K.L.E.Society's
BASAVAPRABHU KORE ARTS, SCIENCE AND COMMERCE COLLEGE,
CHIKKODI – 591201 District – Belagavi (Karnataka state, India)
(ACCREDITED AT 'A' GRADE BY NAAC WITH CGPA OF 3.26 IN THE THIRD CYCLE)

Department of Zoology (2019 – 20)

PROJECT WORK COMPLETION CERTIFICATE

This is to certify that following eight B.Sc Final year students have undertaken the project entitled ***Study of Hardness of Bore well water from selected Chikodi villages*** in-partial fulfillment of the syllabus of Rani Channamma University, Belagavi during the year 2019-20. Following eight students have together successfully completed the said project under the guidance of Dr Sridevi I Puranik.

Sl. No	Gender	Name of the student	Fathers name	Roll Number	Exam Seat Number
1	Miss	Laxmi Metri	Mallappa	151	S1715662
2	Miss	Pooja Pujari	Rajshekhar	153	S1715688
3	Miss	Shivani Metri	Mallappa	158	S1715771
4	Miss	Soumya Shedbale	Sagar	160	S1715802
5	Miss	Bhavana Sarapure	Chandrakant	164	S1715631
6	Miss	Revati Khot	Raju	178	S1715726
7	Miss	Sapana Shiraguppe	Vidyasagar	181	S1715749
8	Miss	Savita Halakarni	Siddappa	183	S1715754

Dr Sridevi I Puranik
PROJECT GUIDE

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Acknowledgement

We the students express our sincere gratitude to our principal Prof. U. R. Rajput, KLE Society's B. K. College Chikodi for providing facilities.

We are extremely lucky to have wonderful association with our Head, Department of Zoology Dr. N. R. Birasal for encouraging and allow us to carry out the project on the topic "Study of Hardness of Bore well water from selected Chikodi villages". He gave us the idea to undertake the project and carry out titrations of the water samples at our department laboratory.

It is our privilege to express our sincere regards to our project guide Prof. Sridevi I. Puranik for her valuable inputs, able guidance, encouragement, whole hearted co-operation and constructive criticisms throughout the duration of our project.

We take this opportunity to thank our faculty members Miss Trupti P Khidrapure, Megha P Kapurkar and non teaching staff. We pay our respect to our parents for their love and encouragement throughout our career.

Last but not the least we express our thank to our friends for their co-operation and support

Content

Introduction

Water Quality can be defined as the physical, chemical and biological characteristics of water, usually in respect to its suitability for a designated use. Water can be used for drinking, fisheries, agriculture and recreation or for industry. Each of these designated uses has different defined chemical, physical and biological standards necessary to fulfill the respective purpose. For example, there are stringent standards for water to be used for drinking or swimming compared to that used in agriculture or industry.

One of the primary goals of the World Health Organization (WHO) and its Member States is that "all people, whatever their stage of development and their social and economic conditions, have the right to have access to an adequate supply of safe drinking water". A major WHO function to achieve such goals is the responsibility "to propose ... regulations, and to make recommendations with respect to international health matters ...." (*WHO 2011*). Against this backdrop, the project is undertaken

After many years of research, water quality standards are put in place to ensure the suitability of efficient use of water for a designated purpose. Water quality analysis is to measure the required parameters of water, following standard methods, to check whether they are in accordance with the approved standards or not. Water quality analysis is required mainly for monitoring purpose. Importance of such assessment includes:

1. To check whether the water quality is in compliance with the standards and hence, suitable or not for the designated use

2. To monitor the efficiency of a system, working for water quality maintenance

3. To check whether up-gradation / change of an existing system is required and to decide what changes should take place

4. To monitor whether water quality is in compliance with rules and regulations. Water quality analysis is of extremely necessary in the sectors of: Public Health (especially for drinking water) and industrial use

Hardness is property of water which prevents the formation of foaming and it increases the boiling point of water. The major cat-ions which are importing the hardness of water are calcium and magnesium. The an-ions which are responsible for hardness of water are Bicarbonates, Carbonates, Sulphates and Chlorides.

