GOVT. DEGREE COLLEGE(MEN) SRIKAKULAM

AFFIDIVT TO DR.B.R.AMBETKAR UNIVERSITY

CERTIFICATED

A STUDY PROJECT ON

ESTIMATION OF HARDNESS OF WATER IN VARIOUS RESOURCES OF SRIKAKULAM-2021-2022

DEPARTMENT OF CHEMICAL SCIENCES

BY

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INTRODUCTION

Most water supplies contain certain amount of dissolved minerals, Some of there minerals, like Sodium are soluble and remain in solution despite changes in water characteristics like temperature, other hard minirals scale when water characteristics changes.

water is commonly classified as hard and soft Depending upon the type and amount of naturally occuring minerals and salts dissolved it,

Hardness water is again classified into temporary and permenent Hardness,

The Phenomena Hardness is very close to human being water is main source for living, so we have know drinking water Hardness. This Hardness estimated with conductometric titration which Chemical process estimated ions, minerals in drinking or other water,

WATER

water is most abundant compound on earth's surface covering about 70%. the plant's surface.

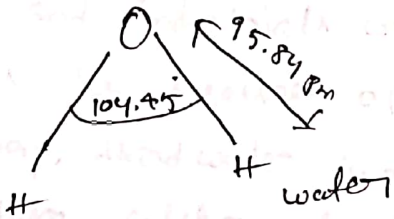
In nature exists in liquid, solid, and gases.

Water,

many substance dissolve in water and it is commonly referred to as the universal solvent

water usually make up 55% to 78% of the human body.

Structure and it's names



IUPAC name :- oxidane

other names - hydrogen oxide

Dihydrogen monoxide

Hydrogen monoxide

HARD WATER

Hard water is due to metal ions that are dissolved in the ground water, These minerals include Ca^{+2}, Mg^{+2}, Fe^{+3}, SO_4^{-2} and HCO_3^-, The hard water in the solution India area is due to rain moving through the cement of limestone, $CaCO_3$, That occurs in over area to the aquifer This is why we measure hardness in term of $CaCO_3$. The Concentration of the Ca^{+2} ion is greater than the concentration of any other metal ion in pure water,

Why be Concerned About water :-

The determination of water hardness is a useful test that provides a measure of quality of water for house holds and industrials user, Originally water hardness was defind as the measure of capacity of the water precipapite soap, Hard water is not a health hazard, people regularly take calcium supplements, Drinking hard water contributed a small amount of calcium and magnisium towards the national Academy of Science states that consuming externally hard water could be major Contributer of Calcium and magnesium to the diet,

Hard water does cause soap 'dog pipes and clog boiler.

