Chem 122 **Instrumental Analysis** **Fall 2010**

Laboratory #2
Estimation of Copper in a Water Sample

Your second laboratory assignment is to *develop* a method for the quantitative determination of dissolved copper in tap water based on a technique utilizing ultraviolet/visible molecular absorption spectrometry.

The concentration of dissolved copper in tap water is expected to be in the range of 0.05 to 1.2 ppm (0.8 to 18 μM). A spectroscopic technique is required to determine the concentration at these levels. Your job is to employ an organic ligand to chelate copper and form a complex with a high molar absorptivity in the visible or near UV region of the electromagnetic spectrum. Clearly, you need to utilize a charge-transfer (CT) band to estimate the concentration of copper in the tap water sample.

For example, it has been reported that Cu(II) forms a colored complex with diethyldithiocarbamate, a ligand which is fairly specific for Cu(II) at pH 7 to 8. Other potential organic ligands that form colored complexes with either Cu(II) or Cu(I) include bathocuprine (and its derivatives), bicinchoninate and cuproizone.

Prior to your actual experiment, you must choose a ligand (reagent), outline a proposed analytical approach, and discuss this choice with one of the TAs during their office hours. You must pass this oral pre-lab prior to the beginning of the lab period you wish to begin collecting data.

Once you have completed the above, you need to incorporate the following as part of your method development:

1. Obtain a "hands on" working knowledge of the spectrophotometer.
2. Collect the absorption spectrum of the copper complex of the ligand you have selected. You also need the spectrum of the reagent itself in the same solvent.
3. Investigate any potential interferences and if present, how to correct them.
4. Determine the optimal nominal wavelength for your method.
5. Obtain the working curve and select a working range for your method.
6. Determine the molar absorptivity of the complex at your optimal, nominal wavelength.
7. Determine the sensitivity of your method.
8. Determine the detection limit and lower limit of detection of your method.
9. Determine the concentration of copper in the unknown tap water.
10. Determine the precision of your technique for the determination of copper in tap water.
11. Determine the concentration of copper in the pond water that contains humic material.
12. Determine how to handle the proper disposal of both unused reagents and reaction products.