The hardness of water is temporarily associated with Carbonates and Bicarbonates and it is permanently associated with Sulphates and Chlorides.

In the past five decades or so evidence has been accumulating about an environmental factor, which appears to be influencing mortality, in particular, cardiovascular mortality, and this is the hardness of the drinking water (*Pallav Sengupta, 2013*)

Hard water is a water substance that contains cat-ions which has a charge of +2 also Ca^{2+} and $Mg^{2+.}$ These ions stand for calcium and magnesium. Hardness of water is mainly caused by calcium and magnesium salts.

Water hardness is also caused by iron, aluminum and other metals also but only to little extent. Water hardness that is caused by bicarbonates and carbonates from the calcium and magnesium represent temporary hardness. This means that they can be removed by boiling the water. This softens the carbonates in the water.

Another type of hardness is residual hardness (non-carbonated). In other words, it is permanent water hardness. To soften this type of hardness it is necessary to add sodium carbonate, lime and filtration through natural zeolites. Natural zeolites absorb the water hardness which then produce metallic ions and then release sodium ions to the water.

Control of water pollution has reached to its peak. Prevention of water pollution is a challenge in all developing countries and in a few developed countries. The prevention of pollution at source, the precautionary principle and the prior licensing of wastewater discharges by competent authorities have become key elements of successful policies for preventing, controlling and reducing inputs of hazardous substances, nutrients and other water pollutants from point source into aquatic ecosystems.

In some situations, even stricter requirements are necessary. A partial ban on the use of some compounds or even the total prohibition of the import is essential. Use of certain substances such as DDT and lead or mercury based pesticides, may harm the human health because these constituents get percolated into the ground water.

Some water pollutants like copper, zinc, manganese, boron and phosphorus become extremely toxic in high concentration. However, these are needed in trace amounts. The concentration above the range may likely to affect the water quality.

India being an agrarian country, our farmers depends mainly on groundwater for irrigation. With increasing population, lesser holdings and spreading urbanization, deeper bore wells are dug for groundwater abstraction.

Bore well and tube wells, are very similar. Both are basically vertical drilled wells, bored into an underground aquifer in the earth's surface, to extract water for various purposes. The difference in the two lies in the (a) type of casing used (b) depth of the casing and (c) type of soil where they are drilled.

Casing to support the external surfaces of the borehole against collapse may be needed at certain depths. Casings are usually made up PVC pipes. Electrical pumps are normally used to pump out the water from the bore wells. These types of pumps may increase the depletion of the ground water table.

Due to human and industrial activities, the ground water gets contaminated. This is the serious problem now a day. Thus, the analysis of the water quality is very important to preserve and keep the natural ecosystem intact. The assessment of the ground water quality was carried out in the different wards of Chikodi.

The most important resource for the survival of human beings is the availability of fresh drinking water. The water samples analysis are crucial for drinking water quality (*Nitasha Khatri,Sanjiv Tyagi and Deepak Rawtani, 2019*)

The quality of drinking water is vital concern for mankind since it is directly linked with human health. People of rural areas located in many villages in India are mainly dependent on ground water for drinking and other domestic needs. Thus, it is necessary to assess the physic-chemical analysis of drinking water in the view of health of human beings living in villages (*S V Dorairaju et al 2012*)

The quality of water is a vital concern for mankind, since it is directly linked with human welfare. It is a matter of history that fiscal pollution of drinking water caused water born diseases. At present, the menace of water born diseases and epidemics still booms large on the horizons of developing countries. Polluted water is the culprit in such cases. Water is the most widely distributed and abundant substances found in nature. The irony is that our planet is awash with water.