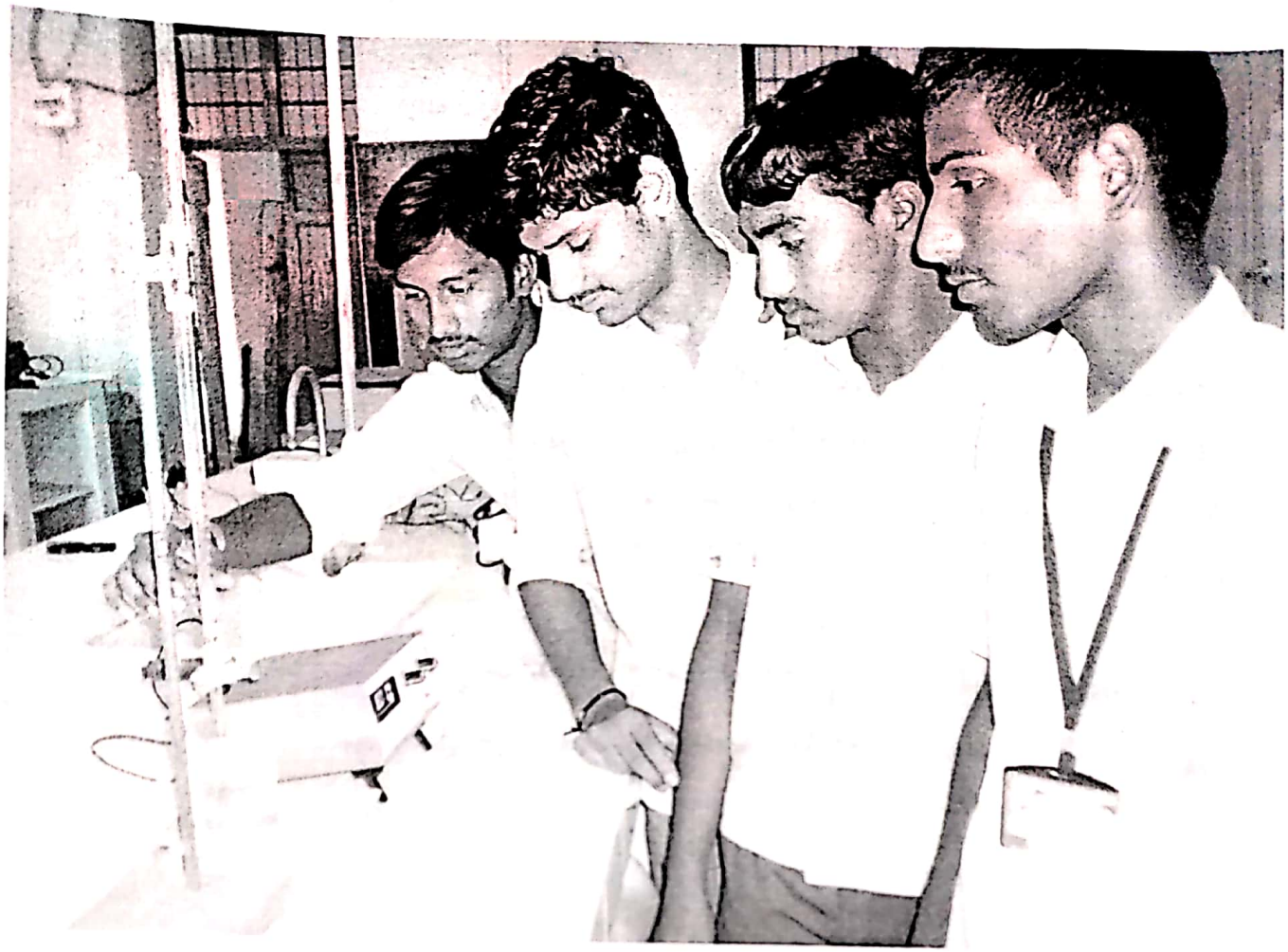
HARD WATER

Hard water is water that has high minerals content In contrast with soft water hard water is high concentration of Ca^{+2} and Mg^{+2} ions, Hard water is generally not harmful to one's health but can pose several problems in Industrial settings, where water hardness is monitored to avoid costly breakdown in boilers cooling towers, and other equipement that handle water. In Domestic settings, the hardness of water is often Indicated by the non-formation of suds when soap is agitated in water sample.

SOURCES OF HARDNESS

Hardness in water is defined as concentration of multivalent cations, multivalent cations are (metal ion) with a charge greater than it, mainly dications, these dications Include Ca^{+2}, and Mg^{+2}. These ions enter a water supply by leaching from minerals.

Common calcium-containing minerals are limestone a form of calcium carbonate $CaCO_3$ and chalk calcium sulphate ($CaSO_4$). A common magnesium mineral is dolomite ($CaMg(CO_3)_2$, which also contains calcium Rain water and distilled water are soft because they contain few ions.

