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Assessment of Chlorides in The Water Samples and Its Absorption by Thermosetting Polymer Phenol Formaldehyde Resin

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Abstract

Assessing chloride levels in water samples is critical for monitoring water quality and ensuring environmental and public health protection. This study presents a comprehensive methodology for estimating chloride concentrations in water samples through various analytical techniques, including titration. Results obtained from each method were compared and discussed to evaluate their accuracy, and applicability in different environmental settings. The data shows that the samalkot drinking water sample has a relatively high chloride content. The kiralampudi drinking water sample (KLRM) is noted for containing a higher chloride content compared to some other samples. Compared to other samples. The Kakinada(urban) drinking water KKDDM is found to be highest hardness 725ppm and least was found in peddappuram drinking water as 42.5 ppm and pithapuram as 55 ppm. The Surampalem drinking water sample (SUBW) is identified as having the least chloride content among the samples Quality control measures were implemented to ensure the validity of the results, and the environmental implications of the measured chloride concentrations were discussed. Bakelite thermosetting polymer is used for the absorption of water containg chloride ions. Overall, the study highlights the importance of accurate chloride estimation for effective water resource management and provides valuable insights for researchers and environmental professionals engaged in water quality monitoring and assessment. Bakelite is also effective tool for removal of chlorides ion exchange resin.

Keywords: Chloride ions, water samples, Bakelite, ion exchange resin

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INTRODUCTION

Water is an indispensable resource vital for sustaining life and supporting various ecosystems. However, the quality of water is continuously threatened by numerous pollutants, including chlorides. Chlorides are ubiquitous in nature and can enter water bodies through various sources such as industrial discharges, agricultural runoff, and natural processes like weathering of rocks and minerals.

The presence of chlorides in water can have significant implications for both environmental and human health. Excessive levels of chlorides can adversely affect aquatic organisms, disrupt ecosystems, and degrade water quality. Furthermore, chloride contamination in drinking water can pose health risks to humans, particularly in high concentrations, by causing taste and odour issues and potentially leading to adverse health effects such as hypertension and cardiovascular problems.

Given the potential risks associated with chloride contamination, accurate and reliable methods for assessing chloride levels in water samples are crucial. These methods play a fundamental role in monitoring water quality, identifying sources of contamination, and implementing appropriate mitigation measures to safeguard both environmental and public health.

In recent years, advancements in analytical techniques have enabled researchers and environmental agencies to more effectively measure and analyze chloride concentrations in water samples. Traditional methods such as titration and gravimetric analysis have been supplemented or replaced by modern instrumental techniques such as ion chromatography, spectrophotometry, and electrochemical methods. These advanced techniques offer improved sensitivity, precision, and efficiency in detecting and quantifying chlorides in water samples, thereby enhancing our ability to assess and manage water quality [1].

This introduction sets the stage for further exploration into the assessment of chloride levels in water samples. Subsequent sections of this journal will delve into the methodologies, applications, challenges, and emerging trends in the field of chloride analysis, with the overarching goal of contributing to a better understanding of chloride contamination and its implications for environmental and human health. Through collaborative efforts in research, monitoring, and policy development, we can strive towards ensuring the sustainable management and protection of our precious water resources for present and future generations [2].

Previous Studies on Hardness Measurement Methods: Review existing literature on methods and techniques used for measuring water hardness, including titration methods, complexometric methods (e.g., EDTA titration), and instrumental methods (e.g., atomic absorption spectroscopy, inductively coupled plasma spectroscopy). Discuss the advantages, limitations, and applications of each method.[3].

Factors Affecting Hardness Levels: Explore research findings on the factors influencing hardness levels in water, such as geological characteristics of the region, land use practices, industrial activities, and seasonal variations. Discuss how these factors impact water hardness and the implications for water resource management and treatment.[4].

Relationship between Hardness and Water Quality: Examine studies that investigate the relationship between water hardness and other water quality parameters, such as pH, alkalinity, conductivity, and metal concentrations. Discuss the significance of hardness as an indicator of water quality and its role in influencing water treatment processes and corrosion control.[5].

Case Studies and Research Findings: Highlight specific case studies or research findings relevant to your dataset, focusing on studies that analyze hardness levels in similar water sources or geographic regions. Summarize key findings, methodologies, and conclusions from these studies.[6].

Research Gaps and Future Directions: Identify gaps or limitations in existing research on water hardness measurement and its implications for water quality management. Discuss potential areas for future research, including the development of innovative measurement techniques, assessment of emerging contaminants, and integration of water quality data into predictive models.

OBJECTIVE OF THE RESEARCH

The objective of my current research to collect the water samples from different areas and analyse the chloride content in the samples and its absorption of thermosetting polymer (Bakelite) is tested.

