

Photometric sensing of heavy metal ions using a naphthoquinodimethyl-*bis*-thioamide dye: Selectivity & photophysics of the metal organic complexes

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Abstract

As Mother Nature is experiencing catastrophic environmental pollutions from both natural sources and anthropogenic activities, many scientists have been working around the clock to develop environmentally benign and cost-effective, yet sensitive, detection techniques for pollutants, especially heavy metal species (e.g. lead, cadmium, mercury, among others) that are deleterious to human health. Herein, we report a novel sulfur-containing small organic dye/sensor naphthoquinodimethyl-*bis*-thioamide (**QDM**), which was found to be particularly selective toward mercury ion (**Hg²⁺**). Using a combination of UV–vis absorption, photoluminescence, and time-resolved pump–probe techniques, we established that **QDM** and **Hg²⁺** can form stable complex(es) due to the strong affinity of sulfur toward mercury. In this investigation, while a higher ratio of **QDM:Hg²⁺** was necessary to fully quench the fluorescence emission of **QDM**, only 1 equiv of the **Hg²⁺** ion was necessary to observe the sensing effect on the excited state photo-behavior(s) of **QDM**. The present results highlight a synergy between molecular sensors' selectivity/sensitivity and sensor-analytes dynamics.