Comparison of Reduction of Hydroxylamin Hydrochloride, Ascorbic Acid, and Sodium Sulfite in Analysis of Iron with Zn2+ Disturbing Ions

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**Abstract.** Research on the interference of Zn2+ ions in the determination of Fe(II) phenanthroline using Hydroxylamine Hydrochloride, Sodium Sulfite, and Ascorbic Acid as reductants under optimal conditions has been successfully conducted using UV-vis spectrophotometry. The Fe(II) phenanthroline complex exhibits a wavelength of 510 nm for all three reductants. The optimum concentration for Hydroxylamine Hydrochloride and Ascorbic Acid are 6 ppm, while for Sodium Sulfite is 20 ppm. The optimal reaction time for Hydroxylamine Hydrochloride and Sodium Sulfite are 60 minutes, whereas for Ascorbic Acid is 75 minutes. The calibration curve measurements for Hydroxylamine Hydrochloride show a determination coefficient (r²) of 0.9964, for Sodium Sulfite is 0.9965, and for Ascorbic Acid is 0.996. Zn2+ ions can interfere with the analysis of Fe(II) phenanthroline by decreasing iron absorbance with Hydroxylamine Hydrochloride and increasing iron absorbance with Sodium Sulfite and Ascorbic Acid. For Hydroxylamine Hydrochloride, Zn2+ ion interference begins at a concentration of 0.1 ppm with %recovery is 92.10%. For Sodium Sulfite, Zn2+ interference is observed at a concentration of 0 ppm with %recovery is 64.99%, no interference at 0.003 ppm with %recovery is 95.64%, and interference again at 0.004 ppm with %recovery is 111.99%. For Ascorbic Acid, Zn2+ interference begins at a concentration of 3 ppm with %recovery is 92.15%.

# INTRODUCTION

Iron is the second most abundant metal element in the Earth's crust and is crucial in the metabolism of plants and animals. However, if present in excessive amounts, iron can form oxyhydroxide deposits that stain laundry and porcelain. Therefore, the recommended limit for iron content in domestic water supply is 0.3 mg/L. The determination of Fe(II) and Fe(III) is significant in various natural sciences such as geology, agriculture, biology, and environmental protection, primarily because the bioavailability and metabolism of iron differ in these two oxidation states. Fe(II) is essential for good health as it aids in oxygen transport in the blood and oxygen storage through hemoglobin and myoglobin. Iron deficiency can lead to decreased immunity and infectious diseases. Excessive iron intake in the human body can cause excretory dysfunction and has a higher carcinogenic potential. Both Fe(II) and Fe(III) play vital roles in the biosphere, serving as active centers of various proteins such as oxidase, reductase, and dehydrogenase. However, plants require a certain amount of Fe(II) to survive. Iron assists in chlorophyll formation and supports several other chemical processes performed by plants. Nonetheless, too much iron can have toxic effects on plants, weakening and eventually killing them. It should be noted that plants only absorb ferrous iron particles from the soil, and other forms of iron will not affect the plants (1).

The determination of iron content using UV-Vis spectrophotometry has been widely conducted due to its rapid, easy, and accurate process (2). The use of a UV-Vis Spectrophotometer requires the presence of a colored solution

for analysis purposes. Therefore, the concentration of Fe to be measured needs to be converted into a complex form first, which produces a characteristic color. One commonly used complexing agent is 1,10-phenanthroline (o- phenanthroline). This choice is based on o-phenanthroline's ability to react with Fe ions, forming a complex that has an orange-red color. Additionally, the color produced by this complex can remain stable for up to 6 months. Before complexing, the iron to be tested must undergo a reduction process from Fe3+ to Fe2+ to stabilize it for complex formation (3).

The analysis of iron concentration is not free from the possibility of interference caused by disturbing ions such as Mn2+, Ag+, Zn2+, Mg2+, and others. (4) showed that Mg2+ starts to cause interference at a concentration of 0.04 ppm, with a recovery percentage of 90.99%. Meanwhile, Ag+ ions can interfere at a concentration of 0.03 ppm, with a recovery percentage reaching 92.880% (5). (6) mentioned that Zn2+ ions can also interfere with the analysis of iron concentration at a concentration level of 0.2 ppm, with a recovery percentage of 77.86%. This study aims to compare hydroxylamine hydrochloride, ascorbic acid, and sodium sulfite as reducing agents in the determination of iron concentration in the presence of Zn2+ interfering ions. This test will be conducted using a UV-Vis Spectrophotometer under the optimum conditions for each reducing agent.

