

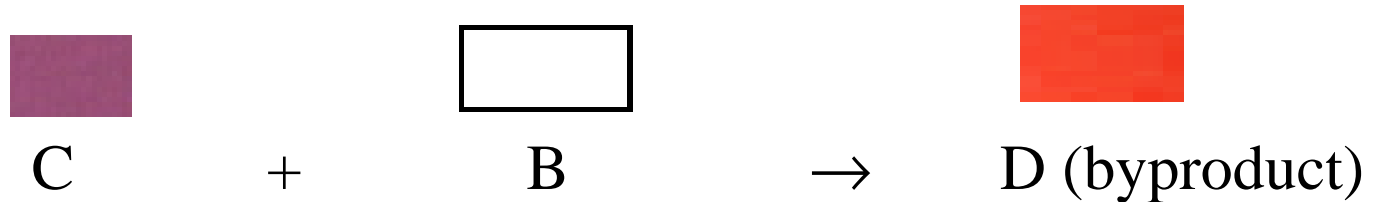
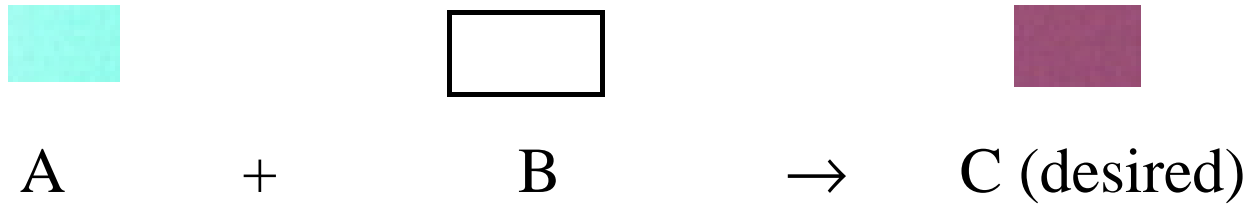
Mixing Diagnostics for Formation of Byproducts

Min Zhan

Department of Chemistry
University of Texas at Dallas

Concept

Formation of Byproduct (FOB)



Concept

- Metal ion Nickel(II) react with ligand 2,2'-bipyridine to form complexes
- Complexes with different coordination numbers have different colors
- Model of formation of byproduct (FOB) is set

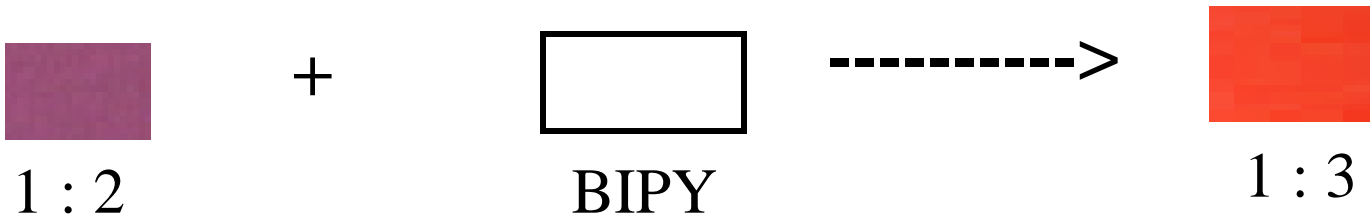
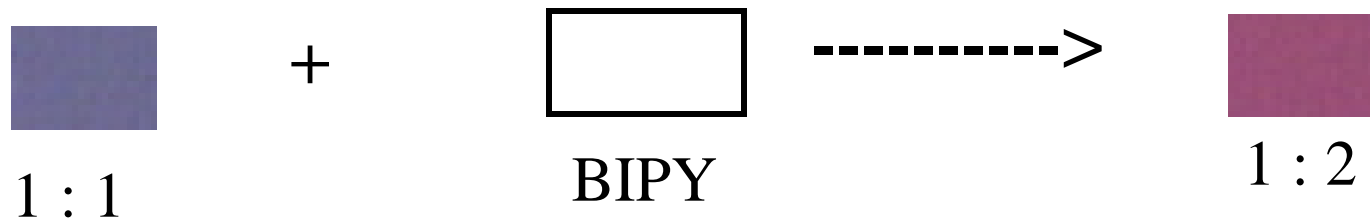
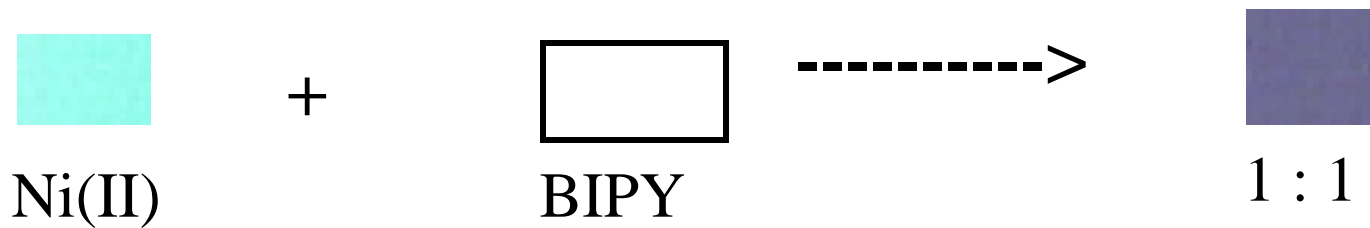
Concept

