

Development of (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate as a fluorescence sensor for Zn²⁺ detection.

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Introduction

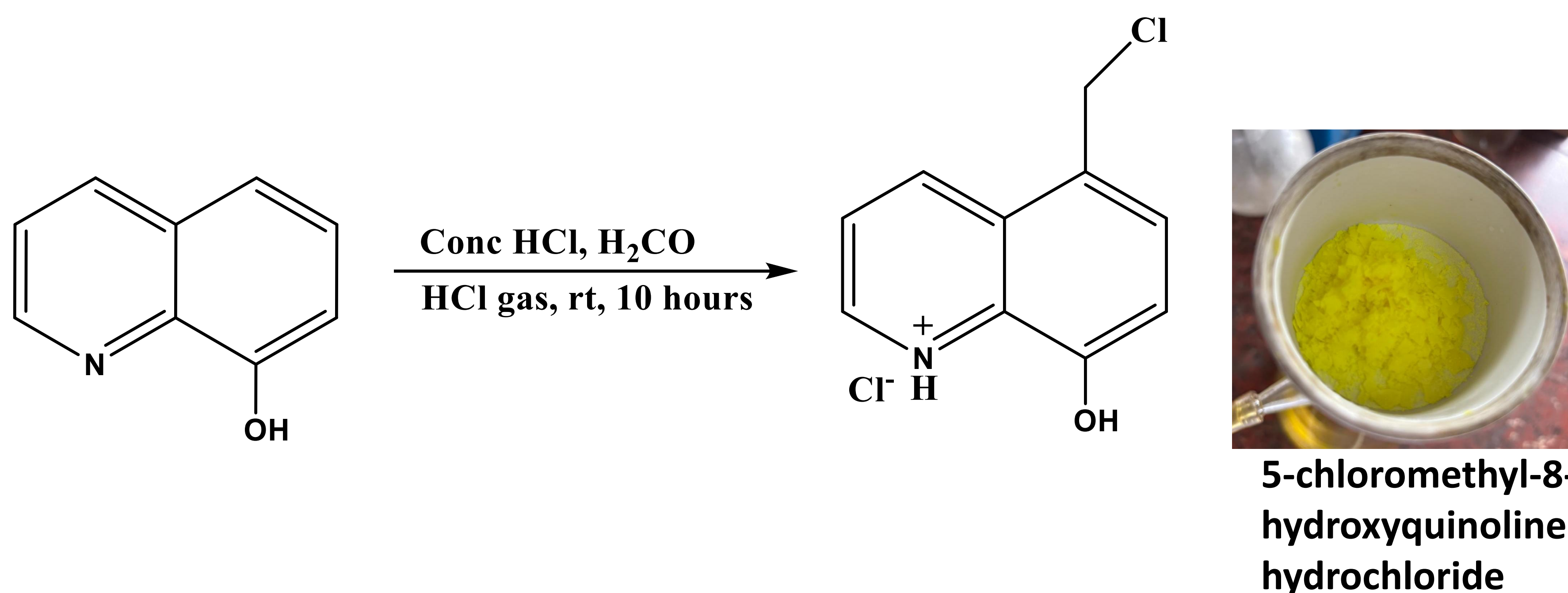
Zinc ions (Zn²⁺) are a major component in biological systems.¹ Zinc dyshomeostasis is also a major indicator of cancer which is one of the most prevalent and fatal types of non-communicable diseases known to mankind.² Previous findings showed that ester derivatives of 5-hydroxymethyl-8-hydroxyquinoline depicted an enhancement in fluorescence upon binding with Zn²⁺. In this study we aim to synthesize (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate and assess its efficacy as a fluorescence sensor for Zn²⁺ detection.