In the study on the determination of iron content comparing the reductants NH2OH.HCl and Na2SO3, it was found that both NH2OH.HCl and Na2SO3 have the same ability to reduce Fe3+ to Fe2+. However, both reductants are less effective than Na2S2O3 (7).

In a previous study on the determination of iron content comparing the reductants NH2OH.HCl, Na2S2O3, and C6H8O6, it was found that NH2OH.HCl was the most effective, followed by C6H8O6, while Na2S2O3 was the least effective (8). Therefore, in this study, the reductants NH2OH.HCl, Na2SO3, and C6H8O6 were chosen for the determination of iron content in the presence of Zn2+ interfering ions to identify the most effective reductant among the three.

# EXPERIMENT

## Materials

The equipment used in this study includes beakers, erlenmeyer flasks, measuring cylinders, volumetric flasks, an analytical balance, drop pipettes, volumetric pipettes, graduated pipettes, propipettes, funnels, watch glasses, spatulas, a digital pH meter, a hotplate, spray bottles, cuvettes, and a UV-Vis spectrophotometer.

The materials used in this study include iron (III) nitrate nonahydrate (Fe(NO3)3.9H2O), 1,10-Phenanthroline (C12H8N2), hydroxylamine hydrochloride (NH2OH.HCl), ascorbic acid (C6H8O6), sodium sulfite (Na2SO3), deionized water (aqua DM), sodium acetate (CH3COONa), glacial acetic acid (CH3COOH), and acetone.

## Preparation of 100 ppm Fe(III) Standard Solution

The Fe3+ standard solution is prepared by dissolving 0.0723 grams of Fe(NO3)3.9H2O in a beaker containing a small amount of deionized water (aqua DM). The resulting solution is then transferred to a 100 mL volumetric flask and diluted to the mark with deionized water.

## Preparation of 100 ppm Zn2+ Standard Solution

A total of 0.0200 grams of ZnCl2 is weighed. The compound is dissolved in a small amount of deionized water (aqua DM) in a beaker. The solution is then transferred to a 100 mL volumetric flask and diluted to the mark with deionized water. The solution is shaken until homogeneous.

## Preparation of 100 ppm Ascorbic Acid Standard Solution

Ascorbic acid (C6H8O6) solution is prepared by dissolving 0.0100 grams of C6H8O6 in a beaker containing a small amount of deionized water (aqua DM). The resulting solution is then transferred to a 100 mL volumetric flask and diluted to the mark with deionized water.

## Preparation of 1000 ppm Sodium Sulfite Standard Solution

Sodium sulfite (Na2SO3) solution is prepared by dissolving 0.1000 grams of Na2SO3 in a beaker containing a small amount of deionized water (aqua DM). The resulting solution is then transferred to a 100 mL volumetric flask and diluted to the mark with deionized water.

## Preparation of 100 ppm Hydroxylamine Hydrochloride Standard Solution

Hydroxylamine hydrochloride (NH2OH.HCl) solution is prepared by dissolving 0.0100 grams of NH2OH.HCl in a beaker containing a small amount of deionized water (aqua DM). The resulting solution is then transferred to a 100 mL volumetric flask and diluted to the mark with deionized water.

## Preparation of 1000 ppm 1,10-Phenanthroline Standard Solution

The 1,10-Phenanthroline (C12H8N2) solution is prepared by dissolving 0.1000 grams of phenanthroline solid into a 100 mL beaker, followed by the addition of 50 mL of deionized water (aqua DM). The mixture is then heated to 60°C while stirring. Afterward, the solution is allowed to cool and is transferred to a 100 mL volumetric flask, which is then filled to the mark with deionized water.

## Preparation of Acetate Buffer Standard Solution

Acetate buffer solution at pH 4.5 is prepared by dissolving 0.7249 grams of sodium acetate (CH3COONa) in a beaker with a small amount of deionized water (aqua DM) until completely dissolved. The acetate buffer solution is then transferred to a 100 mL volumetric flask, to which 5 mL of acetic acid (CH3COOH) is added, and the solution is diluted to the mark with deionized water.

