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A study on the use of Bathophenanthroline as a fluorescence sensor for iron(II)

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Although Fe^{2+} is present as a trace element, it plays a vital role in living systems. Therefore measurement of trace amounts of Fe^{2+} is very important for many biological and ecological studies. Bathophenanthroline (BPhen) forms a stable 1:3 red color complex with Fe^{2+} and appears as a promising colorimetric probe for Fe^{2+}. Using colorimetry, it has been possible to detect 10 parts of Fe^{2+} in 10^9 parts of water (540 nM).[1,2] Although fluorescence is much more sensitive than absorbance, no reported attempts were made to detect Fe^{2+} with BPhen, using a fluorescence method. Therefore this study was conducted to study the capability of BPhen as a fluorescence sensor for Fe^{2+}.

In this study, the fluorescence emission by BPhen was studied in 50% ethanol. At the excitation wavelength of 272 nm, BPhen gave a very high emission intensity with an emission maximum at 385 nm. A maximum fluorescence intensity was observed at a concentration of 0.15 μM, with 5 nm slit width for both excitation and emission. A 0.15 μM solution of BPhen was titrated with a 0.51 μM solution of Fe^{2+}. A linear calibration curve could be obtained for this quenching process with a limit of detection of 9.0 nM of Fe^{2+}. The linear range for the curve was 25 nM to 530 nM. The stoichiometry for the static quenching process was 1:3 as predicted according to literature.1 The binding constant for the complex was calculated using the experimental data as 8.1×10^{20} mol^{-3} dm^9. An interference study was conducted with common fluorescence quenchers Ni^{2+}, Co^{2+} and Cu^{2+} as well as Fe^{3+}. The tolerance limits were 2 for Ni^{2+} and Co^{2+} while the values were 3 and 10 for Cu^{2+} and Fe^{3+}, respectively, in terms of molar ratio of Fe^{2+}. Further investigations should be carried on pH effect, solvent effect and temperature effect for this fluorimetric method although its sensitivity was impressive relative to the colorimetric method.

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References

1. Smith, G. F.; McCurdy, W. H.; Diehl, H. *Analyst* **1952**, 77 (418), 418–422.
2. Perry, R. D.; Clemente, C. L. S. *Analyst* **1977**, *102* (114), 114–119.
3. Zhu, G. H.; Ju, H. x.; Ye, B. F. A. *Chinese Jounal Chem.* **2002**, *20* (200002), 301–304.