Using Ferene S (a.k.a. PDFST) for Spectrophotometric Determination of Iron in Abandoned Mine Drainage and Other Natural Waters and Products… and Possibilities for Exposing Undergraduates to the Scientific Research Experience

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Abstract

This paper describes a joint faculty-student effort to study the organic molecule 3-(2-pyridyl)-5,6-diphenyl-1,2,4-triazine sodium salt (Ferene S, abbreviated PDFST in our laboratory) for use in the spectrophotometric determination of iron. A number of our students have also investigated the use of Ferene S as a vehicle to introduce students to the scientific research process. The following presentation will endeavor to address these objectives.

Experimental

Preparation and Optimization: There are some steps involved with spectrophotometric determination of iron (1, 4-6). These are: 1) preparing an absorbance-concentration curve, and perform linear regression analysis; 2) plotting absorbance vs. concentration of Fe in solution, dilution and 3) volume; following spectrophotometric determination of iron. Wavelength of maximum absorbance: 580 nm for the Per-Fe(II) chelate from 300-800 nm (400-700 nm the instrument has no capability) and 580 nm for the water-soluble Ferene S. 3) adjusting the pH of the analysis solution to that required for optimum color formation, F (aqueous phase) standard solution, hydroquinone solution, and sodium acetate. 4) generating an absorbance-concentration curve, and perform linear regression analysis; 5) plotting absorbance vs. concentration of Fe in solution, dilution and 5) volume; following spectrophotometric determination of iron.

Absorbance-concentration (Beer’s Law) relationship for the Fe(II)-Ferene S chelate: Prepare a series of at least eight reagent blanks consisting of sodium acetate in the absence and presence of Fe(II)-Ferene S chelate. Perform a series of at least eight reagent blanks consisting of sodium acetate in the presence of Fe(II)-Ferene S chelate.

Results

The stoichiometry of the iron(II)-Ferene S chelate (Figure 2), and pH range for optimum color formation (Figure 3), are logical steps associated with the determination of iron(II) in Fe(II)-Ferene S and UV-VIS. Coupled with a relatively inexpensive UV-VIS spectrophotometer or simple colorimeter, one would have a portable method for field use.

Discussion

The compound known as Ferene S (3-(2-pyridyl)-5,6-diphenyl-1,2,4-triazine sodium salt, abbreviated PDFST in our laboratory) is a pyridyl and triazine-containing (“Feerene”) ligand capable of forming highly charged, highly absorbing complexes with iron. Its chelate properties are similar to those of Ferene S (3-(2-pyridyl)-5,8-bis(phenyl)-1,2,4-triazine sodium salt, 1,1,1-triphenyl, and analogous iron(III) chelate). The most popular use of Ferene S has been as a highly sensitive agent for detection of iron(II) in the electroanalytical detection of iron(II) in natural waters and simple water samples. The resin maker reported a specific heat capacity of the chelate formed by Ferene S (10 g oFerene S/L oFerene S) to be 1,000 g/L, 100 g/L, and 10 g/L Fe(II) for aqueous phases, respectively. It is possible to use the aqueous phases, respectively.

This paper describes a joint faculty-student effort to study the organic molecule 3-(2-pyridyl)-5,6-diphenyl-1,2,4-triazine sodium salt (Ferene S, abbreviated PDFST in our laboratory) for use in the spectrophotometric determination of iron. A number of our students have also investigated the use of Ferene S as a vehicle to introduce students to the scientific research process. The following presentation will endeavor to address these objectives.

The primary objectives of this research are: 1) assess the usefulness of PDFST as a chelating agent for the spectrophotometric determination of iron in abandoned mine drainage and other natural waters, and other samples, and 2) explore the possibilities of using Ferene S as a vehicle to introduce students to the scientific research process. The following presentation will endeavor to address these objectives.