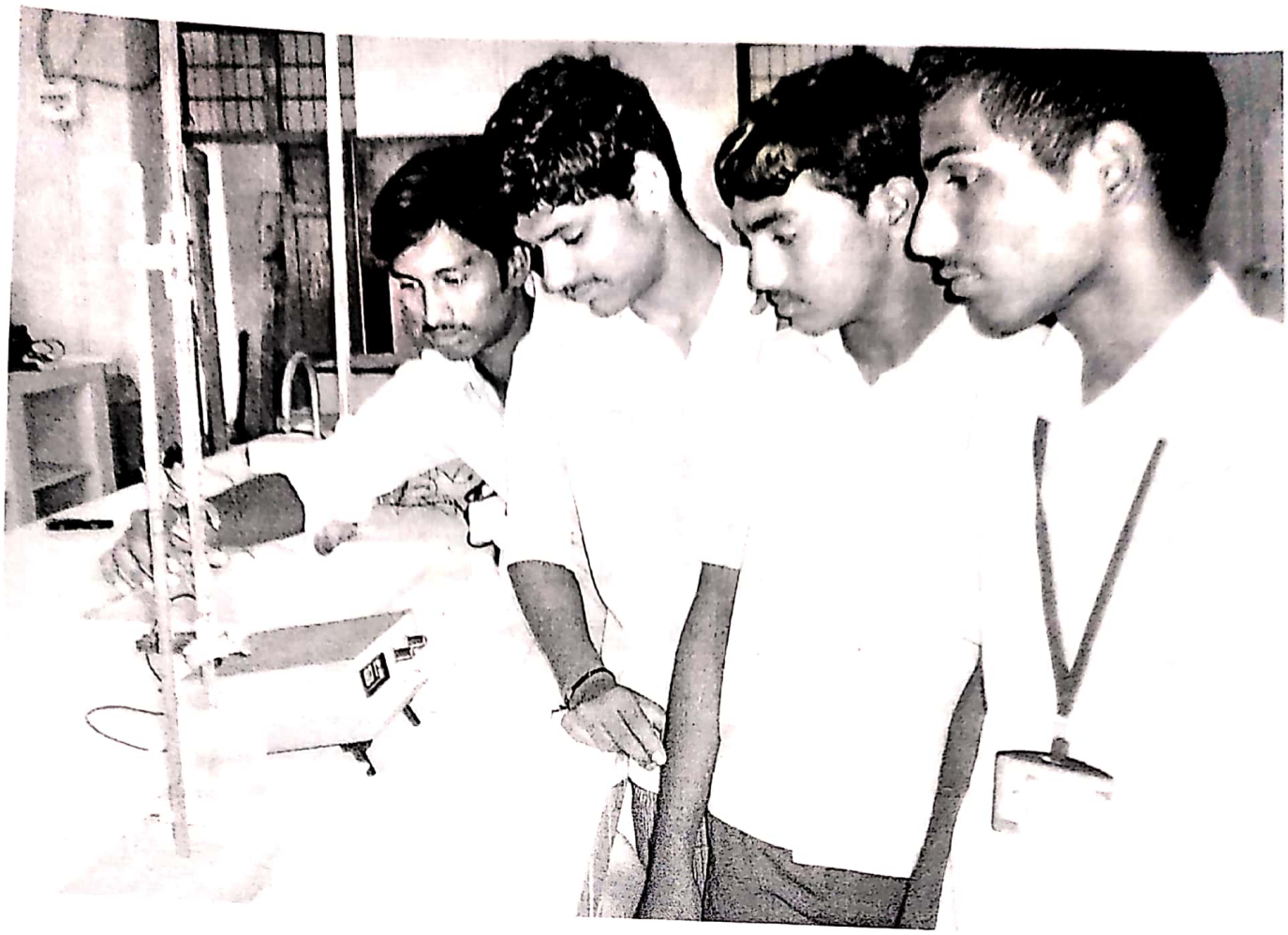


EFFECTS OF HARD WATER

With hard water, soap solutions form a white ppt instead of producing lather. This effect arises because the cations destroy the surfactant properties of the soap by forming a solid ppt. A major component of such scum is calcium stearate which arises according from sodium stearate the main component of soap.

$$2C_{17}H_{35}CO^- + Ca^{2+} \longrightarrow (C_{17}H_{35}CO)_2Ca$$

Hardness can thus be defind as the soap consuming capacity of water sample or the capacity of ppt of soap as a characteristic property of water that prevents the lathering of soap. Synthetic detergents do not form such scums.