For centuries, human have been disposing off waste products by burning, placing them in streams, storing them on ground or putting them in the ground. Human induced influences on surface water quality reflect not only waste discharge directly into a stream, but also include contaminated surface runoff. The quality of ground water is most commonly affected by waste disposed and land use. (*Anwar Khalid Amir et al, 2011*)

Degradation of water resources in rural and urban area due to industrialization, urbanization, overpopulation and modern lifestyle is becoming serious issue for the mankind. These resources are being deteriorated by various ways at high alarming rate. As water is one of the basic amenity for human being, waterborne diseases have adverse impact on human health.

Use of contaminated water for domestic purposes and irrigation have irreversible disadvantages on human civilization. So pre and post monsoon study of physico-chemical characteristics of ground water including bore well is essential (*R V Kupwade and A D Langade, 2013*)**.**

Water is a major natural resource, a basic human need and precious natural asset, which should be conserved for future uses in a balanced manner. About 85 % of rural population in India is solely depended on ground water, which is depleting at a faster rate (*Mohd Nafees, 2015*).

Water supplied to consumer should not have any impurities which cause taste, odour, colour, toxicity and injuries to human health. The different impurities in water which cause undesirable effects may be classified into physical, chemical, bacteriological and radiological . The parameters like pH, total dissolved solids, total suspended solids, total hardness, calcium hardness, magnesium hardness, copper, iron, chlorides, sulphates, nitrates and fluorides contribute for the quality index of the potable water (*R.E. Khadsan and Mangesh V. Kadu, 2018*)

The present work is aimed at assessing the water quality index for the ground water in Chikodi. The ground water samples of selected wards were collected for the analysis. The study of ground water sample suggests that the evaluation of water quality parameters as well as water quality management practices should be carried out periodically to protect the water resources.

Materials and methods

Materials:

Glass wares: Burette, Pipette, Conical flask, measuring cylinder etc.

Reagents:

EDTA Solution: (0.01) Dissolve 3.7 to 3gm of Disodium salt of EDTA in distilled water to prepare 1 litter of solution.

Buffer Solution: Dissolve 16.9gms of ammonium chloride (NH_3Cl) in 1.43ml of concentration ammonium Hydroxide. (NH_3OH). Dissolve 1.179gm of disodium EDTA and 0.780gm of magnesium sulfate ($MgSo_4$).$7H_2O$ in 50ml of distilled water mix both i) and ii) solution and dilute to 250ml with distilled water.