## Preparation of Maximum Wavelength Blank Solution

1.1 mL of the 100 ppm solution of C6H8O6, Na2SO3, or NH2OH.HCl is transferred into a 10 mL volumetric flask. To this, 1.5 mL of 1000 ppm 1,10-Phenanthroline, 1.5 mL of pH 4.5 acetate buffer, and 5 mL of acetone are added. The solution is then diluted to the mark with deionized water.

## Determination of Maximum Wavelength

0.5 mL of 100 ppm Fe(III) standard solution is transferred into a 10 mL volumetric flask. To this, add 1.1 mL of Na2SO3, NH2OH.HCl, or C6H8O6 solution, 1.5 mL of 1000 ppm 1,10-Phenanthroline solution, and 1.5 mL of pH 4.5 acetate buffer. Then, add 5 mL of acetone and dilute to the mark with deionized water. The mixture is shaken and allowed to stand for 15 minutes. After that, measure the absorbance using a UV-Vis spectrophotometer twice, with the blank solution as a reference. The obtained data are used to create a curve of absorbance versus wavelength to determine the maximum wavelength.

## Determination of Optimal Reducing Agent Concentration

0.5 mL of 100 ppm Fe(III) standard solution is transferred into a 10 mL volumetric flask. To this, add Na2SO3, NH2OH.HCl, or C6H8O6 solution at 100 ppm with varying volumes of 0.2, 0.3, 0.4, 0.5, and 0.6 mL as reducing agents and 1.5 mL of acetate buffer at the optimal pH. Then, add 1.5 mL of 1000 ppm Phenanthroline solution and 5 mL of acetone and dilute to the mark with deionized water. The mixture is shaken and allowed to stand for 15 minutes. Absorbance is then measured using a UV-Vis spectrophotometer twice. The obtained absorbance data are used to create a calibration curve of absorbance versus the concentration of Na2SO3, NH2OH.HCl, or C6H8O6, from which the optimal concentration of the reducing agent can be determined.

## Determination of Optimal Reducing Agent Reaction Time

0.5 mL of 100 ppm Fe(III) standard solution is transferred into a 10 mL volumetric flask. To this, add 1.1 mL of 100 ppm reducing agent solution (Na2SO3, NH2OH.HCl, or C6H8O6) and 1.5 mL of acetate buffer at the optimal pH. Then, add 1.5 mL of 1000 ppm 1,10-Phenanthroline solution and 5 mL of acetone, and dilute to the mark with deionized water. The mixture is shaken and allowed to stand for varying times of 0, 15, 30, 45, 60, 75 and 90 minutes. Absorbance is then measured at the maximum wavelength using a UV-Vis spectrophotometer. The obtained absorbance data are used to create a curve of absorbance versus reaction time. From this curve, the optimal reaction time for the reducing agent can be determined.

## Determination of Fe(II)-Phenanthroline Calibration Curve

0.1 mL of 100 ppm Fe(III) standard solution is transferred into a 10 mL volumetric flask. To this, add 1.1 mL of 100 ppm solution of Na2SO3, NH2OH.HCl, or C6H8O6. Then, add 1.5 mL of 1000 ppm 1,10-Phenanthroline solution,

1.5 mL of acetate buffer, 5 mL of acetone, and dilute to the mark with deionized water. Absorbance is measured at the maximum wavelength using a UV-Vis spectrophotometer, and the measurement is repeated twice. The obtained absorbance data are used to create a calibration curve of absorbance versus varying concentrations of Fe(III) solution. This procedure is then repeated for Fe(III) concentrations of 0, 0.1, 0.2, 0.3, 0.4, and 0.5 mL.

## Effect of Zn(II) on Hydroxylamine Hydrochloride Reductant

0.5 mL of 100 ppm Fe3+ solution is transferred into a 10 mL volumetric flask, and then varying concentrations of Zn2+ solution are added (0.01, 0.02, 0.03, 0.04, and 0.05 mL). Next, add 1.1 mL of hydroxylamine hydrochloride solution, 1.5 mL of 1000 ppm 1,10-Phenanthroline monohydrate solution, 1 mL of pH 4.5 acetate buffer, 5 mL of acetone, and dilute to the mark with deionized water. The mixture is shaken until homogeneous and allowed to stand for 45 minutes. Absorbance is then measured using a UV-Vis spectrophotometer. The procedure is repeated three times.

