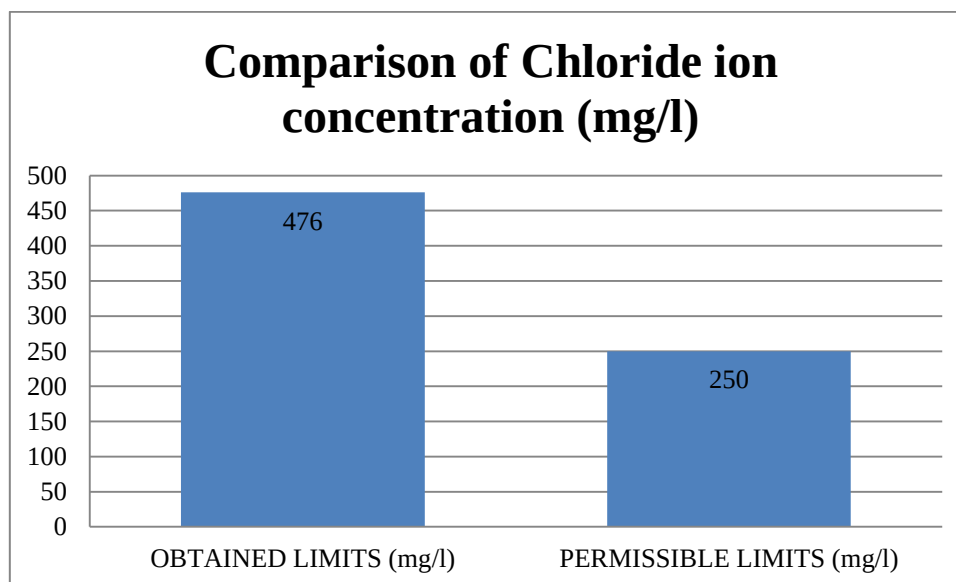
POTASSIUM ION CONCENTRATION(mg/l)	
Sample 1	13
Sample 2	36
Sample 3	28
Permissible Limits	10



5.1.6 Determination of chloride (Cl^-) ion concentration:

- The Mohr titration technique employs silver nitrate (normality 0.0041). This is equivalent to 1 mg of chloride in 0.0141 ml of solution. A sodium chloride standard chloride solution is used to standardise the silver nitrate (NaCl). A white silver chloride precipitates as a result of the titration. The indicator (potassium chromate) is used to demonstrate the presence of excess silver ions at the end point. The solubility product of silver chromate is surpassed in the presence of excess silver ions, resulting in a reddish brown precipitate.

CHLORIDE ION CONCENTRATION	
Sample 1	243
Sample 2	381
Sample 3	476
Permissible Limits	250

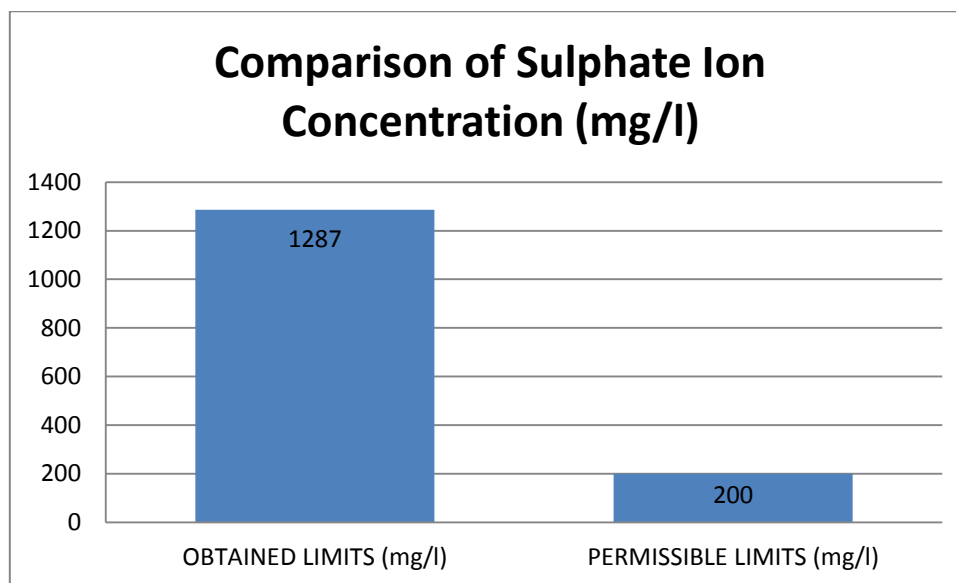


5.1.7 Determination of Sulphate (SO_4^{2-}) ion concentration:

Following the addition of barium chloride, the colloidal barium sulphate generated tends to precipitate in a colloidal state, and this tendency is accentuated by the presence of an acidic buffer solution (consists of magnesium chloride, potassium nitrate, sodium acetate, and acetic acid). Filtration (using a filter) is required to remove these precipitates from the sample before sulphate concentration can be determined. Sulfate concentrations larger than 10 mg/L may be measured with this approach, which is quite quick (samples can be diluted and then it can be analyzed).