Objectives

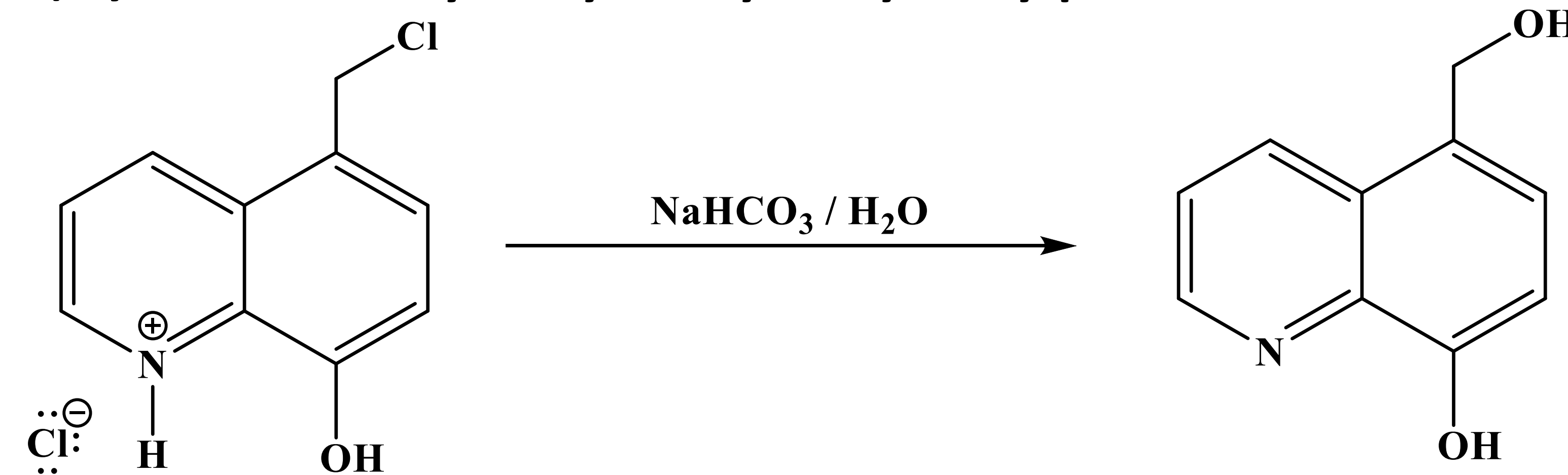
- Synthesis of (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate.
- Obtaining absorption and emission spectra of (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate at various concentrations of Zn²⁺.

Methodology

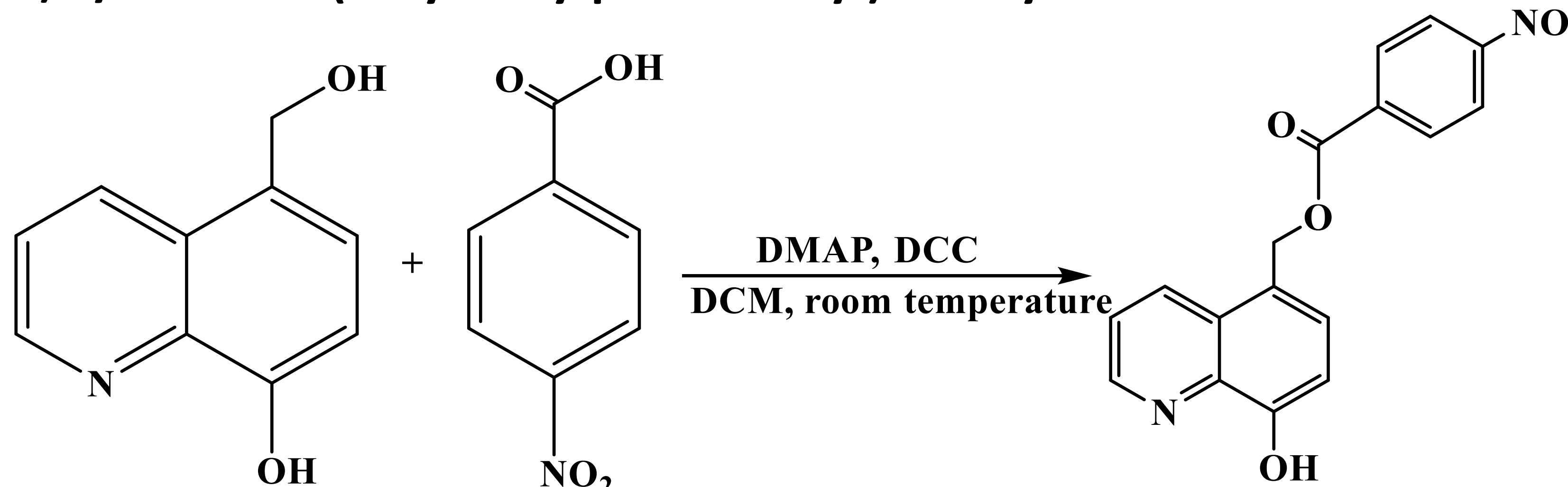
1) Synthesis of 5-chloromethyl-8-hydroxyquinoline hydrochloride³



