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Pyrrolo[3,4-*c*]pyridine-Based Fluorescent Chemosensor for Fe^{3+}/Fe^{2+} Sensitivity and Their Application in Living HepG2 Cells

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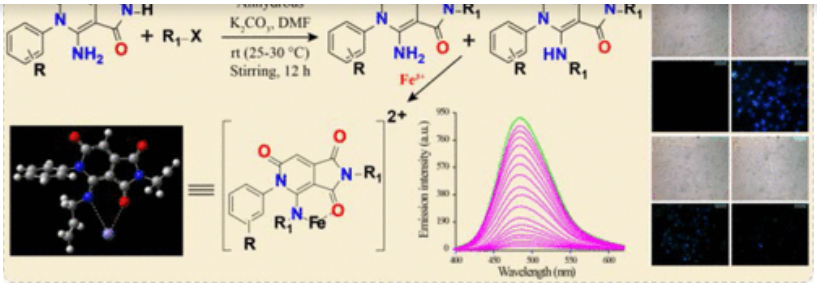

New 2*H*-pyrrolo[3,4-*c*]pyridine-1,3,6(5*H*)-trione-based fluorophores have been synthesized by a single-step procedure in an ambient reaction condition. By this protocol, a total of 44 new compounds were generated and the photophysical property of 23 compounds was studied in detail. These fluorophores show good fluorescence activity and illustrate high selectivity for Fe^{3+}/Fe^{2+} cation in the 10^{-7} (M) range. Notably, this 2*H*-pyrrolo[3,4-*c*]pyridine-1,3,6(5*H*)-trione moiety is first used as a turn-off chemosensor for the Fe^{3+}/Fe^{2+} cation. In addition, this probe was further applied for imaging Fe^{3+} in living HepG2 cells.

Introduction

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Small-molecule organic fluorophores are an important candidate in the multidisciplinary field of chemosensing, photovoltaic, confocal microscopy, organic light-emitting diode technology, and polymer and textile industry because of their enormous potential. (1) Hence, they have attracted considerable attention to a broader scientific community including biology, chemistry, and material science. (2) Toward that end, development of fluorogenic probes for selective sensing of metal ions of biological interests has certainly become relevant. Of the different metal ions such as iron, aluminum, copper, and zinc, iron is the most abundant essential trace element present in the human body. (3) Because of the high affinity toward oxygen, iron is critically engaged in oxygen transport in all the tissues. (4) However, it is really important to have a certain balance of the iron content in the human body. Whereas the deficiency could lead to anemia, hemochromatosis, diabetes, liver damage, and cancer, the excess of iron could cause severe damage to nucleic acids, lipids, and proteins, which further accelerates the possibility of serious diseases like Alzheimer's, Parkinson's, and so forth. (5)