## Effect of Zn(II) on Sodium Sulfite Reductant

0.2 mL of 100 ppm Fe3+ solution is transferred into a 10 mL volumetric flask, and then varying concentrations of Zn2+ solution are added (0, 0.001, 0.002, 0.003, 0.004, and 0.005 mL). Next, add 1.1 mL of sodium sulfite solution,

1.5 mL of 1000 ppm 1,10-Phenanthroline monohydrate solution, 1 mL of pH 4.5 acetate buffer, 5 mL of acetone, and dilute to the mark with deionized water. The mixture is shaken until homogeneous and allowed to stand for 45 minutes. Absorbance is then measured using a UV-Vis spectrophotometer. The procedure is repeated three times.

## Effect of Zn(II) on Ascorbic Acid Reductant

0.5 mL of 100 ppm Fe3+ solution is transferred into a 10 mL volumetric flask, and then varying concentrations of Zn2+ solution are added (0, 0.1, 0.2, 0.3, 0.4, and 0.5 mL). Next, add 1.1 mL of ascorbic acid solution, 1.5 mL of 1000 ppm 1,10-Phenanthroline monohydrate solution, 1 mL of pH 4.5 acetate buffer, 5 mL of acetone, and dilute to the mark with deionized water. The mixture is shaken until homogeneous and allowed to stand for 45 minutes. Absorbance is then measured using a UV-Vis spectrophotometer. The procedure is repeated three times.

# RESULT AND DISCUSSION

## Determination of Maximum Wavelength

**Figure 1.** Curve for Determining the Maximum Wavelength of the [Fe(phenanthroline)3]2+ Complex with Hydroxylamine Hydrochloride as the Reducer

Figure 1 shows that the maximum wavelength of Hydroxylamine Hydrochloride is at 510 nm with an absorbance value of 0.4605. The reaction that occurs between Fe(III) and the reducer Hydroxylamine Hydrochloride is shown by the equation below:

4Fe3+(aq) + 2NH2OH.HCl(aq) ⇌ 4Fe2+ + N2O(aq) + 4H+ (aq) +H2O(l)

(aq)

(1)

**Figure 2*.*** Curve for Determining the Maximum Wavelength of the [Fe(phenanthroline)3]2+ Complex with Sodium Sulfite as the Reducer

Figure 2 shows that the maximum wavelength of Sodium Sulfite is at 510 nm with an absorbance value of 0.5055. The reaction that occurs between Fe(III) and the reducer Sodium Sulfite is shown by the equation below:

2Fe + 3Na SO ⇌ 2FeSO + Na S O + 2Na

3+ +

(aq) 2 3(aq) 4(aq) 2 2 5(aq) (aq)

(2)

**Figure 3.** Curve for Determining the Maximum Wavelength of the [Fe(phenanthroline)3]2+ Complex with Ascorbic Acid as the Reducer

Figure 3 shows that the maximum wavelength of Ascorbic Acid is at 510 nm with an absorbance value of

0.343. The reaction that occurs between Fe(III) and the reducer Ascorbic Acid is shown by the equation below: 2Fe3+ (aq) + C6H8O6 (aq) + 2H2O ⇄ 2Fe2+ (aq) + C6H6O6 (aq) + 2H3O+ (aq)

(3)

The resulting maximum wavelength will be used as a reference to test the maximum absorbance in the subsequent method. Measurements in the subsequent method are conducted at the maximum wavelength because the change in absorbance for each unit concentration is most noticeable at the maximum wavelength (9).

## Determination of Optimal Reducing Agent Concentration

**Figure 4.** Optimum Concentration Curve of Hydroxylamine Hydrochloride

Figure 4 is a curve showing the results of the optimum concentration test with Hydroxylamine Hydrochloride as the reducer, with concentration variations of 2, 3, 4, 5, and 6 ppm. Figure 4.7 shows that as the concentration increases, the absorbance value also increases. Figure 4.7 indicates that the concentration capable of optimally

reducing Fe³ to Fe² is Hydroxylamine Hydrochloride at a concentration of 6 ppm, with an absorbance value of 0.41.