2) Synthesis of 5-hydroxymethyl-8-hydroxyquinoline³

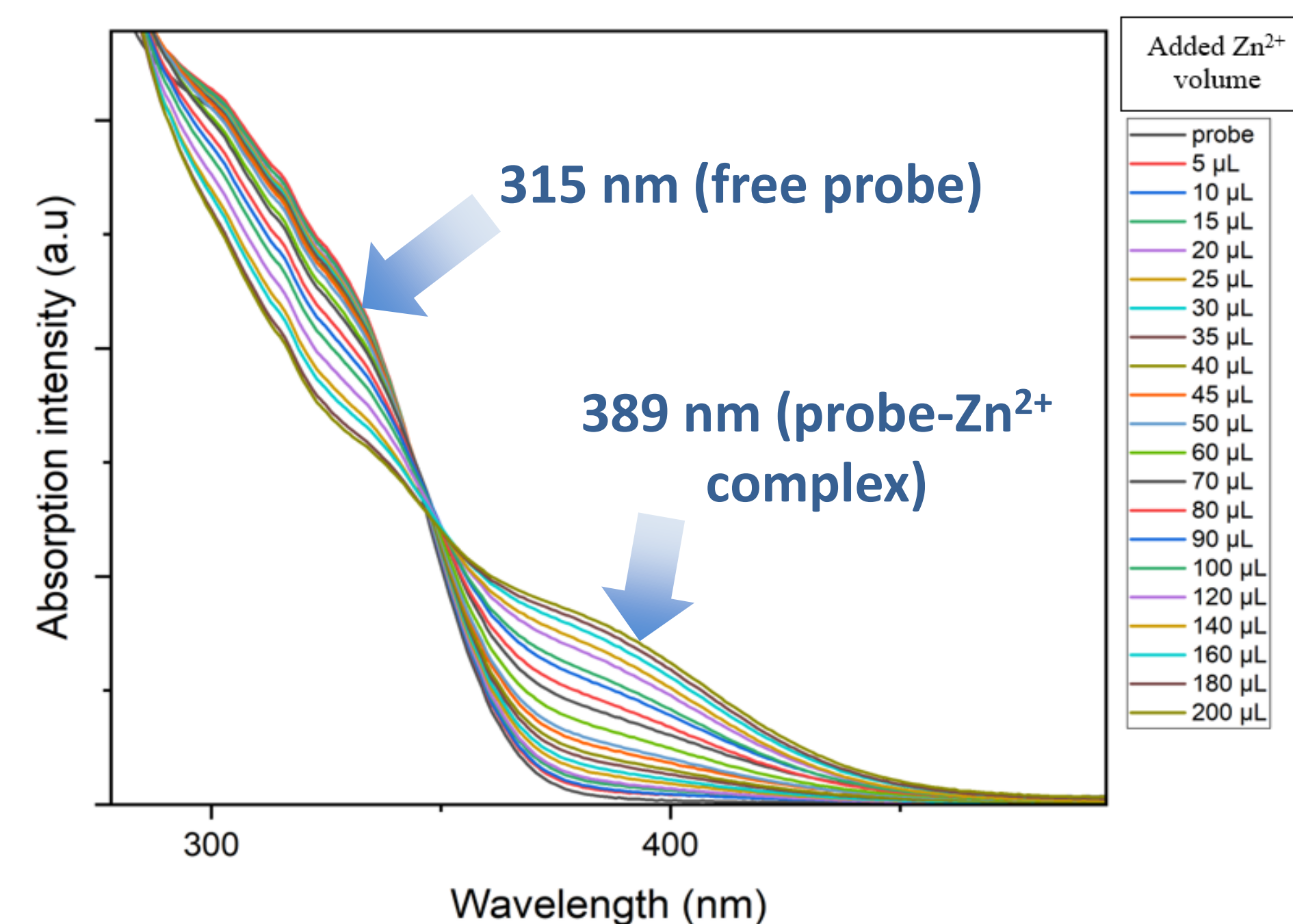


3) Synthesis of (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate



