



Determination of Iron Concentration in Water Sources from SSC Oil company by Titration Method

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Abstract

The determination of iron concentration in water that passes through wastewater treatment systems and water sources within factories is crucial, as iron is a heavy metal that affects both aquatic ecosystems and human health. This study aimed to determine the concentration of total iron (Fe) in water sourced from SSC Oil company. Water samples were collected from three locations: after chemical coagulation, after complete treatment, and groundwater around the factory. The analysis was conducted using the titration method following the Thai Industrial Standard TIS 2391 – 2551, where total iron was titrated with a potassium dichromate solution. Each sample was tested 11 times. The test results showed that the average iron concentrations in % (w/v) were 0.52, 0.22, and 0.13, respectively, with variance coefficients of 8.48, 10.59, and 18.54, respectively. When comparing the results with Atomic Absorption Spectrometry (AAS) and using the z-score, the values for the chemical coagulation water, the fully treated water, and the groundwater were 11.79, 9.42 and 5.36, respectively. The findings showed significant differences, likely due to the lower accuracy of the titration method, which is more suitable for analyzing iron in samples with medium to high concentrations, or potential interference from ions or other chemicals reacting with the reagent.

Introduction

SSC Oil Company is an industrial facility that specializes in waste disposal, including the treatment of oil that may be contaminated with heavy metals. One of the heavy metals that could be present is iron. Therefore, the laboratory aims to develop its capability in analyzing and determining the iron concentration in water.

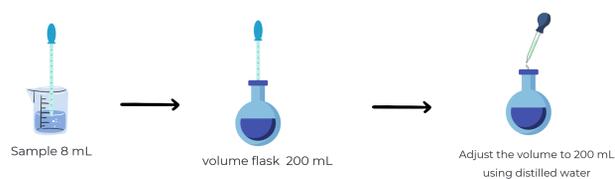
This study is based on the standard Thai Industrial Standard TIS 2391 – 2008, using the titration technique with a potassium dichromate solution. Additionally, the results from this analysis were compared with those obtained using the advanced technique of Atomic Absorption Spectrometry (AAS), which allows for precise measurement of iron concentration. Statistical values were used as criteria for evaluating the results.

Objectives

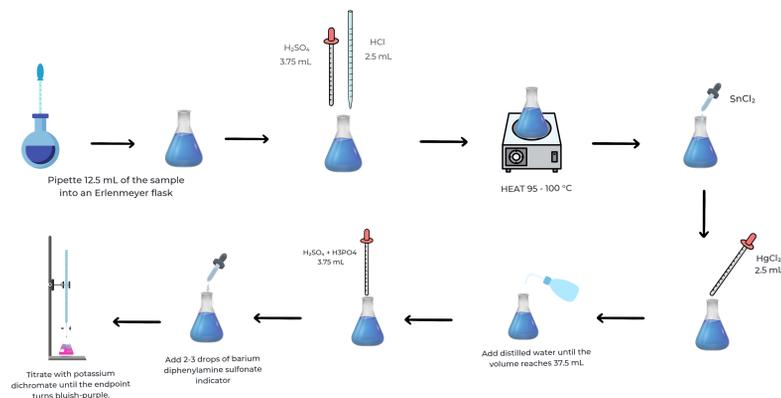
1. To prepare a Work Instruction (WI) for the determination of Total Iron in water using the Titration Technique.
2. To assess the accuracy of the titration method for determining iron content in water.

Methodology

1. Sample preparation



2. Experiment



Acknowledgement

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Results

Table 1. Total iron content determined by titration with potassium dichromate solution.

Times		1	2	3	4	5	6	7	8	9	10	11	average
total iron (%(w/v))	effluent of chemical coagulation	0.50	0.56	0.50	0.50	0.50	0.61	0.44	0.50	0.50	0.56	0.50	0.52
	effluent of biological treatment	0.24	0.24	0.18	0.24	0.18	0.24	0.24	0.24	0.24	0.24	0.24	0.22
	monitoring water	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.17	0.12	0.12	0.17	0.13

Table 2. Statistical analysis results of total iron quantification.

samples	Average total iron (%(w/v))	CV (Coefficient of Variation)	Total iron from AAS (%(w/v))	Z - score
effluent of chemical coagulation	0.52	8.48	0.000169	11.79
effluent of biological treatment	0.22	10.59	0.00036	9.42
monitoring water	0.13	18.54	0.000819	5.36

Conclusion

The determination of Total Iron concentration in water using the titration method with potassium dichromate showed that the iron concentration in the samples exhibited moderate to high variability. This reflects process instability or potential interference from other substances present in the water. When compared to the highly accurate Atomic Absorption Spectrometry (AAS) method, the titration results showed high z-score values, indicating a significant deviation from the true values and a tendency to overestimate iron concentration. Although the titration method can be used to estimate iron levels in water, its limitations in accuracy may affect the reliability of the results. Therefore, for higher precision, more stable and reliable analytical techniques such as AAS should be used.

Reference

Thai Industrial Standards Institute. Thai Industrial Standard for Ferric Chloride Solution (TIS 2391-2551). Bangkok: Ministry of Industry; 2008.