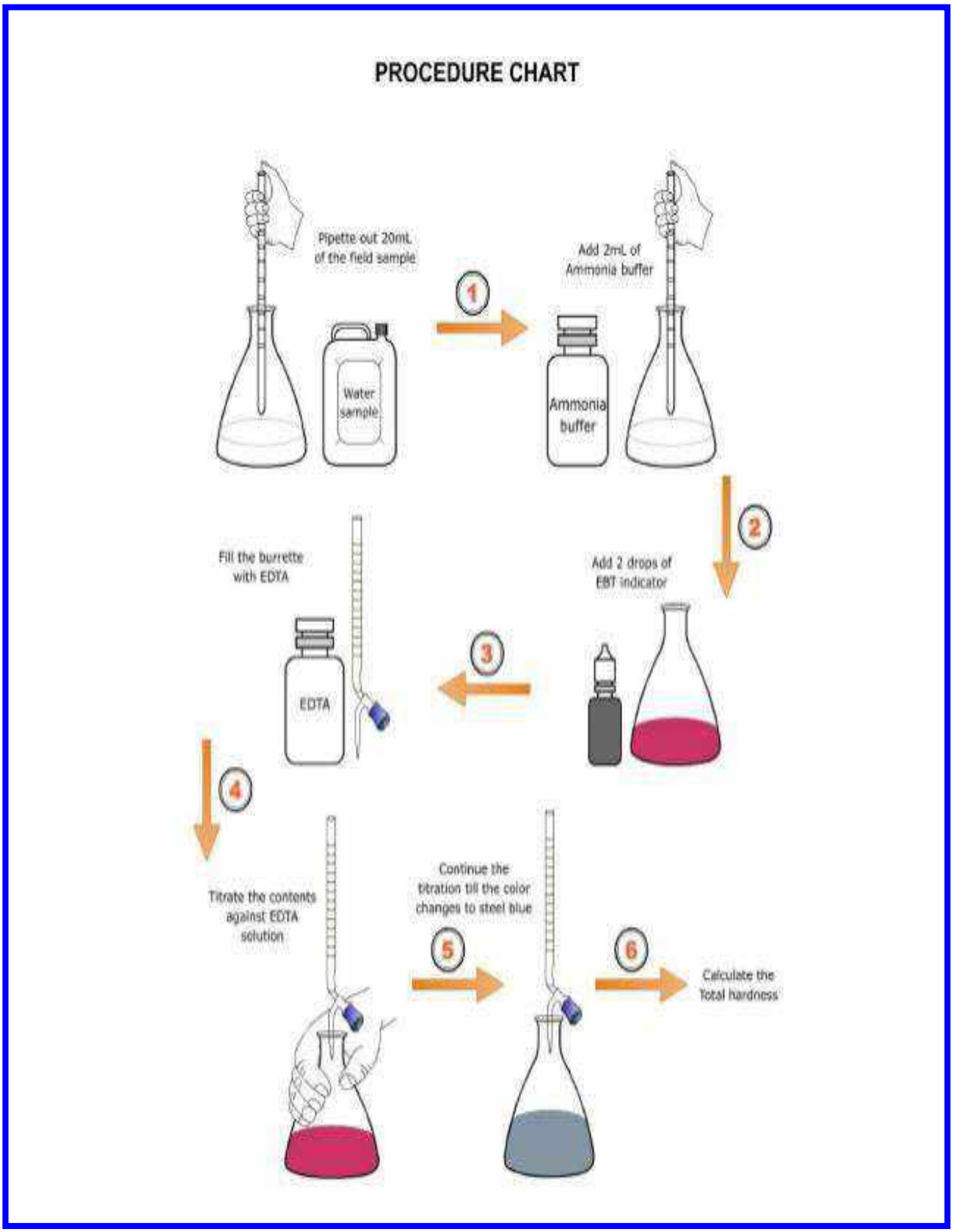
Eriochrome Black-T Indicator; grind 0.40gm of Erichrome Black-T with 100gm of sodium chloride. (NaCl).

Water hardness is a measure of divalent cat-ions (primarily calcium and magnesium) present in the water and is expressed as mg/L or (ppm = Parts Per Million). Hardness as calcium carbonate. **(Reference:** B. Krishna Kumari, 2016)

Methods

While coming to the college, we have collected water samples from chikodi town, from five different areas in the morning hours between 8 – 9 AM in the plastic bottles. The water samples were immediately brought to the laboratory for the estimation of hardness of water. Evening also while going from the college, we have collected five different samples from five different areas. The following methods are as follows.

1. Take 50ml of water sample in conical flask.
2. Add 1ml of buffer solution in to it.
3. Add approximately Eriochrome black T indicator solution which turns in to red wine color titrate against 0.01 EDTA solutions.


PROCEDURE CHART
Pipette out 20mL of the field sample
Water sample
1
Add 2mL of Ammonia buffer
Ammonia buffer
2
Add 2 drops of EBT indicator
3
Fill the burrette with EDTA
EDTA
4
Titrate the contents against EDTA solution
Continue the titration till the color changes to steel blue
5
6
Calculate the total hardness

Results

Burette : 0.01N EDTA Solution

Conical flask : 50 ml of water sample + Buffer solution

Indicator : Erichrome black T

End point : wine red to blue color

Table 1: Analysis of hardness of water samples collected from Chikodi town

Inference	Pilot Reading ml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	2-3	2.1	2.2	2.2	2.2
Initial		0.0	0.0	0.0	
Difference		2.1	2.2	2.2	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

= $\frac{2.2 \times 1000}{50} = 44$

Hence, Hardness of water sample collected from Chikodi town is 44 mg/litter

Table 2: Analysis of hardness of water samples collected fromKerur.