Concentration

Sample 1	436
Sample 2	543
Sample 3	1287
Permissible Limits	200

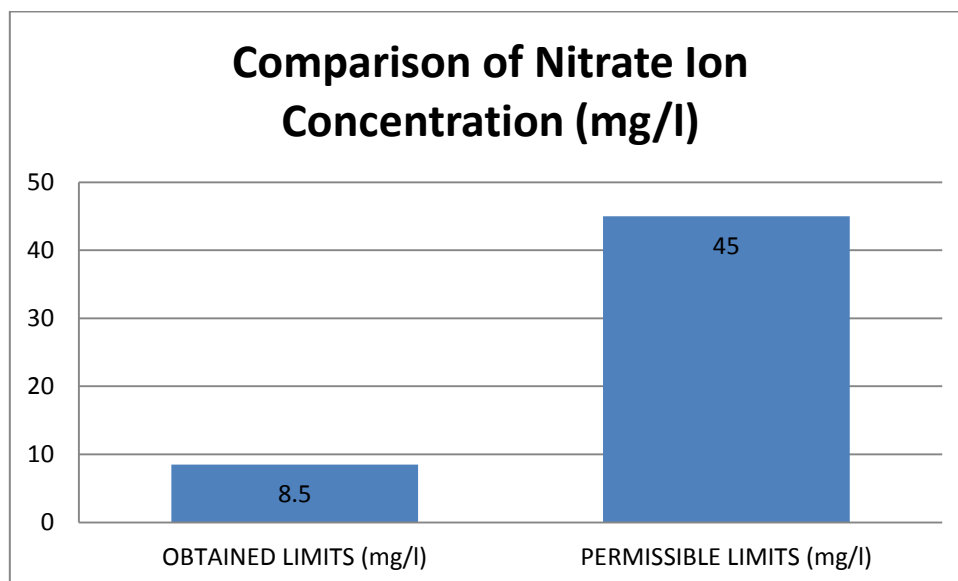


5.1.8 Determination of Nitrate (NO₃) Ion Concentration:

In order to find out how much nitrate is in a sample of water, scientists employ spectrometric methods. Between 0.01 and 1 mg/l may be detected (ISO, 1986, 1988). Nitrite concentrations in drinking water, raw water, and wastewater may be measured using a molecular absorption spectrometric technique. The detection limit is between 0.005 and 0.01% of a milligramme per litre (ISO, 1984). An undiluted sample may be used for nitrite concentrations between 0.05 and 5 mg/l, and for the total of nitrite and nitrate, between 1 and 100 mg/l, in a continuous flow spectrometric technique (ISO, 1996). Liquid chromatography may also be used to measure nitrate and nitrite in water down to a concentration of 0.1 mg/l for nitrate and 0.05 mg/l for nitrite, respectively (ISO, 1992).

Nitrate ion Concentration

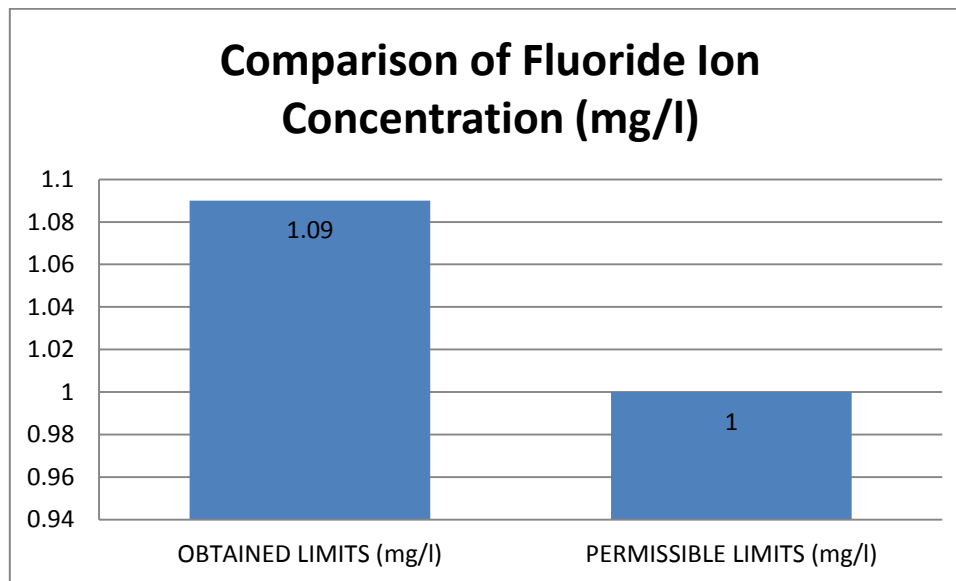
Sample 1	34
Sample 2	27
Sample 3	8.5
Permissible Limits	45



