Study on luminescence quenching of selected systems

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The luminescence spectroscopy is an important detection method in different fields of life sciences such as medicine, biology, or analytical chemistry. However, the most practical analyses are performed in aqueous solutions where the luminescence signal can be quenched by the present -OH oscillators. The simple exchange of H_2O for heavier D_2O can positively affect the luminescence of many important analytes, labels, probes, etc. Performed fluorescence spectroscopy measurements combined with evaluations of fluorescence-based methods described and quantified the practical impacts of D_2O on chemical and biological samples. Several novel features are observed in fluorescence spectra and lifetime decay curves of molecules including fluorescence probes and labels that are used frequently in biomolecular labelling and bioimaging. The observed characteristics suggest that D_2O enhances the fluorescence signal due to the exchange of labile hydrogen on a fluorophore for heavier deuteron and the reduction of energy transfer from excited fluorophores to H_2O molecules. Furthermore, performed quantifications approve that D_2O increases significantly the detection signal of all examined fluorescence-based approaches where the brightness of fluorophores and sample viability are crucial.[1, 2] The fluorescence quenching by H_2O can be employed in the determination of the deuterium oxide content in aqueous solution for analytical purposes. Both innorganic (Sm^{3+} and Eu^{3+}) compounds and organic dyes were tested to find considerable change of the fluorescence lifetime (τ). Innorganic compounds such as europium nitrate shown almost 35-fold lifetime prolongation in D_2O. [3]

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