

Synthesis, characterization, and zebrafish embryo imaging of group II metal-8-hydroxyquinoline complexes as novel fluorescent stains

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8-Hydroxyquinoline (8-HQ) has excellent chelating properties because it can form coordination complexes with a large number of metal ions through oxygen and nitrogen binding sites. The fluorescence properties of 8-HQ are an important focus in bioimaging research. This study aimed to synthesize and characterize Group II metal complexes of 8-Hydroxyquinoline and to determine whether they can be used as novel fluorescent stains using Zebrafish embryos. Accordingly, group II metal ion complexes: Mg-8HQ, Ca-8HQ, Sr-8HQ, and Ba-8HQ were synthesized using deionized water as the solvent. Then they were characterized through UV-Visible and FTIR spectroscopic analyses. In UV-Visible spectroscopic analysis, the characteristic absorption maxima compared to the 8-HQ free ligand confirmed successful complex formation. In FTIR, the appearance of a new band in the low-frequency region corresponding to the metal-oxygen stretching vibration, which includes bands at approximately 509 cm⁻¹ for Mg-O, 492 cm⁻¹ for Ca-O, 647 and 588 cm⁻¹ for Sr-O, and 473 cm⁻¹ for Ba-O stretching vibrations, confirmed successful complex formation. Fluorescence study with zebrafish embryos showed that all metal complexes exhibited fluorescence localized in the trunk

and tail skeletal muscles, confirming their ability to be used as fluorescent stains. Fluorescence intensity was shown to decrease with decreasing concentration. The acute zebrafish embryo toxicity bioassay was done over a 72-hour post-exposure period across concentrations ranging from 10⁻⁴ to 10⁻⁹ molL⁻¹. A dose-dependent toxic effect was observed, with LD₅₀ values of 1.35×10⁻⁴ molL⁻¹ for Mg-8HQ, 4.06×10⁻⁸ molL⁻¹ for Ca-8HQ, and 6.49×10⁻⁷ molL⁻¹ for Ba-8HQ, with abnormalities such as head deformities, spinal curvature, and lack of pigmentation. Sr-8HQ showed 90% mortality even at 1×10⁻⁹ molL⁻¹ concentration. No mortality was observed for Mg-8HQ and Ca-8HQ at 1×10⁻⁹ molL⁻¹. Among the four metal complexes, Mg-8HQ and Ca-8HQ are potential candidates as novel fluorescent stains with low mortality and intense fluorescence compared to Sr-8HQ and Ba-8HQ.

Keywords:

8-Hydroxyquinoline, Fluorescence, Mortality, Zebrafish