5.1.9 Determination of Fluoride Ion Concentration:

Fluoride concentrations in water may be measured using an ion-selective electrode, which measures both free and complex-bound fluoride ions. Water with a concentration of at least 20 micrograms per litre may be tested using this approach (Slooff et al., 1988). Fluoride was detected at a concentration of 10 g/liter in rainwater, with a detection limit of 1 g/liter (Barnard & Nordstrom, 1982). Fluoride concentrations between 0.05 and 0.4 mg/litre may be measured using an ion analyzer and a fluoride-selective electrode (Liu et al., 1987).
 Flouride ion Concentration

Sample 1	0.97
Sample 2	1.02
Sample 3	1.09
Permissible Limits	1



5.1.10 Determination of Total Alkalinity: Water's alkalinity, or its ability to neutralise acids, is a measure of its buffering capacity. Acidic pollution from rainfall or wastewater may be neutralised by measuring alkalinity in a stream. Alkalinity is not a

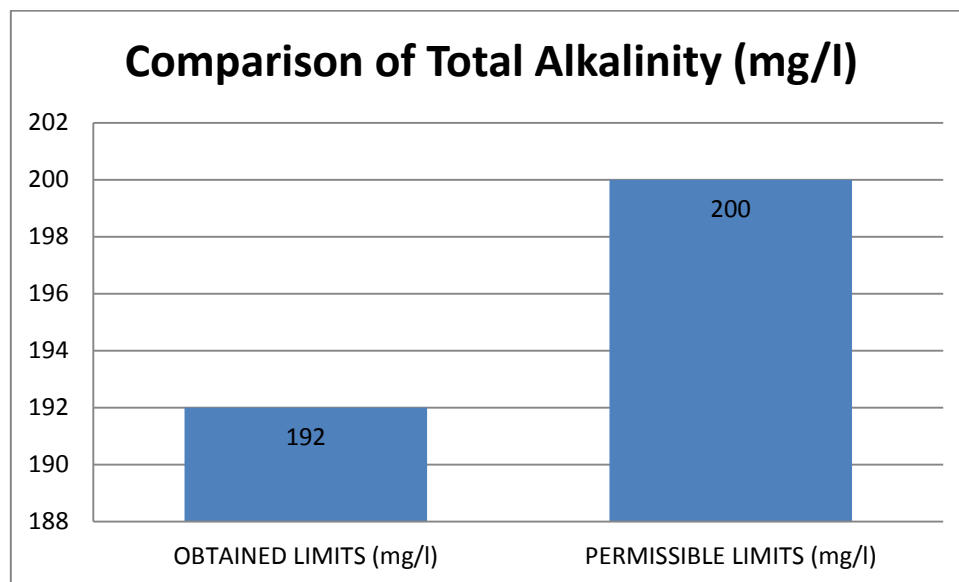
measure of pH, but rather a measure of the water's capacity to withstand changes in pH. Adding buffering elements to water helps neutralise acids that have been added. Bicarbonate (HCO_3^-), carbonate (CO_3^{2-}), hydroxide (OH^-), borates, silicates, phosphates, ammonium, sulphides, and organic ligands are the most common buffering materials.

Because of their high sensitivity to pH fluctuations, waters with low alkalinity are particularly vulnerable. Extreme changes in pH are not as damaging to water that has a high alkalinity. The pH of water lowers and the water's buffering capability is depleted as acid concentrations rise. To begin with, the pH drops slowly to approximately 6; subsequently, when the bicarbonate buffering capacity (CO_3^{2-} and HCO_3^-) is depleted, the pH drops rapidly. Acids that lower the pH below 5.5 have only extremely minimal buffering capacity left. Because no CO_3^{2-} or HCO_3^- ions remain in a solution with a pH lower than 4.5, it lacks alkalinity.