Inference	Pilot Reading ml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	1-2	1.5	1.7	1.7	1.6
Initial		0.0	0.0	0.0	
Difference		1.5	1.7	1.7	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

= $\frac{1.6 \times 1000}{50} = 32$

∴ **Hardness of water sample collected from Kerur is 32 mg/litter**

Table 3: Analysis of hardness of water samples collected from Ankali.

Inference	Pilot Reading ml.	Burette Reading In ml.			Mean Burette Reading ml.
		I	II	III	
Final	1-2	1.8	1.9	1.9	1.8
Initial		0.0	0.0	0.0	
Difference		1.8	1.9	1.9	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

= $\frac{1.8 \times 1000}{50} = 36$

∴ Hardness of water collected from Ankali is 36 mg/litter

Table 4: Analysis of hardness of water samples collected from Manjari.

Inference	Pilot Reading ml.	Burette Reading ml.			MeanBurette Reading ml.
		I	II	III	
Final	1-2	1.8	2.0	2.0	1.9
Initial		0.0	0.0	0.0	
Difference		1.8	2.0	2.0	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

= $\frac{1.9 \times 1000}{50} = 38$

∴ Hardness of water collected from Manjari is 38 mg/litter

Table 5: Analysis of hardness of water samples collected from Nasalapur.

Inference	Pilot Reading ml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	2-3	2.0	2.1	2.1	2.0
Initial		0.0	0.0	0.0	
Difference		2.0	2.1	2.1	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

= $\frac{2.0 \times 1000}{50} = 40$

∴ Hardness of water collected from Nasalapur is 40 mg/litter

Table 6: Analysis of hardness of water samples collected from Raibag.

Inference	Pilot Reading ml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	2-3	2.4	2.3	2.2	2.3
Initial		0.0	0.0	0.0	
Difference		2.4	2.3	2.2	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

$= \frac{2.3 \times 1000}{50} = 46$

∴ Hardness of water collected from Raibag is 46 mg/litter

Table 7: Hardness of water samples collected at Bagewadi.

Inference	Pilot Reading ml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	2-3	2.4	2.2	2.2	2.2
Initial		0.0	0.0	0.0	
Difference		2.4	2.2	2.2	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

$= \frac{2.2 \times 1000}{50} = 44$

∴ Hardness of water collected from Bagewadi is 44 mg/litter

Table 8: Hardness of water samples collected in Shamanewadi.

Inference	Pilot Reading ml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	2-3	2.1	2.0	2.0	2.0
Initial		0.0	0.0	0.0	
Difference		2.1	2.0	2.0	

Hardness of water $CaCO_3$ = $\frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

$= \frac{2.0 \times 1000}{50} = 40$

∴ Hardness of water collected from Shamanewadi is 40 mg/litter

Table 9: Analysis of hardness of water samples collected from Shirgaon.

Inference	Pilot Readingml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	2-3	2.2	2.3	2.3	2.2
Initial		0.0	0.0	0.0	
Difference		2.1	2.0	2.0	

Hardness of water $CaCO_3 = \frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

$= \frac{2.2 \times 1000}{50} = 44$

∴ Hardness of water collected from Shirgaon is 44 mg/litter

Table 10: Analysis of hardness of water samples collected from Sadalaga.

Inference	Pilot Reading ml.	Burette Reading ml.			Mean Burette Reading ml.
		I	II	III	
Final	2-3	2.4	2.5	2.5	2.4
Initial		0.0	0.0	0.0	
Difference		2.1	2.0	2.0	

Hardness of water $CaCO_3 = \frac{\text{Mean Burette Reading} \times 1000}{\text{Volume Of Sample Titrated}}$

