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Aminodihydroxamic acid derivative of naphthalene as a fluorescence ionophore for iron(III)

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Fluorimetric based determinations of trace metal ions using fluorescent sensors consisting of the flurophore and ionophore have drawn increased attention in bio-medical and environmental studies during the past few decades. In this study, the fluorescence quenching properties of 1– naphthalene methylimminodiacetohydroxamic acid [I] by iron (III) was studied.

The charge transfer spectra of the iron (III) complexes of the compound [I] shifts to shorter wavelengths with increasing pH and a clear isobestic point at 550 nm indicates that only two complexes were formed. In accordance with the λ_{max} observed, these two complexes could be assigned to 1:1 and 1:2 and the absence of a further shift in the λ_{max} below 478 nm indicates the absence of 1:3 complex.

The fluorescence emission spectra of the compound [1] by iron (III) was studied at different pH values 1, 3, 5 and 6 with increasing concentration of iron (III). It was observed that the compound [I] was effectively quenched at pH 3 by iron (III). It is well known that a static quenching mechanism due to the formation of non-fluorescent complex abides by the Stern-Volmer equation. In the present study quenching of compound [I] by iron (III) gives two sets of straight lines with $r^2 = 0.9985$ and $r^2 = 0.9921$.

This indicates that Fe (III) quenches the fluorescence of compound [I] in two steps by forming of 1:2 and 1:1 complexes. At a constant concentration of ligand with increasing concentration of iron (III) at constant pH, the complexation changes from 1:2 to 1:1. The formation constant of the complex formed in a fluorescence quenching process could be correlated with change in fluorescence and concentration of metal ion. The formation constant (log K) values for the 1:1 and 1:2 complexes formed were calculated at 25 °C as 3.30 and 9.05 respectively.