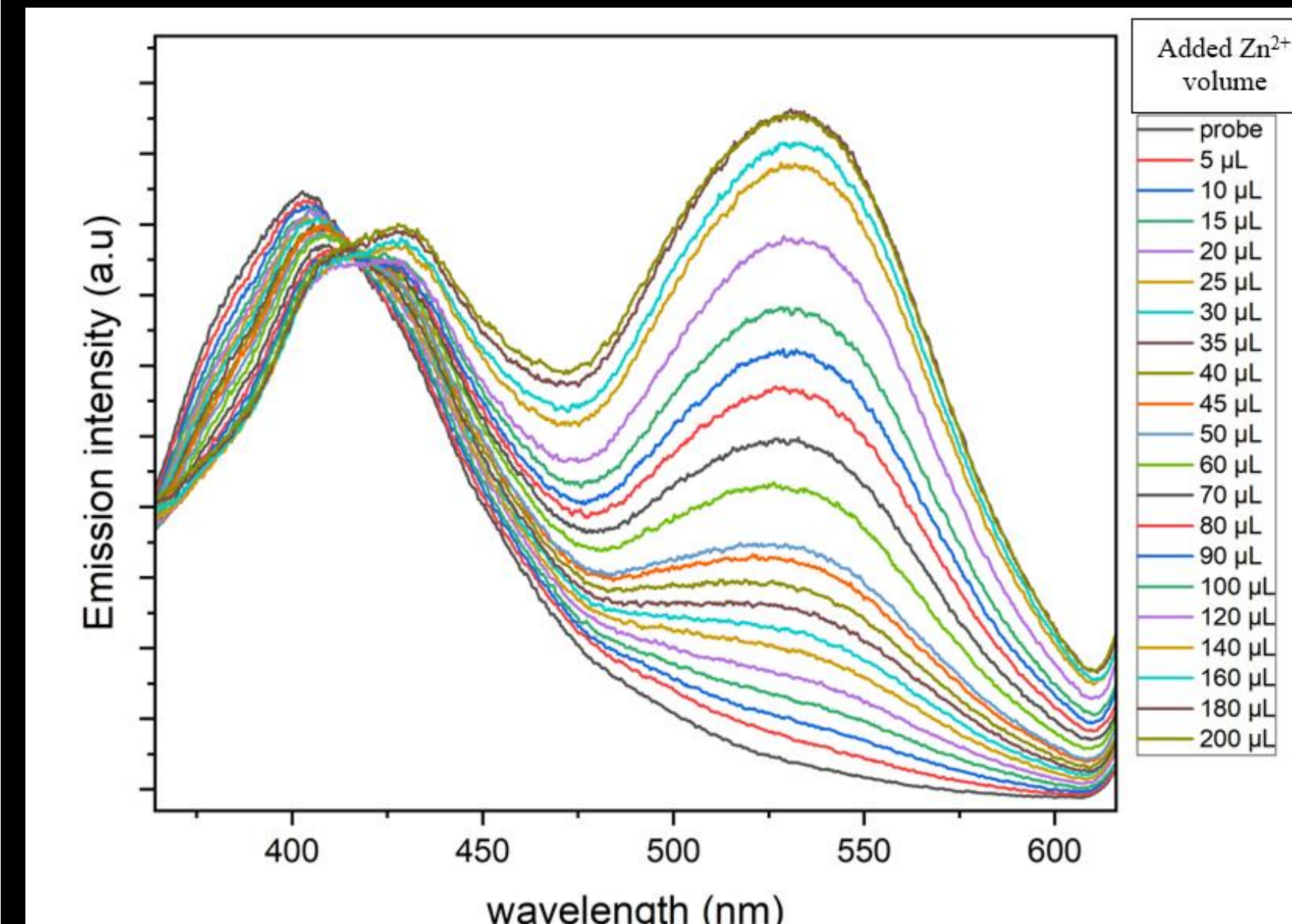
4) Spectral properties of (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate through absorption and emission spectra analysis.