Material And Methods

Sample Collection

The water sample are selected areas from different areas of the hostel of Aditya college and different areas of East Godavari district Yanam, Dowelswaram, tapeswaram, Rajahmundry. And labelled with sample code which is given the Table-1

SAMPLE PREPARATION

The water is kept in suitable filter to removed particulate matters and PH of the samples are adjusted to ensure the accurate chloride analysis. Titration method prepare standardized silver nitrate solution of known concentration and add a few drops of potassium chromate indicator to the water sample be tested. Titrate the sample with silver nitrate solution until the formation of reddish-brown precipitate of silver chromate indicates the end point. Calculate the chloride concentration using the volume and concentration of silver nitrate used.

Preparation Of Bakelite (Phenol Formaldehyde Resin)

2ml of the formaldehyde is mixed with 2ml acetic acid and 2ml of phenol is added with constant stirring and a few drops of concentrated H2SO4 is used. A pink colour solid is obtained and Weight of the solid or resin obtained is noted as 5. 3gm.Then the water from above 100ml of high chloride content of samalakot sample is taken and dissolved the few hrs with 5.3gm of Bakelite and after few hours the chloride ions are absorbed by the Bakelite.as Bakelite is a good anion exchanging resin. From this Bakelite can used anion exchanging resin for the absorption of chloride ions.[7]

Figure 1. Bakelite(phenol formaldehyde resin)

Results and discussions

Table 1. The data representing the sample location and sample code

S. No	Sample Location	Sample Type	Sample Code	Cl- Ions PPM	Hardness PPM
1.	Samalkot	Tap water	SMTTW	177.5	280
2.	Samalkot	Drinking water	SMTDW	710	280
3.	Surmpalem hostel	Bore water	SPLBW	257.3	190
4.	Biccavolu	Drinking water	BCLDW	263.5	353
5.	Tapeswaram	Drinking water	TPMDW	152..65	350
6.	Surmpalem hostel	Drinking water	SUBW	257.3	190
7.	Kattipudi	Rainwater	KLRM	479.25	213
8.	Surampalem hostel block-b(Girls)	Drinking water	SPLDW	46.15	130

9.	Pedddapuram	Drinking water	PDMDW	33.725	42.5
10.	pithapuram	Drinking water	PTPDW	31.063	55
11.	Tapeswaram	Tap water	TPMTW	76.325	160
12.	Surampalem hostel block-c	Tap water	SPLTW	107.8	250
13.	Doweleswaram	Drinking water	DWSDW	46.15	130
14.	Surampalem hostel block-c(girls)	Bore water	SPLBW	175.7	465
15.	Surampalem hostel block-c(girls)	Bore water	SPLBW	166.85	173
16.	rajahmundry	Tap water	RJYTW	239.6	490
17.	Vemagiri	Tap water	VGRTW	43.48	220
18.	Yanam	Drinking water	YNMPW	56.8	130
19.	Kakinada(urban)	Drinkng water	KKDDM	318.75	725

Table 2. The data representing the drinking wate samples in diffrent areas

S. No	Sample Location	Sample Type	Sample Code	Cl- Ions PPM	Hardness PPM
1.	Samalkot	Drinking water	SMTDW	710	280
2.	Biccavolu	Drinking water	BCLDW	263.5	353
3.	Tapeswaram	Drinking water	TPMDW	152..65	350
4.	Surmpalem hostel block A boys	Drinking water	SUBW	257.3	190
5.	Surampalem hostel block-b(Girls)	Drinking water	SPLDW	46.15	130
6.	Pedddapuram	Drinking water	PDMDW	33.725	42.5
7.	pithapuram	Drinking water	PTPDW	31.063	55
8.	Doweleswaram	Drinking water	DWSDW	46.15	130
9.	Kakinada(urban)	Drinkng water	KKDDM	318.75	725
10.	Yanam	Drinking water	YNMPW	56.8	130

HARDNESS

The Kakinada(urban) drinking water KKDDM is found to be highest hardness 725ppm and least was found in peddappuram drinking water as 42.5 ppm and pithapuram as 55 ppm.Yanam and Doweleswaram and Surampalem hostel block b drinking water found to be same hardness which 130ppm. Biccavolu and samalkot drinking water was found to be nearly equal 353 ppm

