Determination of molecular formula of a compound using spectroscopy

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Introduction

- My project: Find out molecular formula of ferric salicylate
- I used Job's method for doing this experiment.

Job's Method

- Method of continuous variation.
- Dependent on validity of Beer's Law

$$A = \log I_0/I$$

and

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- We vary the concentration of Fe^{3+} and salicylic acid so that $[Fe^{3+}]$ + [Salicylic acid] is constant.
- . . . in the ratios 1:9, 2:8, 3:7, . . . 9:1.
- Get spectral scans 400 nm - 650 nm; visible region
- See peaks; plot absorbance vs composition of solution.
- Maxima gives us molecular composition!

Procedure

What I used

A Spectrophotmeter, Ferric Nitrate, Salicylic Acid, Glass beakers (100 mL), Round bottomed flasks (3)

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Stocks showed negligible absorbance.

Procedure *contd.*

- Mix stocks $\longrightarrow$ purple colour. Complex formation.

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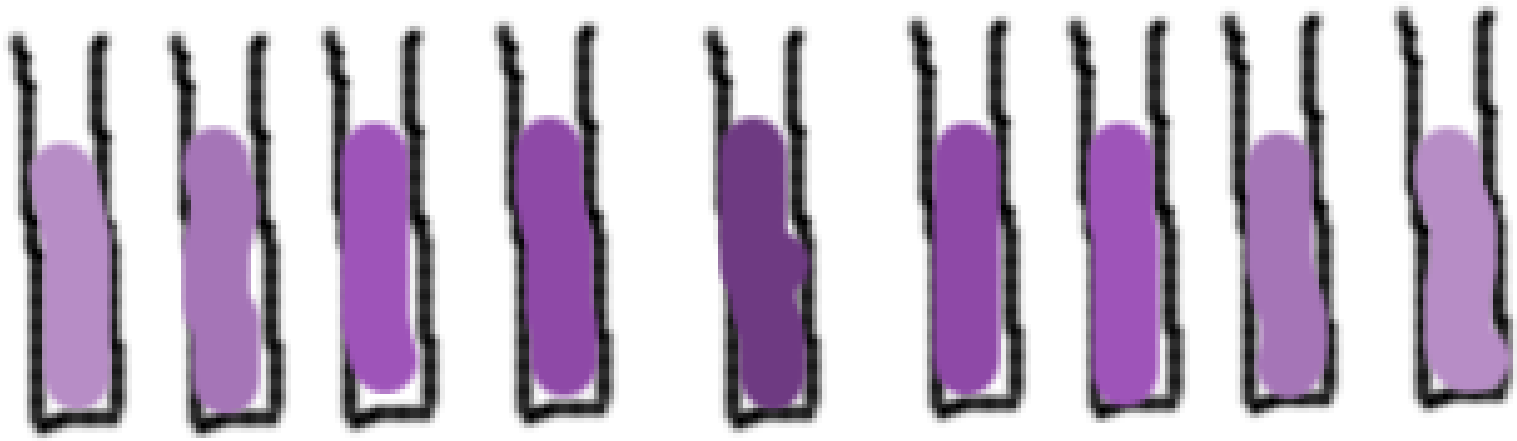
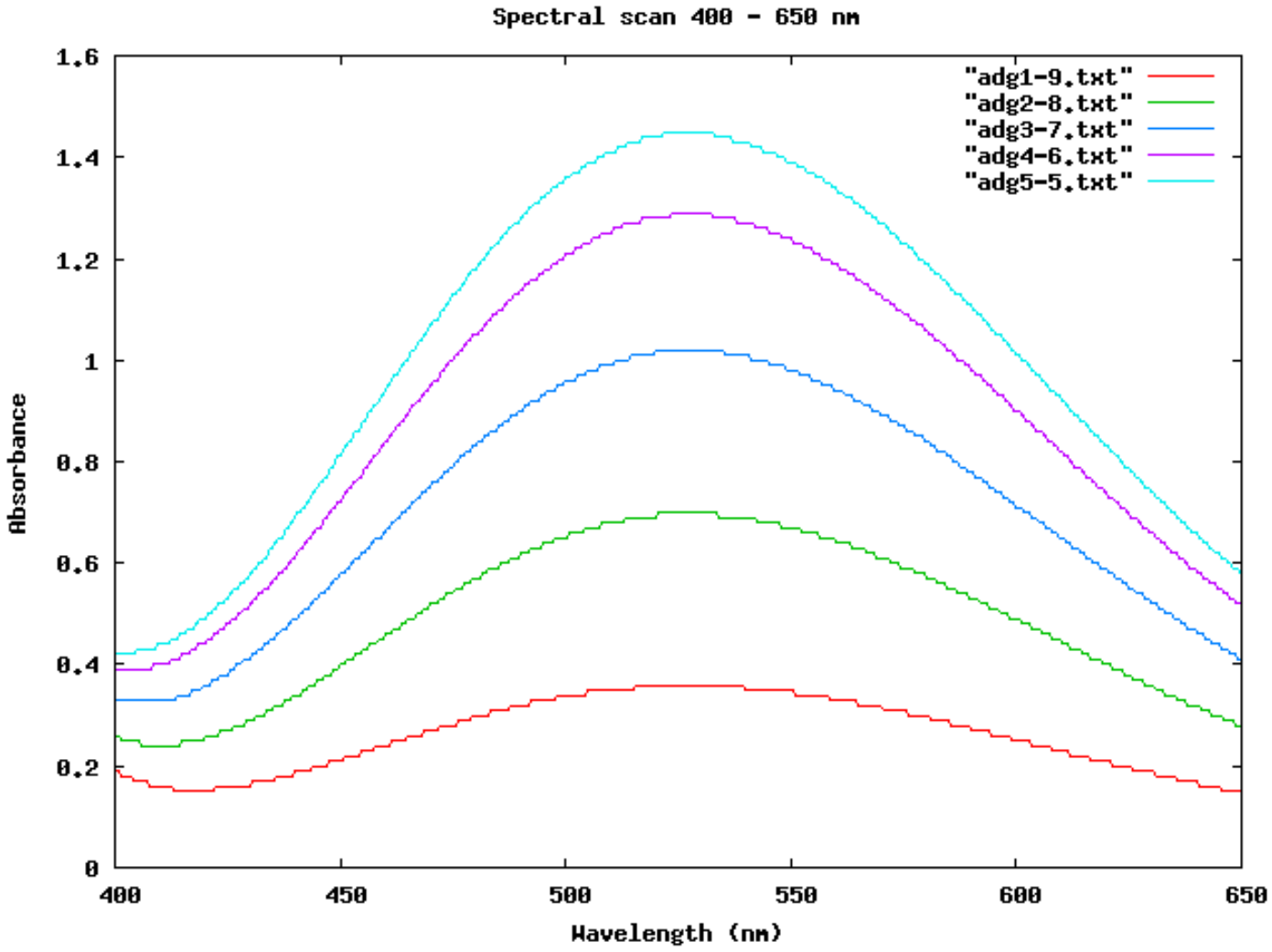
- 9 compositions taken: varying from 10 percent to 90 percent of Ferric nitrate.