Results



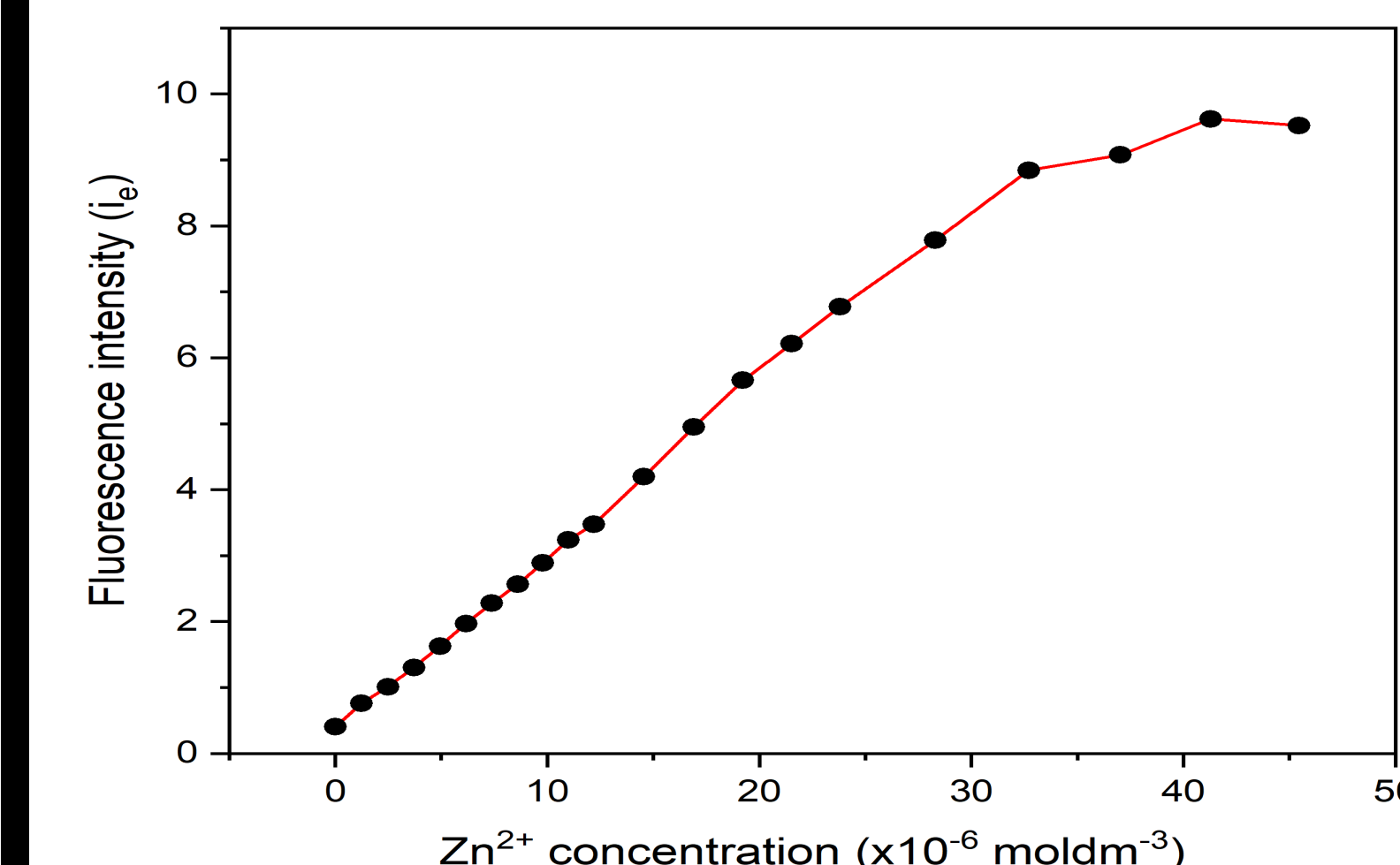
Absorption spectrum

Absorbance of free probe at 315 nm decreasing with the gradual increase in Zn²⁺ concentration while the peak corresponding to the probe-Zn²⁺ complex at 389 nm increases in intensity simultaneously.



Emission spectrum of at excitation wavelength of 315 nm

The intensity of emission peak corresponding to free probe at 403 nm decreases with the gradual addition of Zn²⁺ ions while the intensity of peaks at 529 nm, 530 nm and 532 nm corresponding to 3 types of probe-Zn²⁺ complexes increases simultaneously.



Fluorescence intensity Vs Zn²⁺ concentration

Plot depicting variation of fluorescence intensity with the gradual increase in Zn²⁺ concentration for the probe-Zn²⁺ complex.

Conclusion

- Analysis of emission spectra depicted that 3 types of complexes were formed upon binding of (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate with Zn²⁺.
- (8-hydroxyquinolin-5-yl) methyl-4-nitrobenzoate is a strong candidate to be used as a ratiometric fluorescence sensor.

References

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