

Determination of Alkalinity of Water in Selected Areas in East Godavari Dist. (A.P) India

Prakash Gadipelli¹, Dr. Harsh Sharma²

1(Research Scholar, Department of Science / Chemistry, OPJS University, Churu (Raj.)India)

2(Associate Professor, Department of Science / Chemistry, OPJS University, Churu (Raj.) India)

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ABSTRACT:

The water's ability to withstand pH changes that would cause it to become more acidic is known as alkalinity. When it comes to drinking water, it also serves as a plumbing and health protection. Water is essential for keeping good health since it aids in metabolism (digestion), controls the body temperature, and remove toxins from the body, among other functions. Life is water. Alkalinity is the term used to describe water's ability to neutralize acids. Since alkalinity of the water prevents abrupt changes in the pH of the stream caused by the entry of acid deposition (from the air), organic acid-containing water, groundwater discharges, or industrial wastes, it has been dubbed "The Protector of the Stream" for surface waters. If you own a fish tank, swimming pool, or spa, you are aware of the significance of maintaining the proper pH and alkalinity levels in the water. In certain circumstances, pure surface water and groundwater derived from the majority of sandstone bedrock have very low levels of alkalinity and would be negatively damaged by acid rain and the addition of even weak inorganic acids. Precipitation's alkalinity ranges from 1 to roughly 10 mg. So need to estimate the water alkalinity by the titrimetric method with the help of indicators Phenolphthalein and Methyl Orange.

Key words: Alkalinity, pH, Indicators, Inorganic acids, titrimetric method,

I. INTRODUCTION

The ability of water to resist acidification is known as alkalinity. Contrast it with Basicity, a pH scale absolute measurement that shouldn't be confused with it. These substances can also be formed from the dissolving of carbon dioxide and the microbial degradation of organic matter, in addition to the components' mineral roots.

Alkalinity is measured in concentrations, such as mill equivalents per litre (meq/L), micro

equivalents per kilograms (eq/kg), or milligram's per litre of calcium carbonate (mg/L CaCO₃) (milligrams/litre of calcium carbonate). Each of these readings represents the quantity of acid that was added as a Titrant.

In his PhD theses, **Svante Arrhenius** demonstrated for the presence of ions in solutions and described bases as liberates the hydroxide ion and acids as liberates the Hydronium ion. He was awarded the greatest Nobel Prize in Chemistry in the year 1903 for that work.

East Godavari, which has its headquarters in Kakinada, is split up into two revenue divisions: Peddapuram, which has 12 mandals, and Kakinada, which has seven mandals. It has seven constituencies: Tuni, Pratipadu, Jaggampeta, Pithapuram, Kakinada Rural, and Kakinada City. It has a population of 19.37 lakhs and a 2,605 sq km area.

II. RESEARCH METHODOLOGY:

Alkalinity of the water sample is determined by the using acid Solution like Sulfuric Acid (H₂SO₄). Alkalinity – because the presence of the hydroxides, carbonates, bicarbonates, phosphates and borates in the water.

Titration is a method used to measure alkalinity. The water is mixed with an acid of a known strength, also known as a Titrant.

The alkalinity of the water affects how much acid is required to raise it to a particular pH level. The pH endpoint causes a color shift in the water. Alkalinity is expressed in calcium carbonate milligrams per litre (mg/L) (CaCO₃).

Water that is alkaline has a pH of 8 or higher. The alkalinity of water is determined using the pH scale. Water that has a pH of 8 to 10 is seen to be somewhat alkaline, whereas water that has a pH of 10 or more is thought to be extremely alkaline. Anything with a pH below 7 is regarded as acidic, whereas 7 is considered neutral.

Standards for Alkalinity:

Low Alkalinity: 20 mg CaCO₃/L or less
 Alkalinity - Moderate range between (20–160 mg CaCO₃/L)
 Greater than 160 mg of CaCO₃/L - High alkalinity
 In this experiment used by the indicators are Methyl Orange (pH – 4.5) and Phenolphthalein (pH – 8.4). It is exhibits in terms of Calcium Carbonate equivalents.

Principle:

Water test sample Alkalinity,

$$\text{Sample volume} = \frac{\text{H}_2\text{SO}_4 \text{ Volume} \times \text{H}_2\text{SO}_4 \text{ Normality} \times 50 \times 1000}{\text{volume of sample}}$$

50 = CaCO₃ Equivalent weight.

Total Alkalinity is determined with the help of Phenolphthalein Indicator; similarly partial alkalinity is measured with the help of Methyl Orange Indicator.

Procedure:

A) **Phenolphthalein Alkalinity / Partial Alkalinity:**

- 1) Burette filled with H₂SO₄ Solution.
- 2) 20 ml sample water pipette out in the conical flask.
- 3) 1-2 drops of Phenolphthalein indicator add to the conical flask solution.
- 4) Titrate against the burette H₂SO₄ solution
- 5) Until get the solution appears Pink to Colorless.
- 6) Repeat the titration until get the two concordant readings. Noted in the following table and calculate the total alkalinity of the water sample.