**Figure 5***.* Optimum Concentration Curve of Sodium Sulfite

Figure 5 shows that the absorbance value of the 10 ppm concentration increases towards the optimum absorbance value of 0.3825 at a concentration of 20 ppm, and then the absorbance values fluctuate from 30 to 60 ppm. At a concentration of 20 ppm, Sodium Sulfite successfully reduces Fe³ to Fe² optimally with an absorbance value of 0.3825. Absorbance values below the optimum concentration absorbance value indicate that the reducer concentration used to reduce Fe³ to Fe² has not yet been completely reduced, and the formed complex compound [Fe(C H N ) ]² is still minimal because Fe³ ions are still present in the solution (10).

**Figure 6.** Optimum Concentration Curve of Ascorbic Acid

Figure 6 shows the results of the optimum concentration test of the Ascorbic Acid reducer with a linear curve, indicating that the higher the concentration of the reducer, the higher the absorbance value. This is consistent with the results of the qualitative test for the color change of the [Fe(C H N ) ]² complex shown in Figure 4.12, which shows that the higher the concentration of the reducer, the more intense the color produced. The results of the optimum concentration test of Ascorbic Acid indicate that the Ascorbic Acid reducer is able to optimally reduce Fe³ to Fe² at a concentration of 6 ppm with an absorbance value of 0.17.

## Determination of Optimal Reducing Agent Reaction Time

**Figure 7.** Optimum Time Curve of Hydroxylamin Hydrocloride

Figure 7 shows the results of the optimum time test with Hydroxylamine Hydrochloride as the reducer, with time variations from 0 to 90 minutes. The results of the optimum time test with Hydroxylamine Hydrochloride indicate that Hydroxylamine Hydrochloride is able to reduce Fe³ to Fe² with an incubation time of 60 minutes, resulting in an absorbance of 0.452.

**Figure 8.** Optimum Time Curve of Hydroxylamin Hydrocloride

Figure 8 shows the results of the optimum time test with Sodium Sulfite as the reducer, with time variations from 0 to 90 minutes. The results indicate that Sodium Sulfite requires 60 minutes with an absorbance value of 0.511 for all Fe² ions to be fully bound with the ligand 1,10-Phenanthroline and form the complex compound

[Fe(C H N ) ]² .

**Figure 9.** Optimum Time Curve of Hydroxylamin Hydrocloride

Figure 9 shows the results of the optimum time test with Ascorbic Acid as the reducer, with time variations from 0 to 90 minutes. The results indicate that Ascorbic Acid is able to reduce Fe³ to Fe² with an incubation time of 75 minutes, resulting in an absorbance of 0.452.

## Determination of Fe(II)-Phenanthroline Calibration Curve

**Figure 10.** Calibration Curve of Hydroxylamine Hydrochloride

Figure 10 shows the results of the calibration curve test for Hydroxylamine Hydrochloride with varying concentrations of Fe(NO ) ·9H O at 0, 1, 2, 3, 4, and 5 ppm. The calibration curve test for Hydroxylamine Hydrochloride resulted in the equation y=0.0698x+0.061 with R2=0.9964, R=0.9981, an intercept of 0.0061, and a slope of 0.0698. The calibration curve can be considered successful because it meets the acceptance criterion for calibration curves, which is R2 ≥ 0.995. This indicates that the calibration curve shows a good relationship between

concentration and absorbance (11). This is consistent with the Lambert-Beer Law (A=ε⋅b⋅c), which states that higher concentrations lead to higher absorbance values.

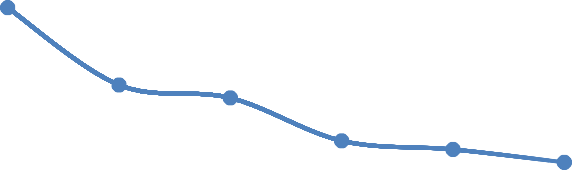
Additionally, a T-test was performed to determine H0 and H1. H0 means there is no correlation between absorbance and concentration, while H1 indicates that there is a correlation. The condition to reject H0 is ttest > ttable, while H0 is accepted if ttest < ttable. The calculated ttest for the calibration curve of Hydroxylamine Hydrochloride with 4 degrees of freedom and a 95% confidence interval is 33.27, while the ttable with 4 degrees of freedom and 95% confidence interval is 2.78. Since ttest > ttable , H0 is rejected and H1 is accepted, leading to the conclusion that there is a correlation between absorbance and concentration.

