Chem 1112 Spectrometry Dye Solution Preparation	Identifier: CSP-0017 Revision: 0 Page: 1 of 4

ISU Chemistry Department	Stockroom Procedure	Effective Date: 10/01/2019

1. INTRODUCTION

This procedure provides guidance in the preparation of dyed water solutions for the CHEM 1112 spectrometry laboratory experiment.

2. PRECAUTIONS AND LIMITATIONS

2.1. Food coloring is able to stain clothes

2.2. Orient the cuvette with its frosted sides facing the front and rear of the instrument.

3. APPARATUS AND MATERIALS

3.1. Spectronic™ 200 Spectrophotometer

3.2. Plastic cuvettes

3.3. 2L beaker

3.4. 4L beaker

3.5. 4L carboy

3.6. Glass stir rod

3.7. Transfer pipettes, any size

3.8. Waste beaker, around 150 mL

3.9. Wash bottles

3.10. Paper towels

3.11. Label maker

3.12. Clear packing tape

4. REAGENTS

4.1. Water

4.2. Food coloring

5. INSTRUCTIONS

5.1. Getting water

5.1.1. Measure 2L of DI water in the 2L beaker.

5.1.1.1. Pour the water into the 4L beaker.

5.1.2. Repeat steps 5.1.1. and 5.1.2.

5.2. Dying the water

5.2.1. Add approximately 50 drops of dye to the 4L of water.
5.2.1.1. Record the exact amount of drops added.
5.2.2. Stir the water with a glass stirring rod until it is a homogenous solution.

5.3. Preparing the Spectrophotometer for operation
5.3.1. Turn on the spectrophotometer.
5.3.2. Remove any cuvette in the sample compartment.
5.3.3. Close the lid.
5.3.4. Wait for the instrument to finish its series of self-tests.

5.4. Select the correct settings
5.4.1. Select SPEC 200E Modern Interface.
5.4.2. Use the UP, DOWN, LEFT, RIGHT arrows to toggle between the options.
5.4.2.1. Switch the Measurement Mode to Abs.
5.4.2.2. Change Measurement λ to the proper wavelength with the knob.

Note: Every color absorbs at a different wavelength. In this procedure, *λ for the blue dye is 631 nm, and λ* for the yellow dye is 427 nm.

5.4.3. Select GO.
5.4.3.1. Press Enter.

5.5. Running Samples
5.5.1. Blanking the instrument
5.5.1.1. Place a cuvette with DI water in the sample stage.
5.5.1.2. Press the AUTOZERO button.
5.5.1.3. Wait for the autozero to finish.
5.5.2. Press ENTER to freeze data collection.
5.5.3. Open the sample compartment.
5.5.3.1. Remove the blank cuvette from the sample chamber.
5.5.3.2. Put it to the side.
5.5.4. With a transfer pipette, fill an empty cuvette with the dyed water.
5.5.4.1. Put it in the sample compartment.
5.5.4.2. Close the lid.

5.5.5. Press ENTER to resume data collection.
5.5.6. Record the Abs next to the amount of food coloring added.

Note: *The ABS needs to be between 1.5 and 2 for both colors of water.*

5.6. Increasing the Abs value
5.6.1. Add drops of food coloring to the water.
5.6.1.1. Record the new total drops added.
5.6.2. Repeat steps 5.5.4. - 5.5.6. until the desired abs is reached.

5.7. Decreasing the Abs value
5.7.1. Pour out 100mL of dyed water.
5.7.2. Add 100mL of pure DI water.
5.7.3. Repeat steps 5.5.4. - 5.5.6.
5.7.4. If the Abs still needs to be decreased, repeat steps 5.7.1. - 5.7.2.

5.8. Finishing
5.8.1. Transfer the dyed water with the correct Abs to a 4L carboy.
5.8.2. Label the carboy.
5.8.2.1. Apply a piece of clear tape to the carboy.
5.8.2.2. Print a label with the correct concentration (see 6.1.).
5.8.2.3. Apply the label above the clear tape.
5.8.2.4. Put an additional piece of tape over the label.

5.9. Cleanup
5.9.1. Rinsing cuvettes
5.9.1.1. Squirt DI water into the cuvettes.
5.9.1.2. Empty the cuvette into a waste beaker.
5.9.1.3. Repeat 5.8.1.1. - 5.8.1.2. two times.
5.9.1.4. Put the cuvette upside down on a paper towel.
5.9.2. Pour the contents of the waste beaker down the drain.
5.9.3. Rinse all glassware DI water three times
5.9.4. Throw all other used materials in the trash.

6. Calculations

6.1. Beer's Law

$$Abs = \varepsilon\, b\, c$$

Where:

ε = Molar absorptivity

b = path length = 1 cm

c = concentration in Molarity

Note: *The molar absorptivity constant changes for every solution. In this procedure, it is equal to* 1.3×10^5 *for the blue dye, and* 2.73×10^4 *for the yellow dye.*

$$c = \frac{Abs}{\varepsilon\, b}$$