- Requirements for FOB model
- All chemicals should be safe and cheap
- Reaction time should be considered
- Great color difference between the product and the byproduct

Reactions

- $\text{Ni}^{2+} + \text{Bipy} \rightarrow \text{Ni}(\text{Bipy})^{2+}$ (blue)
- $\text{Ni}(\text{Bipy})^{2+} + \text{Bipy} \rightarrow \text{Ni}(\text{Bipy})_2^{2+}$ (purple)
- $\text{Ni}(\text{Bipy})_2^{2+} + \text{Bipy} \rightarrow \text{Ni}(\text{Bipy})_3^{2+}$ (red)

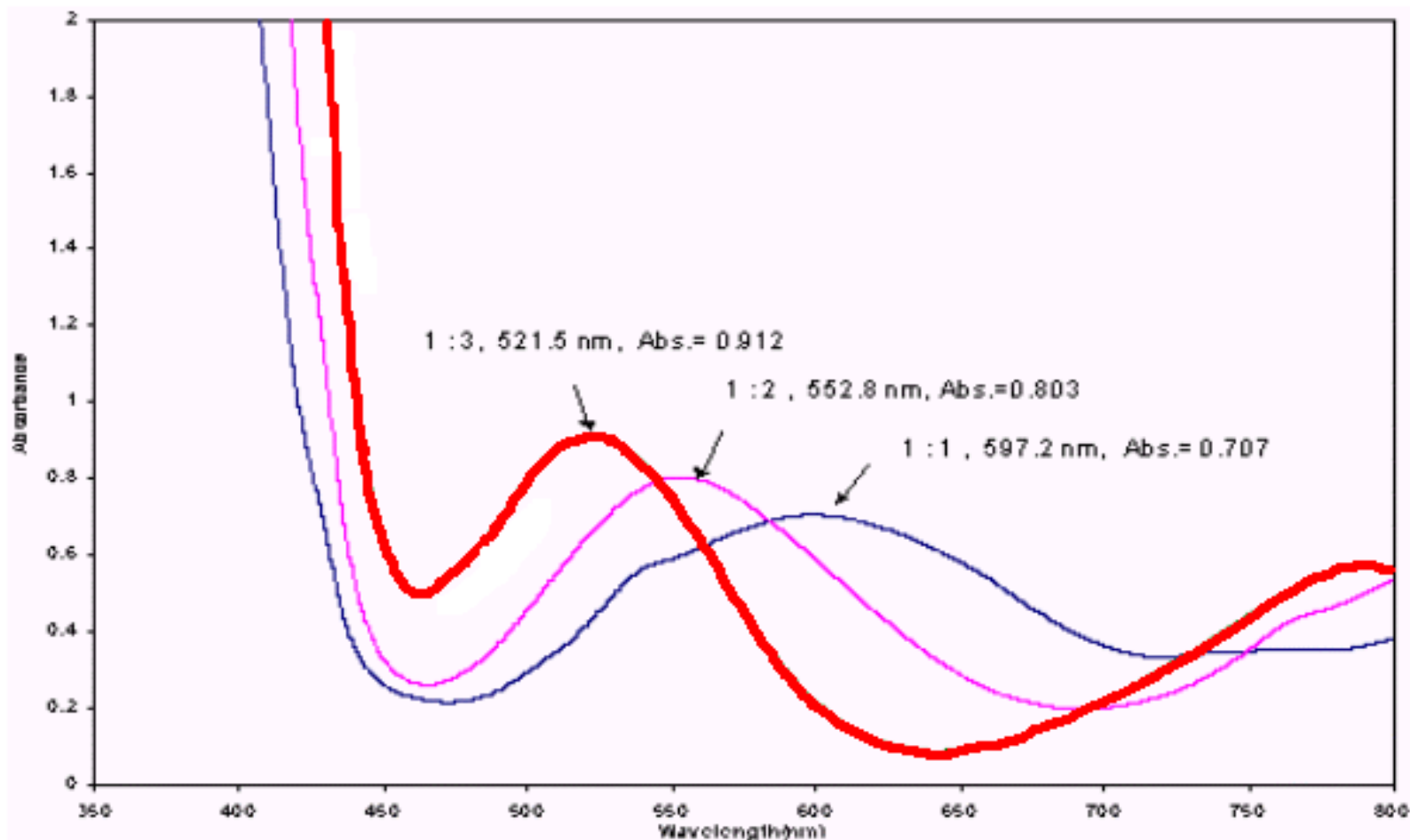
Reactions



Experimental

- Make up 0.200 M Nickel Sulfate 30% (v/v) Ethanol solution
- Make up 0.200 M 2,2'-Bipyridine 30% (v/v) Ethanol solution
- Mix them with different ratios