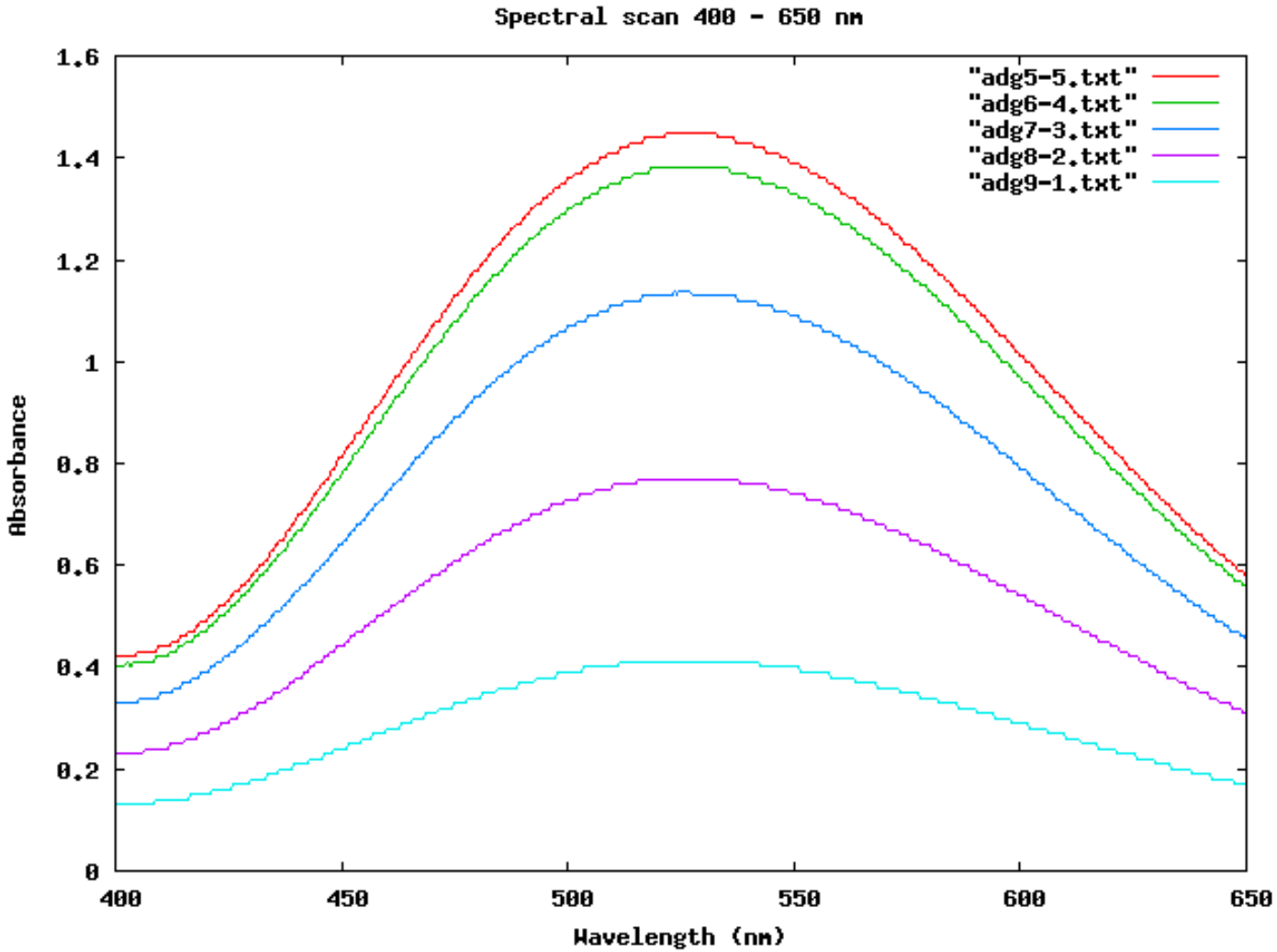


- Spectral scan of visible region.

Spectra


Spectral scan 400 - 650 nm
"adg1-9.txt"
"adg2-8.txt"
"adg3-7.txt"
"adg4-6.txt"
"adg5-5.txt"
Absorbance
Wavelength (nm)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
400
450
500
550
600
650

