

# CHEM 101 Laboratory 4

## Lab Report 4

### Abstract

In this experiment, standard solutions of salicylic acid were prepared by diluting a stock iron nitrate solution with various volumes of salicylic acid solution and distilled water in 25.00 mL volumetric flasks. Different aliquots of the iron nitrate and salicylic acid solutions were mixed to create three distinct standard solutions (#1, #2, and #3) with known concentrations of salicylic acid. The resulting solutions were noted for their respective colors. Additionally, a blank solution was prepared using only the iron solution and distilled water. This procedure enabled the precise formulation of standard solutions, providing a foundation for further quantitative analysis of salicylic acid concentration <sup>[1]</sup>..

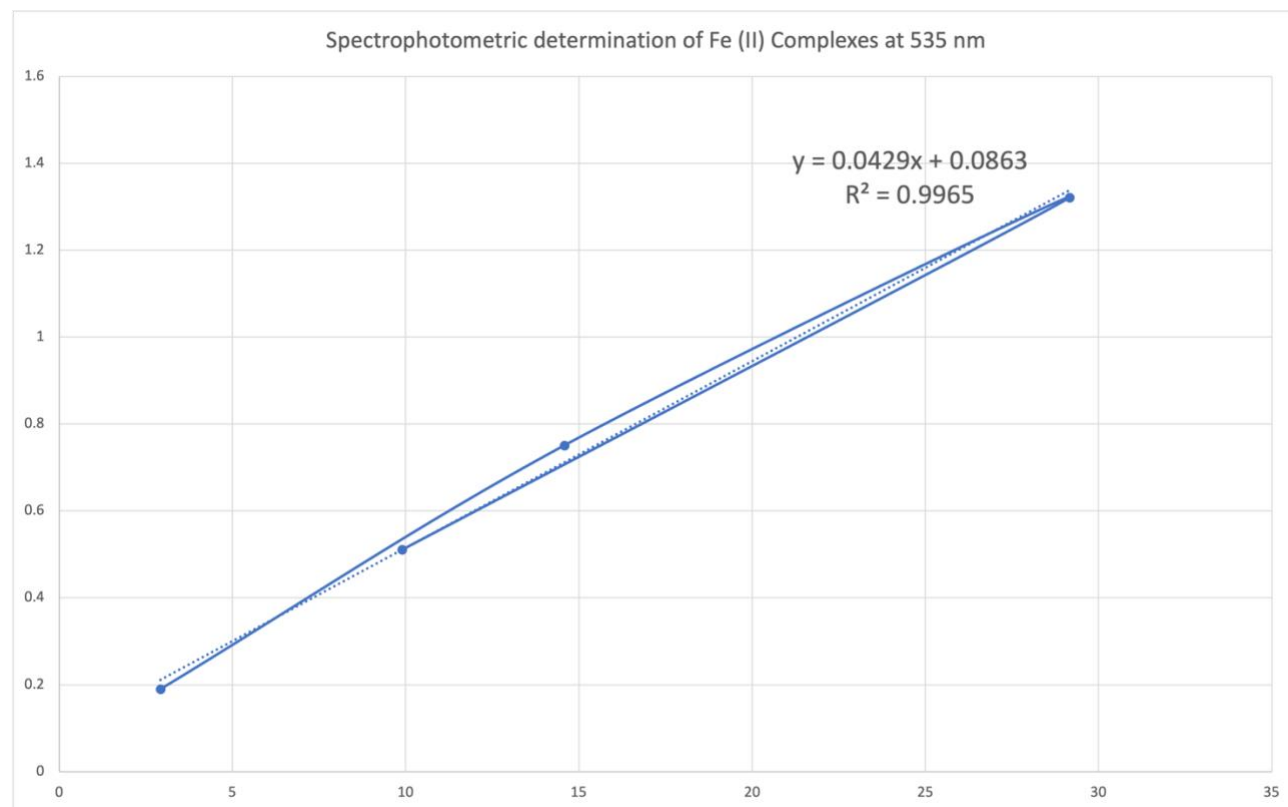
### Procedure

In the experimental procedure, a stock iron nitrate solution was initially measured, and 5.0 mL aliquots of this solution were added to separate 25.00 mL volumetric flasks. Similarly, a stock salicylic acid solution was measured, and 1.00 mL, 5.00 mL, and 10.00 mL aliquots (SA Solution) were transferred into three different 25.00 mL volumetric flasks, respectively. Distilled water was added to each flask to reach the mark, creating standard solutions #1, #2, and #3 with known concentrations of salicylic acid. The color of each solution was noted. Additionally, a blank solution was prepared by adding distilled water to a 25.00 mL volumetric flask containing only the iron solution. This experiment allowed the creation of three distinct standard solutions with specified concentrations of salicylic acid by diluting the stock solution in volumetric flasks and noting the resulting colors of the solutions.

**Figure 1:** Calibration Curve for absorbance of 535 nm vs Concentration of Salicylic Acid Solution

## Data/ Results

Concentration (M)	$2.916 \times 10^{-3}$	$14.58 \times 10^{-3}$	$29.16 \times 10^{-3}$	$9.899 \times 10^{-3}$
Absorbances	0.190	0.751	1.321	0.511
Volume of SA (L)	$1 \times 10^{-3}$	$5 \times 10^{-3}$	$10 \times 10^{-3}$	$1.5 \times 10^{-3}$
Moles of SA (moles)	$2.916 \times 10^{-6}$	$7.29 \times 10^{-5}$	$2.916 \times 10^{-4}$	$1.48 \times 10^{-5}$
Mass of SA (g)	$0.0085 \times 10^{-3}$	$0.21 \times 10^{-3}$	$0.850 \times 10^{-3}$	<b><math>4.33 \times 10^{-5}</math></b> in 0.3 mL Acne <b><math>1.4433 \times 10^{-4}</math></b> in 1 mL Acne