SOFTENING

For the reasons discussed above, it is often desirable to soften hard water, most detergents contain ingredients that counteract the effects of hard water on the surfactants. For this reason water softening is often unnecessary. Where softening is practiced, it is often recommended to soften only the water sent to domestic hot-water systems so as to prevent or delay inefficiencies and dangers due to scale formation in water heaters. A common method for water softing involves the use of ion exchange resins, which replace ions like Ca^{2+} ions twice the number of monocations such as sodium(87) potassium ions.

HEALTH CONSIDERATION

The "word Health Organisation" says that 'There does not appear to be any convining evidence that water causes adverse health effects in humans'.

Some studies have shown a week inverse relationship between water hardness and cardiovascular disease in mean upto level of 170 mg Calcium Carbonate per litre of water. The who has reviewed the evidence and concluded the data were 'inadquate to allow for a recomendation for a level of Hardness.

Recommendations have been made for the maximum levels of Calcium (40-80pm) and magnesium (20-30ppm) in drinking water, and a total Hardness expressed as the sum of the calcium and magnesium concentration of 2-4 mm1/L

MEASURMENT

Hardness can be quantified by instrumented analysis the total water hardness. Including both Ca^{+2} and Mg^{+2} ions is reported in parts per million (ppm) or weight volume mg/l) of calcium carbonate ($CaCO_3$) in the water. Although water hardness usally measure only the total concentration of calcium and mangnesium the two most prevalent divalent metaical ions, ion aluminium, and manganum can also be present at elevated levels in some locations. The presence of Iron characteristically confers a grayish (rust-like) colour to the calification. Instead of white The colour of most of the other components.

Because it is a precise mixture of minerals disloved in the water, Together the waters pH and temprature that determines the behaviour of the hardness a single number scale doesnot adquately define hardness. Description of hardness, correspond roughly with ranges of mineral concentrations.

Soft	0–60 mg/l
moderately hard	61–120 mg/l
Hard	121–180 mg/l
very hard	>18 mg/l

The level of total hardness in water can be evaluated with commercial testing kits, which measure the conc of calcium and magnesium. Several scales are used to describe the hardness of water in different contents. The hardness is indicated by a calculation where both calcium and magnesium values are separated reports as mg/L (ppm)

(Ca X 2.5 + (mg X 4.12) = Hardness in mg/L

Parts per million (ppm)

Usually defined as one milligrams of calcium carbonate ($CaCO_3$) per liter of water.

Complexometric Titration

Permanent hardness is usually determined by titrating it with a standard solution of ethylenediaminetetraacetic acid. EDTA. The EDTA is a complexing or chelating agent used to capture the metal ion that are not removed from the water. EDTA simply binds the metal ions to it very tightly

EDTA

EDTA is a versatile chelating agent A chelating agent is a substance whose molecule can form several bonds to a single metal ion chelating agents are multi-dentate ligands ligand is a substance that binds with a metal ion to form the metal ion to form a very stable complex can form four or six bonds with metal ion,