**Figure 11.** Calibration Curve of Sodim Sulfite

Figure 11 shows the results of the calibration curve test for Sodium Sulfite with varying concentrations of Fe(NO ) ·9H O at 0, 1, 2, 3, 4, and 5 ppm. The calibration curve test for Sodium Sulfit resulted in the equation y=0.0743x+0.0096 with R2=0.9965, R=0.9982, an intercept of 0.0096, and a slope of 0.0743. The calibration curve can be considered successful because it meets the acceptance criterion for calibration curves, which is R2 ≥ 0.995. This indicates that the calibration curve shows a good relationship between concentration and absorbance (11). This is consistent with the Lambert-Beer Law (A=ε⋅b⋅c), which states that higher concentrations lead to higher

absorbance values.

Additionally, a T-test was performed to determine H0 and H1. H0 means there is no correlation between absorbance and concentration, while H1 indicates that there is a correlation. The condition to reject H0 is ttest > ttable, while H0 is accepted if ttest < ttable. The calculated ttest for the calibration curve of Hydroxylamine Hydrochloride with 4 degrees of freedom and a 95% confidence interval is 33.75, while the ttable with 4 degrees of freedom and 95% confidence interval is 2.78. Since ttest > ttable , H0 is rejected and H1 is accepted, leading to the conclusion that there is a correlation between absorbance and concentration.



**Figure 12.** Calibration Curve of Ascorbic Acid

Figure 12 shows the results of the calibration curve test for Ascorbic Acid with varying concentrations of Fe(NO ) ·9H O at 0, 1, 2, 3, 4, and 5 ppm. The calibration curve test for Ascorbic Acid resulted in the equation y=0.0619x+0.0108 with R2=0.996, R=0.9979, an intercept of 0.0108, and a slope of 0.0619. The calibration curve can be considered successful because it meets the acceptance criterion for calibration curves, which is R2 ≥ 0.995. This indicates that the calibration curve shows a good relationship between concentration and absorbance (11). This is consistent with the Lambert-Beer Law (A=ε⋅b⋅c), which states that higher concentrations lead to higher

absorbance values.

Additionally, a T-test was performed to determine H0 and H1. H0 means there is no correlation between absorbance and concentration, while H1 indicates that there is a correlation. The condition to reject H0 is ttest > ttable, while H0 is accepted if ttest < ttable. The calculated ttest for the calibration curve of Hydroxylamine Hydrochloride with 4 degrees of freedom and a 95% confidence interval is 31.55, while the ttable with 4 degrees of freedom and 95% confidence interval is 2.78. Since ttest > ttable , H0 is rejected and H1 is accepted, leading to the conclusion that there is a correlation between absorbance and concentration.

## Effect Of Zn(II) On Hydroxylamine Hydrochloride Reductant

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**Figure 13.** Curve of the Effect of Zn on Hydroxylamine Hydrochloride

Pengaruh Zn terhadap Hidroksilamin

Hidroklorida

0.3500

0.3400

0.3300

0.3200

0.3100

0.3000

0.2900

0.2800

0

0.1

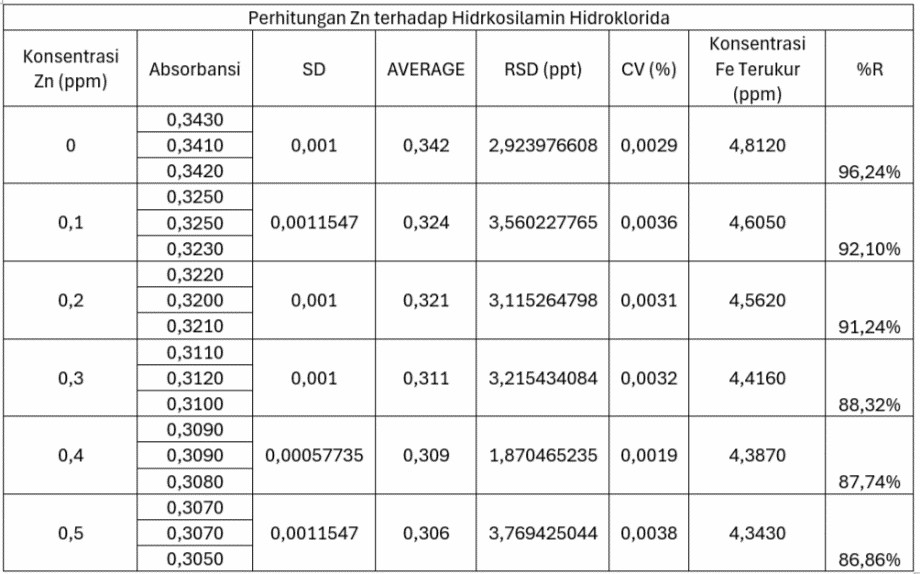
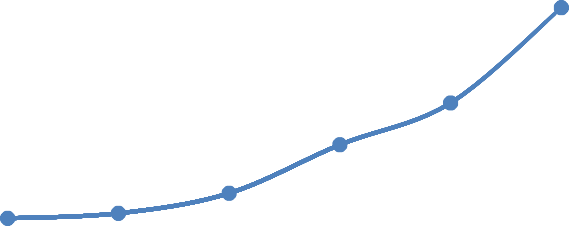
0.2