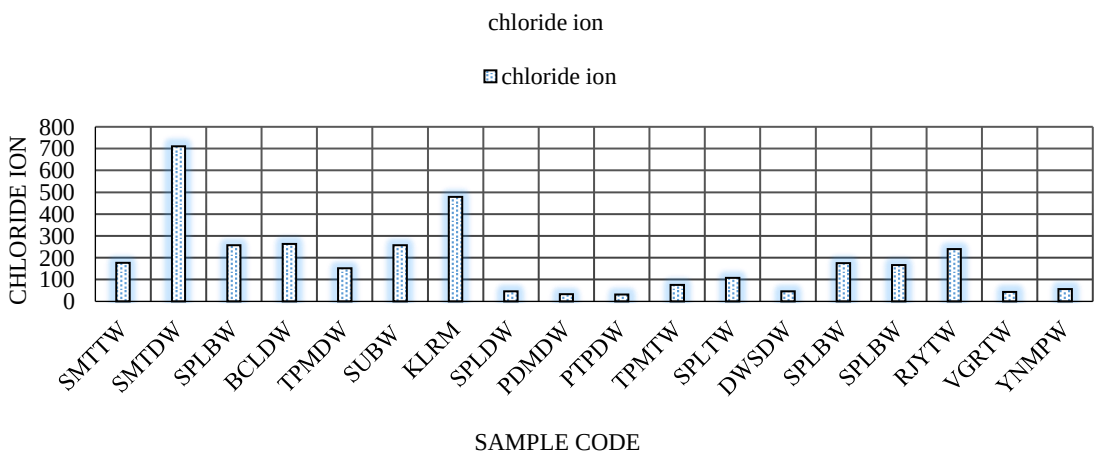

Figure 2. The Graphical representation of different samples and its chloride parameter.

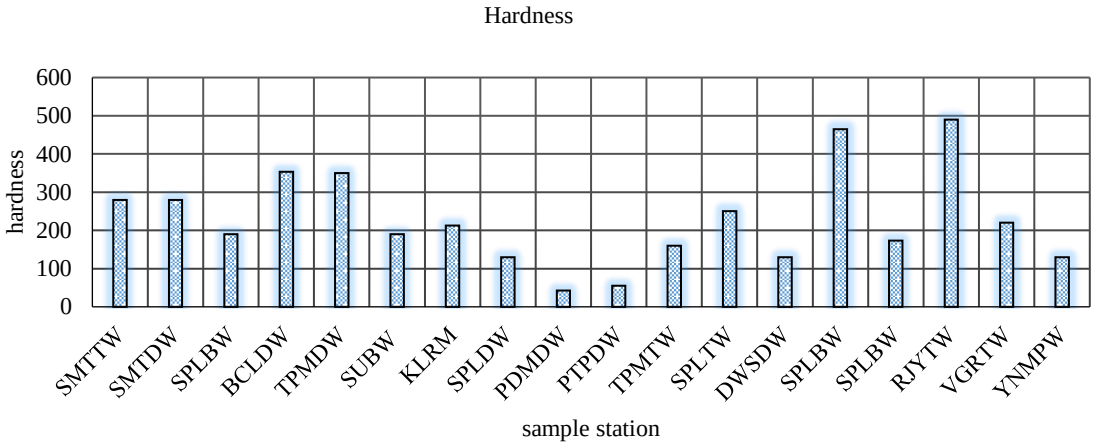

Figure 3. The Graphical representation of different samples and its hardness parameter.

RESULTS AND DISCUSSION

High chloride content in samalkot drinking water (SMTDW)

The data shows that the samalkot drinking water sample has a relatively high chloride content Compared to other samples. The chloride content in the SMTDW sample might indicate elevated levels of chloride ions in samalkot.

Higher chloride content in kiralampudi drinking water (KLRM)

The kiralampudi drinking water sample (KLRM) is noted for containing a higher chloride content compared to some other samples.

This suggests that the water sourced from kiralampudi may have elevated chloride levels which could be attributed to various factors such as geological conditions, industrial activites or pollution.

Least chloride in surampalem drinking water (SUBW)

The Surampalem drinking water sample (SUBW) is identified as having the least chloride content among the samples provided. this indicates that the water from surampalem has Comparatively lower levels of chloride ions which might be due to factors such as the water source characteristics or treatment methods used in surampalem.

Detection Of Vemgiri and Yanam Samples

The data includes samples from vemagiri (VGRTW) and Yanam (YNMPW)While the specific chloride content of these samples is not highlighted in the analysis, their presence in the dataset suggests that monitoring and testing for the chloride levels in drinking water are conducted in these areas as well.

Hardness

The provided data represents the analysis of water samples from various locations in the Samalkot region, including tap water, drinking water, bore water, rainwater, and purified water. The analysis primarily focuses on the hardness of the water samples measured in parts per million (PPM). Hardness in water typically arises from dissolved minerals, primarily calcium and magnesium ions. Here's a breakdown of the results and their implications:

Samalkot: Tap Water (SMTTW): Hardness 280 PPM,Drinking Water (SMTDW): Hardness 280 PPM.