Spectra


Spectral scan 400 - 650 nm
"adg5-5.txt"
"adg6-4.txt"
"adg7-3.txt"
"adg8-2.txt"
"adg9-1.txt"
Absorbance
Wavelength (nm)
1.6
1.4
1.2
1
0.8
0.6
0.4
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0
400
450
500
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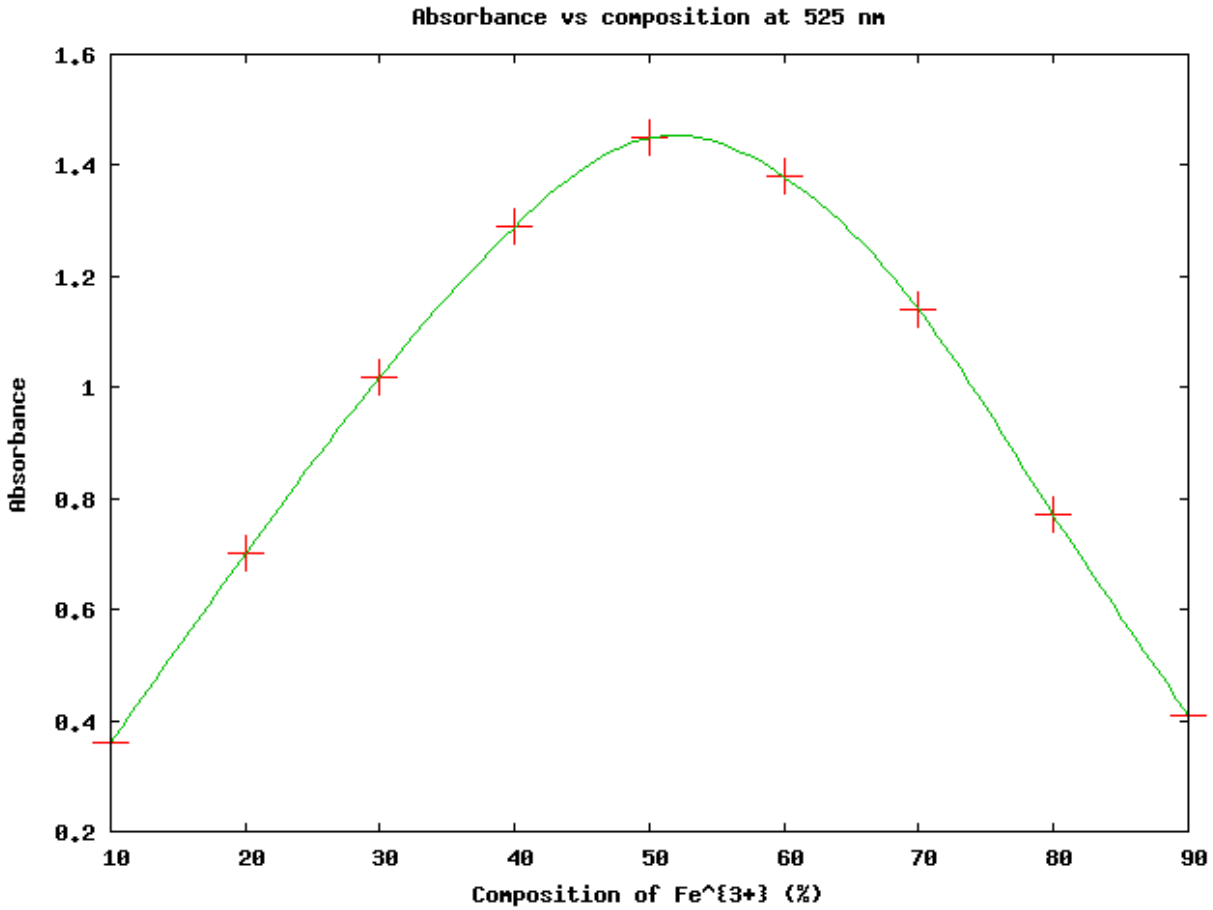

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- Spectral data should be in range where Beer's law is valid; otherwise we absorbance will not have a linear relationship with concentration.

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- Spectral data should be in range where Beer's law is valid; otherwise we absorbance will not have a linear relationship with concentration.

..and so my project ended.

Other things that could be done

The stability constant

... is given by

$$K = \frac{[complex]}{[Fe^{3+}][Sal]}$$

We already know [Fe^{3+}] and [Sal]; if we could find out the extinction coeffient ε for [complex], then we would be done.

Acknowledgements

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