Determination of total water total hardness by Complexometric Titration

water hardness is a measure of the amount of calcium and magnesium salts dissolved in water. There are no health hazards associated with water hardness, however, hard water cause scale, as well as the reduced lathering of soap. Hard water best not used for washing nor in water heaters and kitchen appliance like coffe maker. It is also not good for fish tanks. In general, there are many application where ability to easily determine water hardness is very important complexometric titration is one of the best ways of measuring total water Hardness At pH around to EDTA easily reacts with both calcium and magnesium in the same molar ratio Stability constant of calcium complex is a little bit higher so calcium reacts first. magnesium later. Thus for the end points, we should use the same indicator we use when titrating magansium - that is Erichrome Black T. In these cases of water that doesn't contain magnesium at all, to be able detect end point we should add small amount of calcium magansium will be displaced by Identical amount of calcium, and it will be titrated latter not changing final result, thus easy the situation,

Reaction

Reaction taking place during Titration are

$$Ca^{+2} + EDTA^{4-} \longrightarrow Ca\ EDTA^{-2}$$

and

$$Mg^{+2} + EDTA \longrightarrow Mg\ EDTA^{-2}$$

Sample Size :-

For 0.01 M titrant and assuming 50 ml burette, aliquot taken for titration should contain about 0.35 - 0.45 millimoles of magnesium and calcium together. Depending on water hardness we may more concentrated or more diluted titrant.

END POINT DETECTION

As it was explained above, calcium is complexed first so to detect end point we can use indicator used for detection of end point of magnesium titration, that manaor Erochrome Black. Indicator chelated or acidified, it produce a pinked solution when it is not chelated and under basic conditions it is blue end point titration.

SOLUTION USED :-

To perform titration we boil need titrant - 0.01M EDTA solution and ammonium pH 10.0 buffer, we will also need indicator - either in the form of solution or ground with NaCl - 100 mg of indicator plus 20 g of analytical grade NaCl.

PROCEDURE

* Transfer exactly 50 ml of water to 250ml Erlenmeyer flask
* Acidify the solution with hydrochloric acid
* Bring to boil, cool down
* Alkalize with Ammonia
* filter solution through filter paper
* Add 1 ml of pH 10 ammonia buffer
* Add 3 drops of Eriochrome Black solution or Pinch of Eriochrome black ground with NaOH.

Result Calculation

All water hardness is usually reported in terms of mg/L of calcium carbonate even in water containing both calcium and magnesium. We will use for calculation slightly strange equation.

$$CaCO_3 + EDTA^{4-} \longrightarrow CaEDTA^{-2} + Ca^{-2}$$

Concentration of Ca^{+2} and $CaCO_3$ ions.

$$\frac{\text{moles } Ca^{+2} \text{ ion}}{1L} = \frac{(\text{molarity EDTA})(\text{mL EDTA added})}{50.00 \text{ ml water sample titrate}}$$

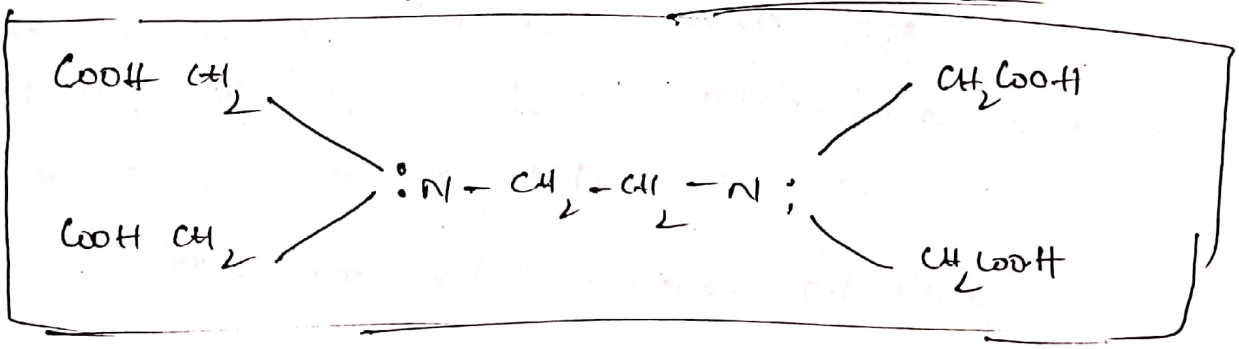
what is hardness?

$$\text{ppm } CaCO_3 = \frac{(\text{mol } Ca^{+2})(1\text{ml/L } CaCO_3)(100.09\ CaCO_3)(1000\text{mg})}{(1L)(1\text{mol } Ca^{+2})(1\text{ml } CaCO_3)(1.0)}$$

Required Solutions for Estimation of Hardness of a sample water various reagents of Srikakulam

(i) EDTA method :- This the method now mostly used for the estimation hardness of water. In this method the following are required.