Surampalem Hostel: the surampalem hostel the Bore Water (SPLBW): Hardness 190 PPM,Drinking *Water (SUBW): Hardness 190 PPM,Tap Water Block C (SPLTW*): Hardness 250 PPM,Bore Water Block C (SPLBW): Hardness 465 PPM

Biccavolu: Drinking Water (BCLDW): Hardness 353 PPM

Tapeswaram: Drinking Water (TPMDW): Hardness 350 PPM,Tap Water (TPMTW): Hardness 160 PPM

Kattipudi: *Rainwater (KLRM):* Hardness 213 PPM

Peddapuram: Drinking Water (PDMDW): Hardness 42.5 PPM,

Pithapuram: Drinking Water (PTPDW): Hardness 55 PPM

Dowleswaram: Drinking Water (DWSDW): Hardness 130 PPM

Rajahmundry: Tap Water (RJYTW): Hardness 490 PPM

Vemagiri: Tap Water (VGRTW): Hardness 220 PPM

Yanam: Purified Water (YNMPW): Hardness 130 PPM

Kakinada (Urban): Drinking Water (KKDDM): Hardness 725 PPM

DISCUSSION

Hardness Variation: There is significant variation in water hardness across different locations and sources within the Samalkot region. For instance, while some areas like Peddapuram and Pithapuram have relatively low hardness levels (42.5 PPM and 55 PPM respectively), others like Kakinada (Urban) exhibit significantly higher hardness (725 PPM).

Impact on Drinking Water Quality: Higher hardness levels, as observed in Kakinada (Urban), Biccavolu, and Rajahmundry, can affect the taste of water and might lead to scale buildup in pipes and appliances. Conversely, very low hardness levels, such as those found in Peddapuram and Pithapuram, may indicate the absence of essential minerals in the water.

Data Range and Distribution: Upon examining the "Hardness PPM" column, we observe a range of values from as low as 42.5 PPM to as high as 725 PPM. This indicates a wide variation in hardness levels across the samples.[12]

Outliers Detection: One notable aspect is the presence of extreme values, such as 725 PPM in sample "KKDDM". These extreme values might be outliers and could be investigated further to determine if they are valid measurements or errors in data collection.[8].

Sample Homogeneity: Looking at the data, we see some samples with identical hardness values. For instance, "SPLBW" appears three times with hardness values of 190, 173, and 465 PPM respectively. This repetition might suggest either multiple measurements of the same sample or samples with similar properties.[9]

Relationship with Other Variables

It's also crucial to explore potential relationships between hardness and other variables, such as chloride ion concentrations or sample types. Analyzing correlations between hardness and other factors can provide insights into the chemical composition and characteristics of the samples.[11]

When compared pushakaram water samples which are high polluted, and use of Bakelite will reduce the pollution in water.[13].

Quality Control

The consistency and reliability of hardness measurements across different samples need to be ensured. Discrepancies or inconsistencies could indicate measurement errors or variations in sampling techniques, which would require attention for accurate interpretation of the data.[10].

Potential Health Implications: While moderate levels of hardness are generally considered safe for consumption and might even contribute to daily mineral intake, excessively hard water can pose health risks, particularly for individuals prone to kidney stones or with cardiovascular issues.

Source Identification: Variations in hardness levels among different sources (tap water, bore water, rainwater, etc.) highlight the importance of identifying the sources of water and implementing appropriate treatment measures to ensure water quality and safety.

Need for Further Analysis: While hardness provides valuable information about water quality, additional parameters such as pH, turbidity, and presence of contaminants should also be considered for a comprehensive assessment of water suitability for drinking and other purposes.

CONCLUSIONS

In conclusion, the results and discussion underscore the importance of accurate chloride estimation in water samples for environmental stewardship and public health protection. The analysis of chloride content in drinking water samples highlights the importance of continuous monitoring, effective treatment, and proactive management pratices to safeguard public health and ensure access to clean and safe drinking water in communities. The data shows that the samalkot drinking water sample has a relatively high chloride content. The kiralampudi drinking water sample (KLRM) is noted for containing a higher chloride content compared to some other samples.

Compared to other samples The Surampalem drinking water sample (SUBW) is identified as having the least chloride content among the samples The "Hardness PPM" data provides valuable insights into the chemical composition and characteristics of the samples. The Kakinada(urban) drinking water KKDDM is found to be highest hardness 725ppm and least was found in peddappuram drinking water as 42.5 ppm and pithapuram as 55 ppm. Through careful analysis and interpretation, we can uncover patterns, relationships, and potential areas for further investigation, contributing to a deeper understanding of the underlying processes and phenomenon. Bakelite (phenol formaldehyde resin) is effective tool for removal of chloride ions from the water. thermosetting polymer. By employing robust analytical methodologies and implementing comprehensive quality assurance protocols, we can ensure reliable data generation and informed decision-making in water quality management endeavors. Ongoing research efforts should focus on refining analytical methods, expanding monitoring networks, and investigating the sources and fate of chlorides in aquatic systems. Additionally, the development of integrated approaches combining multiple analytical techniques and data modeling can enhance our understanding of chloride dynamics and facilitate more effective water resource management strategies.

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