$= \frac{2.4 \times 1000}{50} = 48$

∴ Hardness of water collected from Sadalaga is 48 mg/litter

Table 11: Hardness of water measured in different samples of Chikodi Taluk

Sl. No.	Name of the Village	Hardness of water mg/liter
1.	Chikodi	44
2.	Kerur	32
3.	Ankali	36
4.	Manjari	38
5.	Nasalapur	40
6.	Raibag	46
7.	Bagewadi	44
8.	Shamanewadi	40
9.	Shiragaon	44
10.	Sadalaga	*48 (Highest)

Our team members opinion and comparison with a few previous findings

Hardness is important for drinking water. Drinking water may be a source of calcium and magnesium. Hardness is a type of property which makes water to form an insoluble precipitate with soap and primarily due to presence of calcium and magnesium ions. Precipitation, which is the purest of natural waters, is the most dominant source of ground water recharge. Substantial increase in concentration of dissolved salts may be brought about in the soil zone due to high evaporation rate.

In India, water resource is mainly depends on ground water and surface water. However, surface water is under great threat than ground water because of pollutants, urbanization, industrialization and the use of pesticides in the agricultural sector.

In taluks like Chikodi, Raibag, Gokak the evaporation is very high. Therefore, an increase in salt concentration may occur in the zone of aeration by dissolution of soluble minerals, especially carbonates of calcium and magnesium. Calcium and magnesium ions may be rich in humus.

First life on the earth comes from water. Water is extremely essential for the survival of all living organisms and also essential for our health and our economy. Water is vital for human needs, for homes and gardens, for agriculture, industry, and the environment. Fresh water is the major need of human life.

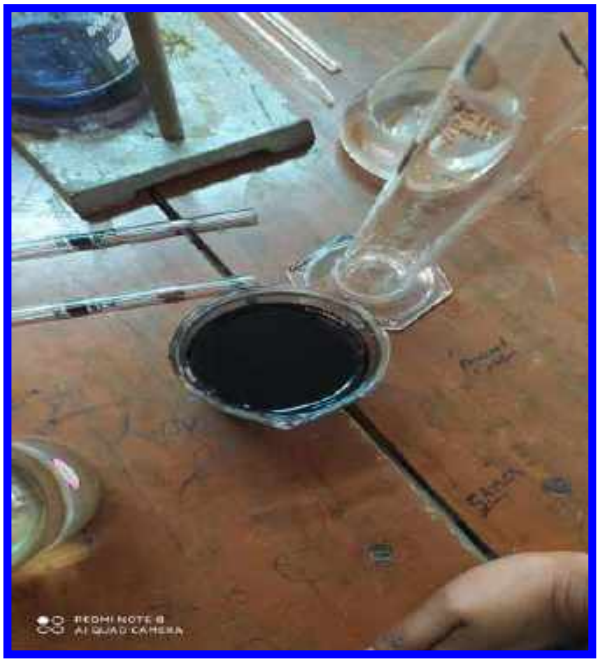
Drinking water quality is a vital concern for mankind since it is directly linked with public health. Drinking water quality has always been a major issue in many countries, especially in developing countries. Although safe drinking water is a basic demand for the people of all over the world, a huge percentage of people of the world are deprived from the pure drinking water (*Tanjila Alam Prosun et al 2018*)

One of the critical areas of environmental assessment is water quality, because of its significance in maintaining the health of human beings and that of the ecosystem. River water is a vital freshwater ecosystem and is very critical for sustainable development. The study of water quality is necessary to determine the health status of any water body. (*S. Priya et al 2016*)

The hardness of water is not a pollution parameter but indicates water quality. According to some classification, water having hardness up to 75 mg/l is classified as soft, 76 – 150 mg/l is moderately soft, 151 – 300 mg/l as hard and more than 300 mg/l as very hard. Based on the present finding, the water sample collected from the all the 10 spots was considered as soft water because of low hardness.

It was a wonderful experience to study about hardness of water, because in class rooms, we can only imagine. By doing this project we were able to know how to determine the hardness of water. Hardness of water which is expressed as CaCo3 mg/liter is a great combination of theoretical and practical knowledge. It helped us to understand and grasp the concepts clearly and extend our thinking capacity.

A few pictures the students project



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