The Synthesis and Physical Chemistry of Zinquin Analogues

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by

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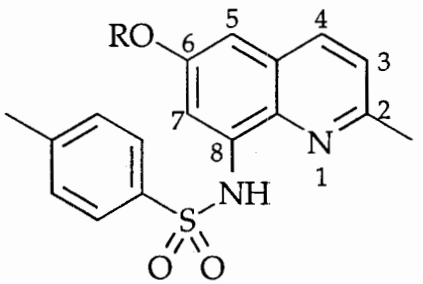
Abstract

This thesis describes the synthesis and physical chemistry of various analogues of the commercially available Zn(II) fiuorophore, Zinquin (ester, **1a**; acid, **1b**). In particular the uv/visible spectra and fluorescent properties of these analogues, in the absence and presence of Zn(II), are described. All of these analogues contain a quinoline nitrogen and a sulfonamide nitrogen at the 8-position, both of which are required for binding to Zn(II) in the Zinquin series of compounds.



1a R = CH_2CO_2Et (ZQE)
1b R = CH_2CO_2H (ZQA)
1c R = CH_3

Such analogues included the alteration of the sulfonamide unit of Zinquin and the position of the alkoxy group on the quinoline ring. The group at the 2-position on Zinquin was also varied by the addition of larger alkyl and aryl substituents. In addition, an acridine and two acridone ligands were investigated as potential Zn(II) fluorophores.

The development of these analogues has led to a number of new Zn(II) fluorophores which exhibit increased fluorescence and selectivity compared with Zinquin. In particular, inclusion of electron withdrawing sulfonamides such as 2,2,2-trifluoroethyl sulfonamide and *m*-trifluoromethylbenzene sulfonamide, led to the formation of analogues that form emore fluorescent complexes with Zn(II) than the *p*-toluene sulfonamide already used in Zinquin. The 4-alkoxy isomer exhibited three

fold enhancement in fluorescence compared to the Zinquin precursor, **1c**, in the presence of Zn(II), while the 5-alkoxy isomer showed no fluorescence in the presence of Zn(II).

Increasing the size of the alkyl group at the 2-position of Zinquin was shown to both increase the fluorescence of the Zn(II)-ligand complex and increase the ligand's selectivity; shown by a reduced fluorescence of the Cd(II)-ligand complex. However, further enlargement of the group at the 2-position, such as by the inclusion of a styryl group only slightly improved the fluorescence of the Zn(II)-ligand complex compared to **1a**. The inclusion of a larger alkyl group was shown to increase the stability of the Zn(II)-ligand complex compared to the Zn(II)-ZQE complex (shown by electrospray ionisation mass spectrometry), but the larger styryl group was shown to decrease the stability of the Zn(II)-ligand complex compared to the Zn(II)-ZQE complex.