UV-vis absorption of 0.200 M Ni(II) with 0.200 M Bipy in 30% (v/v) Ethanol with different ratio



Bipy

Ni(II)

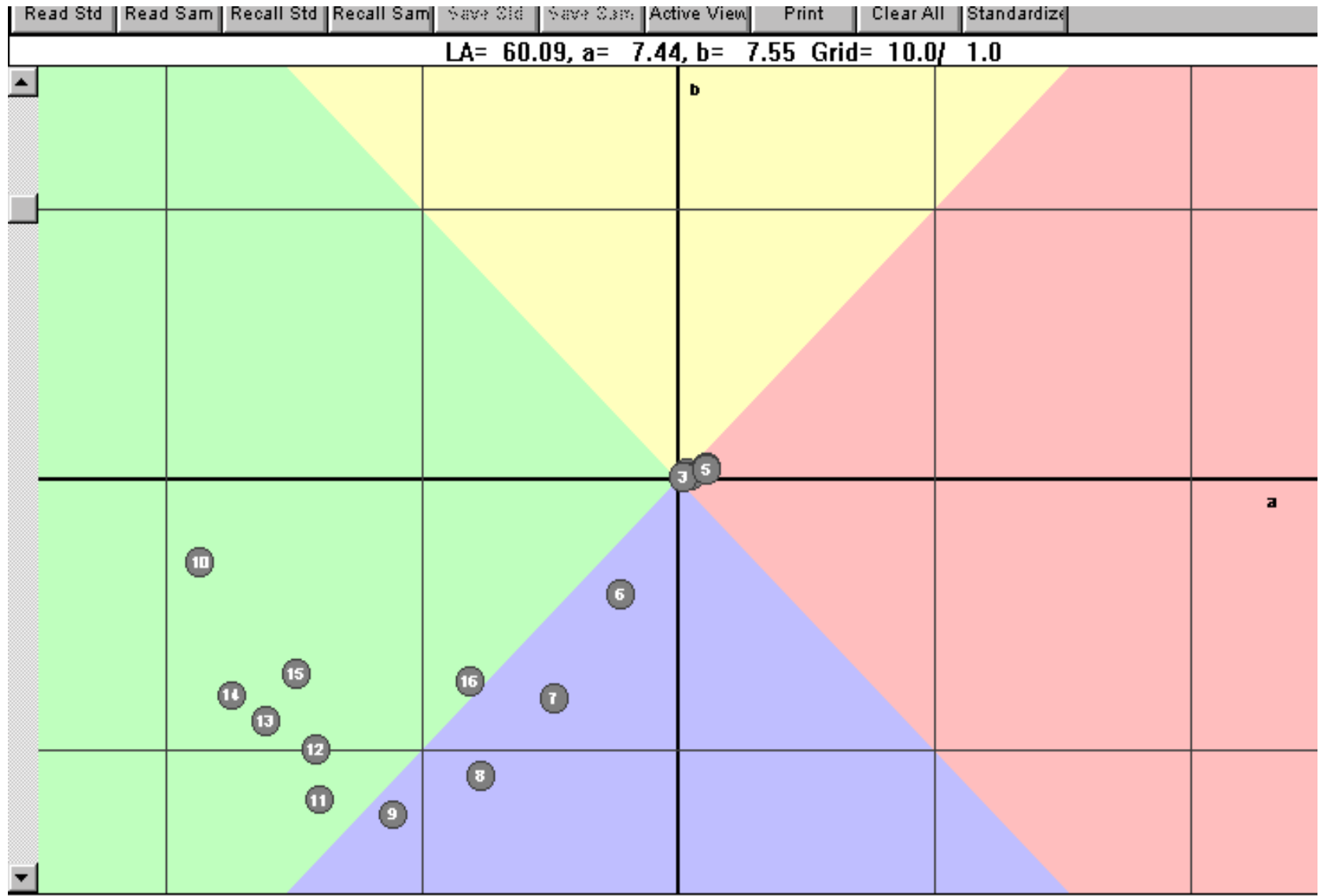
1 : 1

1 : 2

1 : 3



CIELAB Analysis



Mixing Process



Advantages of the FOB Model

- Nickel sulfate and Bipyridine are safe and cheap
- Easy to tell the complexes color (blue, purple, red)
- Easy to control reactions (reaction time longer than 30 seconds)

Conclusion

- System of Nickel bipyridine complexes is a good model for the formation of byproducts

Acknowledgment

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