Burette: Std. H₂SO₄ Solution (0.02N)

Pipette: sample water (20ml)

Indicator; Phenolphthalein

End point: **Pink to Colorless**

S. No	Sample water Volume in (ml)	Burette readings		Consumed H ₂ SO ₄ volume (V1)
		Initial	Final	
1	20 ml			
2	20 ml			
3	20 ml			

Calculation:

Total Alkalinity of the water sample:

$$\text{Sample volume} = \frac{\text{H}_2\text{SO}_4 \text{ Volume} \times \text{H}_2\text{SO}_4 \text{ Normality} \times 50 \times 1000}{\text{volume of sample}}$$

$$= \text{V1} \times 0.02 \times 50 \times 1000/2$$

$$= \dots\dots\dots \text{Ppm}$$

Result: Indicator Phenolphthalein Alkalinity:
ppm

Procedure:

B) **Methyl Orange Alkalinity / Total Alkalinity:**

- 1) Rinse and fill the Burette with H₂SO₄ Solution.
- 2) 20 ml sample water pipette out in the conical

flask.

- 3) 2 drops of Methyl orange indicator add to the conical flask solution.
- 4) Titrate against the burette H₂SO₄ solution
- 5) Until get the solution appears Yellow to Red.
- 6) Repeat the titration until get the two concordant readings. Noted in the following table and calculate the total alkalinity of the water sample.

Burette: Std. H₂SO₄ Solution (0.02N)

Pipette: sample water (20ml)

Indicator; Methyl Orange

End point: **Yellow to Red.**

S. No	Sample water Volume in (ml)	Burette readings		Consumed H ₂ SO ₄ volume (V2)
		Initial	Final	
1	20 ml			
2	20 ml			
3	20 ml			

Calculations:

Total alkalinity of the water sample:
 Sample volume =

$$\frac{\text{H2SO4 Volume } V2 \times \text{H2SO4 Normality} \times 50 \times 1000}{\text{volume of sample}}$$

$$= V1 \times 0.02 \times 50 \times 1000/2$$

$$= \dots\dots\dots \text{Ppm}$$

Result: Indicator Methyl Orange Alkalinity:
ppm.

Final Results:
 Methyl Orange Alkalinity / Total Alkalinity:
ppm.
 Phenolphthalein Alkalinity / Partial Alkalinity:
ppm.

III. RESULTS AND DISCUSSIONS:

S. No	Sample water Location	Type of water	MO Alkalinity	Phe. Alkalinity
1	Kakinada	Well water	31.5	27
2	Nemam	Ground water	25	28.5
3	Marla	Ground water	38.5	14.5
4	Panasapadu	Tap water	45	26.5
5	Ethakota	Bore water	30.7	54.25
6	Mandapeta	Tap water	42.5	29
7	Kandrakota	Under Ground water	36.2	13.9
8	Sarpavarm	Well water	39	22.5
9	Ravulapalem	Bore water	31	37.9

Overall nine samples were collected from the selected zones and those are different water types like ground, well, tap, bore water.

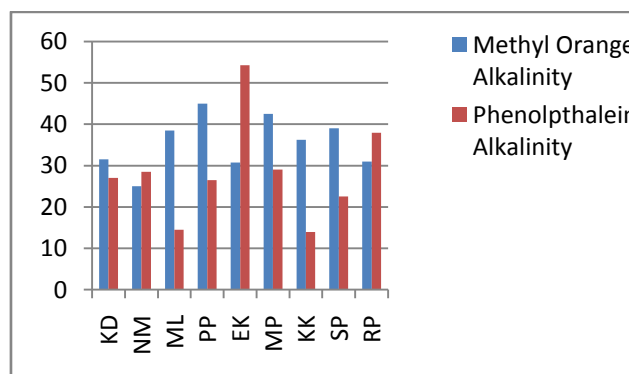
Titrimetric method followed for the estimation of alkalinity. According to the BSI water alkalinity permissible limit below 200 ppm or 200 mg/l.

54.25 mg/l highest partial alkalinity found in the bore water sample collected from the place

Ethakota and 13.6 mg/l highest partial alkalinity found in the underground water sample collected from the place Kandrakota.

Panasapadu tap water contains highest total alkalinity / methyl orange alkalinity i.e. 45 mg/l.

Nemam ground water contains lowest total alkalinity / methyl orange alkalinity i.e. 25 mg/l.



IV. CONCLUSION:

Alkalinity of water is the reason for the corrosion, in the industries, may encounter difficulties washing clothes, chemical scale buildup, or clogging of water pipelines and related machinery.

All the water sample alkalinity ranges below the 160 mg/l. so all the sample water are under permissible limits, useful to different activities, aware the people among the alkalinity in their areas.

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