0.3

0.4

0.5

0.6



**Figure 14.** Effect of Zn² Ions on Fe(II) Phenanthroline Analysis with Hydroxylamine Hydrochloride Reducer

In the Hydroxylamine Hydrochloride reducer, Zn² ions interfere with the Fe(II) phenanthroline analysis by decreasing the absorbance value as the concentration of Zn² ions is increased. Zn² ions start to interfere with the analysis at a concentration of 0.1 ppm, with a % recovery of 92.1%, because the acceptance range for % recovery is between 95% and 105% (12).

## Effect Of Zn(II) On Sodium Sulfite Reductant

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**Figure 15.** Curve of the Effect of Zn on Sodium Sulfite

Pengaruh Zn terhadap Natrium Sulfit

0.26

0.24

0.22

0.2

0.18

0.16

0.14

0.12

0.1

0

1

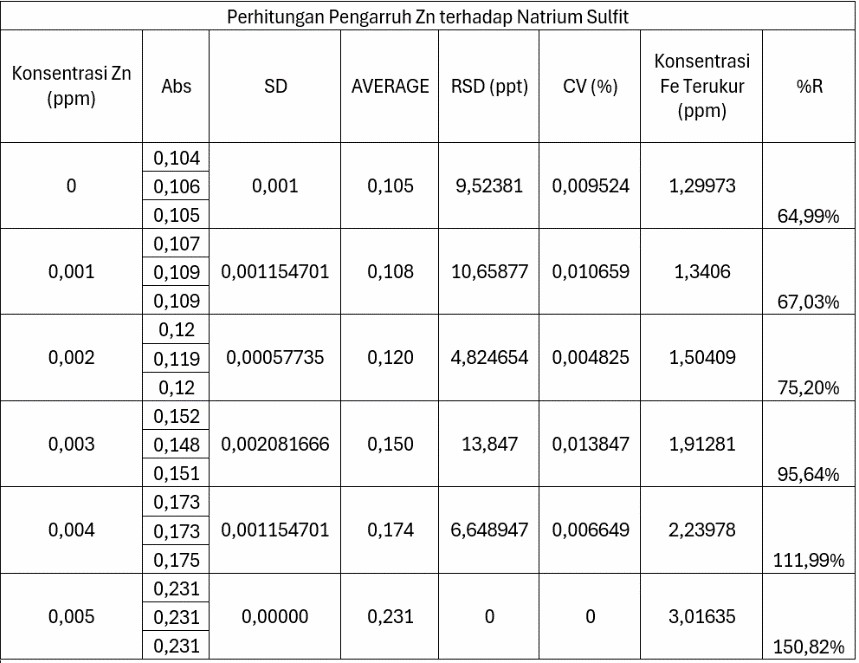
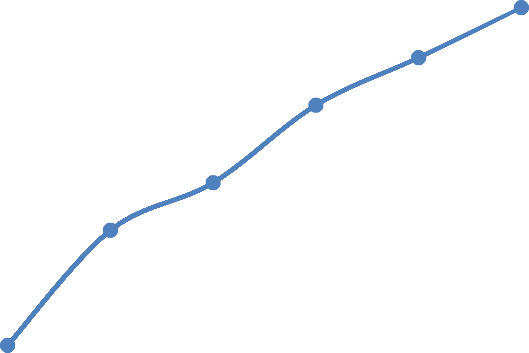
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**Figure 16.** Effect of Zn² Ions on Fe(II) Phenanthroline Analysis with Sodium Sulfite Reducer