Alkalinity not only aids in pH regulation but also in metal content management in bodies of water. It is possible to remove harmful metals such as lead, arsenic, and cadmium from water using bicarbonate and carbonate ions.

Total Alkalinity

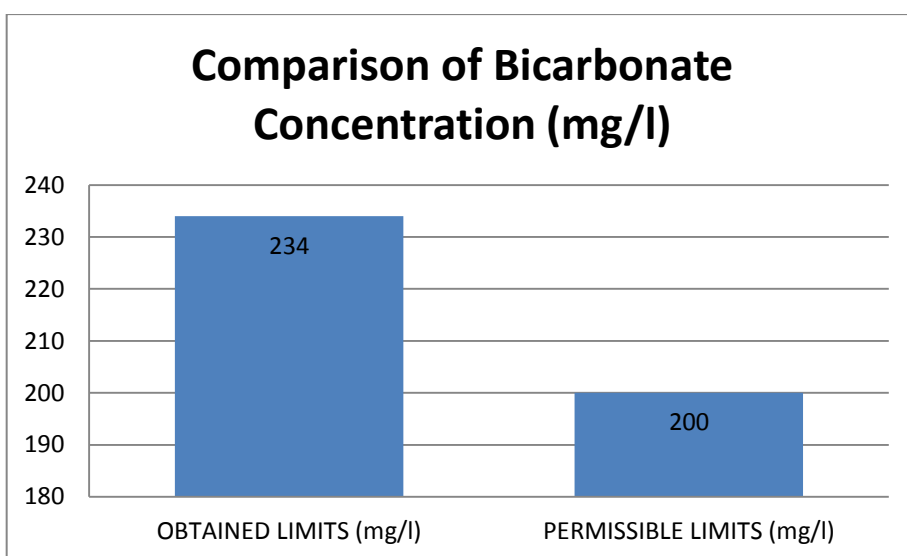
Sample 1	412
Sample 2	267
Sample 3	359
Permissible Limits	200



5.1.11 Determination of Bicarbonate (HCO_3) Concentration

Bicarbonate ion Concentration

Sample 1	224
Sample 2	251
Sample 3	234
Permissible Limits	200



CHAPTER 6

CONCLUSION

At the same time, Markapuram Lake acts as one of the city's two primary rainwater reservoirs. Due to the present importance of this location's water quality, a study was conducted that included a literature review, an on-site examination, and laboratory testing. In terms of physico-chemical features, the lake water samples taken from diverse locations met or exceeded specified requirements. Since this is the case, prompt corrective action is required. In accordance with WHO recommendations and BIS standards, the following corrective measures are recommended for each parameter:

- 1. Objectives:** These choices should take into account hydrological concerns, water consumption, economic growth, and legal requirements. Concentrations or loads should be the focus of monitoring, and whatever monitoring medium is best appropriate for the job at hand must be determined prior to implementation.
- 2. Preliminary surveys:** Water quality fluctuation, monitoring media and contaminants, and the cost sustainability of a complete monitoring programme are all being studied in detail.
- 3. Monitoring design:** Among other things, this includes the selection of pollutant categories, the station location, the frequency of monitoring and the sampling equipment.
- 4. Field monitoring:** operations All of these are done in the field: in situ measurements and sampling of the relevant media (water, biota, and particulate matter).
- 5. Hydrological monitoring:** Monitoring water quality is essential for this kind of data collection. This includes measurements of water outflow, temperature profiles, and other variables.
- 6. Laboratory activities:** Other examples include biological measurements (concentration measurements), and so forth.
- 7. Data quality control:** Analytical quality control in each lab and across all labs participating in the same programme, as well as verification of field operations and hydrological data, are all necessary to complete biological measurements and concentration measurements.

8. Data storage treatment and reporting: Today, this procedure is mostly automatic and includes the use of databases as well as statistical analysis and trend identification as well as multi-factor correlation and the distribution of findings in the proper forms (graphs, tabulated data, data diskettes, etc.).

9. Data interpretation: It is possible to compare water quality data from different stations (water quality descriptors, fluxes), assess trends in water quality, and create cause-effect relationships between water quality data and the environment. To address particular problems and evaluate the environmental significance of observed changes, it may be necessary to seek outside assistance. After the assessment is complete, data and findings should be made accessible to relevant authorities, the general public, and the scientific community as a whole for review and consideration.

10. Water management recommendations: These choices should be made by all levels of government, as well as by water and other environmental agencies. Improvements in monitoring will be made and expenses reduced if assessment activities are redesigned.

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