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Abstract

Applications and Properties by Using Time-Resolved Fluorescence and Transient Absorption Spectroscopy †

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Abstract: In this presentation, absorption (transient absorption) and emission (steady state and time-resolved fluorescence) spectroscopy were used to study, investigate and characterize the mechanisms of fluorescence quenching and obtain new sensors with which to detect toxic environments: heavy metals from water. For this purpose, new compounds were synthesized in order to have a good fluorescence (high quantum yield), stability and selective sensibility. The study of fluorescence quenching by different metal ions, such as Ni^{2+}, Cu^{2+}, Co^{2+}, Zn^{2+}, Fe^{3+}, Mn^{2+}, Ca^{2+}, Pb^{2+}, Cr^{3+}, Cd^{2+}, Sr^{2+}, and Mg^{2+}, will be conducted in solution and film at different temperatures and variations in time to demonstrate that these samples have good stability and can be used as fluorescence sensors for the selective detection of metal ions. For fundamental study, the theory of dynamic quenching, theory of static quenching and combined dynamic and static quenching were used, and the constants of the process, lifetime in excited state, quantum yield and non-radiative and radiative rate constants were estimated. The lifetime, around 0.0001 s for each of the metal complexes, was calculated by the analysis of the decay with and without oxygen. Emission from singlet oxygen was observed at 1275 nm in all samples, and the lifetime and quantum yield are dependent on the substitution on metal ions. In addition, a new application of the compounds investigated for detection of toxic environments (heavy metals—Fe) was found: a sensor to detect Fe from water.

Keywords: metal ions; quenching; lifetime

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