

Purino pagrindu susintetintų D–A ir D–A–D’ cheminių fluorescencinių jutiklių lyginamoji analizė

Comparative analysis of purine-based D–A and D–A–D’ chemical fluorescence sensors

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Purines as nitrogen heterocycles are starting materials widely available in the natural product pool and are readily accessible for chemical modifications that can alter their photophysical properties dramatically. The electron donating functional groups may be coupled at the C2, C6 or C8 positions of the purine core.

A comprehensive photophysical study of a series of purines, decorated at C2 and C6 positions with different polar fragments was performed. Here we compare fluorescence sensing properties of single branched donor–acceptor (D–A) and double branched donor–acceptor–donor’ (D–A–D’) systems. Moreover, the inherent property of coordination of metal ions by purines was enriched due to a presence of nearby triazoles used as spacers for donor or acceptor fragments. New molecules present a multiple coordination mode, which makes the assembly of several ligands with one metal cation possible. This property was exploited to create chemical fluorescence sensor utilizing single and two branch configurations.

Single branched D–A compounds demonstrate high fluorescence quantum yield of charge transfer states and pronounced sensitivity to transition metal ion (Fe^{2+} , Cu^+ , Zn^{2+}) quenching. The combination of two chemically identical electron donating branches at the purine C2 and C6 positions allowed the creation of unique D–A–D’ systems with two distinct electron transitions from each of the electron donating branches. The latter molecular design results in dual fluorescence in polar aprotic solvents that is altered by the strength of the electron donating properties of the substituents. The close proximity of D–A–D’ molecules upon complexation with metal ions enables the intermolecular interbranch photoinduced electron transfer with subsequent complete quenching of a blue side band of dual fluorescence. This allows demonstrating a new concept of a ratiometric fluorescence sensor.

Key words: dual fluorescence, ratiometric fluorescence sensors, metal ion sensing, purine based compounds.

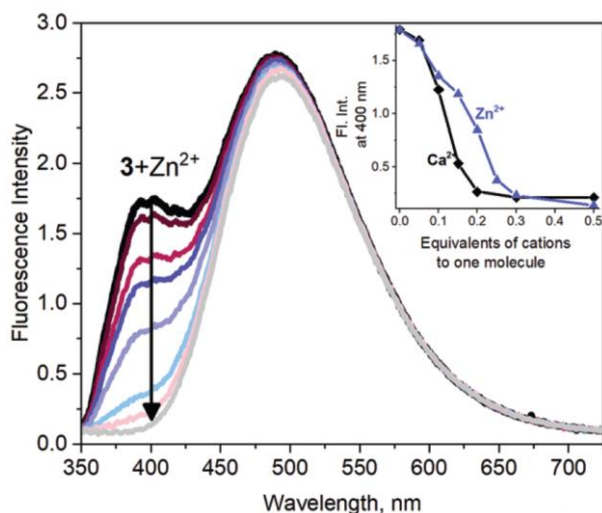


Fig. 1 The fluorescence titration experiment of D–A–D’ compound (10^{-5} M) upon addition of Zn^{2+} metal ion from 0 to 5 equivalents in ACN; inset – the dependence of the fluorescence intensity at 400 nm on the equivalents of Ca^{2+} and Zn^{2+} metal ions.