In the Sodium Sulfite reducer, Zn² ions interfere with the Fe(II) phenanthroline analysis by increasing the absorbance value as the concentration of Zn² ions is increased. Zn² ions start to interfere with the analysis at a concentration of 0 ppm, with a % recovery of 64.99%. They do not interfere at a concentration of 0.003 ppm, with a

% recovery of 95.64%, but interfere again at a concentration of 0.004 ppm, with a % recovery of 111.99%, because the acceptance range for % recovery is between 95% and 105% (12).\

## Effect Of Zn(II) On Ascorbic Acid Reductant

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**Figure 17.** Curve of the Effect of Zn on Ascorbic Acid

Pengaruh Zn terhadap Asam Askorbat

0.34

0.32

0.3

0.28

0.26

0.24

0.22

0.2

0

1

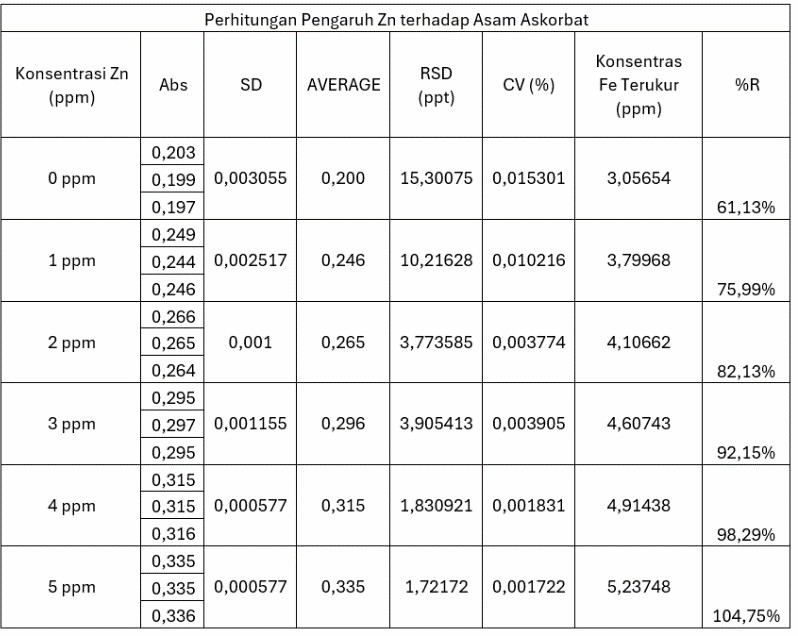
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**Figure 18.** Effect of Zn² Ions on Fe(II) Phenanthroline Analysis with Ascorbic Acid Reducer

In the Ascorbic Acid reducer, Zn² ions interfere with the Fe(II) phenanthroline analysis by increasing the absorbance value as the concentration of Zn² ions is increased. Zn² ions start to interfere with the analysis at a concentration of 3 ppm, with a % recovery of 92.15%, because the acceptance range for % recovery is between 95% and 105% (12).

# CONCLUSION

Based on the research results, it can be concluded that Zn² ions can affect the Fe(II) phenanthroline complex, as evidenced by a decrease in absorbance in the Hydroxylamine Hydrochloride reducer and an increase in absorbance in the Sodium Sulfite and Ascorbic Acid reducers with increasing concentrations of Zn² added. Zn² in the Hydroxylamine Hydrochloride reducer starts to interfere at a concentration of 0.1 ppm with a % recovery of 92.1%. Zn² in the Sodium Sulfite reducer begins to interfere at concentrations from 0 ppm to 0.02 ppm with % recoveries of 64.99%, 67.03%, and 75.20%, and interferes again at concentrations of 0.004 ppm and 0.005 ppm with

% recoveries of 111.99% and 150.82%, respectively. Zn² in the Ascorbic Acid reducer starts to interfere at concentrations from 0 ppm to 3 ppm with % recoveries of 61.13%, 75.99%, 82.13%, and 92.15%, respectively. At the optimum conditions for each reducer, Hydroxylamine Hydrochloride is found to be more stable and efficient in reducing Fe³ compared to the other reducers.

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