1) Standard solution to di-Sodium salt of ethylene diamine tetra acetic acid (Known as versene or required as EDTA which one of the most important reagent in modern analytical Chemistry. The formula diamine Tetra acetic (EDTA) is



(ii) Buffer Solution of ammonium chloride and ammonium hydroxide about 4 gms of NH_4Cl + 50ml of conc NH_4OH having pH-10 buffer.

(iii) Eriochrome black T as an indicator

Estimation of total Hardness of water :-

→ we took the water from various reservoirs of Srikakulam dist. And we did estimation with EDTA Solution.

Procedure :- 50 ml of the water for each source and plate and we estimated individually each water sample following procedure.

50 ml of the given solution of hard water are taken in a titrating flask 2ml of buffer solution of Ammonium chloride and two drops Black T- indicator are called to it. colour of the indicator in the solution will be standard EDTA solution is taken in a burette and then added drop by drop into the flask. The colour of the solution begins to turn blue before end point, the last few drops are added one by one at the decration proceed slow when all traces of purple colour disappear and ornament sky blue colour is obtained. The hardness of water is then calculated as below.

Since 1ml of EDTA - x gm of $CaCO_3$

$\therefore$ V ml of EDTA = xy ugm of $CaCO_3$

therefore 50ml of water corresponding to V gm of $CaCO_3$ & 100.0000 gm of water corresponded to

$$\frac{X.V \times 10,00,000}{50} \text{ gm}$$

of $CaCO_3$ which give the hardness of water in ppm

WATER RESOURCES INFORMATION SYSTEM

SRIKAKULAM

This district lies in the following river basins as below vamsadhara, Nagavali Basin, Bahuda, River basin, Mahendra Tanaya basin, Pond Doinge Basin, Nagpade minor doinge Basins.

The major amount of rainfall is during the South West monsoon and / NEM the normal rainfal is 1162 mm.

Geographical area 5,84,000 SKM and population is 2528491 and SKM district having 193 KM wall area

Experiment — values of water Samples

From various areas and places of Srikakulam

S.No	Source/place/town	Hardness in PPM
1.	Srikakulam Town	202
2.	Amadalavalasa	282
3.	Vamsadara	280
4.	Nagavali	304
5.	Palakonda	320
6.	Pondooru	275
7.	Uppe	281.
8.	Hiramandalam	195
9.	Ramatheertham	300
10.	Rajam	200
11.	Kotturu	250.
12.	Seepana midi peta	260
13.	Kalinga patnam	283
14.	Setthum peta	290

Result:-

we considered the all water samples of various places Srikakulam most water is good water. It is very sufficient to drinking and some major town water hardness is not good due to pollution and the major water is wasted and polluted in other ways.

And rivers have high hardness and it's charged some places and it's polluted by bridges where it is adjoin with towns.

In present days Srikakulam water sources very sufficient for people and cultivation also,

But in future people will be faced water problems, To avoid that plan should take care or water resource and prevent pollution.

CONCLUSION:-

We are the students of GOVT. degree college (men). Srikakulam. we did complete a project on "Hardness of water various places of Srikakulam.

And we knew more details about water sources and the process of how to estimate the hardness of water by EDTA Titration by the help of my betterer.

And we know various sources Hardness and water conditions and also pollution of water.

As far as I know parently the water is very good to drinking.