Mass of Acne Cleaner (g)	N/A	N/A	N/A	0.2883
Percentage of mass of SA in Acne Cleanser	N/A	N/A	N/A	0.05%



Variations in SA Concentrations (mmole/L): 9.899 M, 9.853 M, 9.783 M  
 Variations in SA moles =  $1.48 \times 10^{-5}$ ,  $1.477 \times 10^{-5}$ ,  $1.467 \times 10^{-5}$   
 Variations in SA mass in 1 mL Acne =  $1.4433 \times 10^{-4}$ ,  $1.4366 \times 10^{-4}$ ,  $1.4264 \times 10^{-4}$   
 Variations in % SA mass = 0.05006 %, 0.049829 %, 0.049475%

Average % mass= 0.049788  
 Standard Deviation = 0.000295  
 %RSD = 0.592 %

## Algebraic Equations

$$\text{Molarity, } M = \frac{\text{number of moles (m)}}{\text{Volume of Solution (L)}}$$

$$\text{Moles, } m = \text{Concentration} \times \text{Volume}$$

$$\text{Amount, } \text{Mass} = \text{Molar Concentration} \times \text{Moles}$$

$$\text{Density, } \rho = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Mean, } \mu = \frac{\sum x_i}{N}$$

$$\text{Standard Deviation, } \sigma = \frac{\sqrt{\sum (x_i - u)^2}}{N}$$

$$\%RSD, \quad \% \sigma = \frac{\text{Standard Deviation}}{\text{Mean}}$$

## Discussions

In this experiment, the precise preparation of standard solutions yielded an average percentage mass of salicylic acid in the acne cleanser at 0.049788%, with a minimal standard deviation of 0.000295 and a %RSD of 0.592.

## Conclusions

This experiment successfully demonstrated the meticulous preparation of standard solutions of salicylic acid through precise dilution techniques. The careful measurement of volumes and the observation of distinct colors in the

resulting solutions emphasized the importance of accuracy in analytical chemistry. The inclusion of a blank solution provided a reliable reference, enabling accurate differentiation of color changes. The calculated average percentage mass of salicylic acid in the acne cleanser was found to be 0.049788%, with a low standard deviation of 0.000295 and a %RSD of 0.592%. These results affirm the experiment's reliability and showcase the significance of meticulous preparation in quantitative analyses, laying a solid foundation for further research and applications in chemical analysis.

## **References**

[1] Department of Chemistry, Faculty of Science, "Chem Lab Manual Fall 2023", pp. 27-35