

Improving the Luminescence Sensitivity of a Series of Iridium (III) Complexes via Encapsulation in Cucurbit[10]uril in Aqueous Medium: Binding and Photophysical Studies

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Abstract

The photophysical properties of luminescent iridium(III) cyclometalated complexes are especially interesting for diverse applications, such as in organic light emitting diodes (OLEDs)[1] and as labelling reagents for biomolecules [2]. In many cases, water is the preferred medium in which sensing will be applied, especially for biological systems. However many iridium(III) complexes have much weaker luminescence intensity in aqueous systems compared to organic solvent [2]. Recently we found that the weaker emission typically seen for iridium(III) cyclometalated complexes in aqueous medium can be reversed via encapsulation in cucurbit[10]-uril (Q[10]) [3]. Q[10] encapsulation of these complexes has a dramatic effect on the enhancement of the luminescence properties of iridium(III) complexes in aqueous medium. The Q[10] cavity is shown to effectively maximize quantum yields for series of Ir(III) cyclometalated complexes, compared to any other medium. This may provide significant advantages for a number of sensor applications. NMR studies show that the complexes are accommodated similarly within the host molecule, even with different substituents attached to the phenyl pyridine ligands, indicating that the hydrophobic effect is the dominant driving force for binding. Cavity-encapsulated 1:1 host-guest species dominate the emission, but 1:2 species are also indicated, which also give some enhancement of intensity. Results demonstrate that the enhancement is due primarily to much lower rates of nonradiative decay but also suggest that the encapsulation can cause a change in character of the emitting state [4].

References

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