The C_2-symmetry colorimetric dye based on a thiosemicarbazone derivative and its cadmium complex for detecting heavy metal cations (Ni^{2+}, Co^{2+}, Cd^{2+}, and Cu^{2+}) collectively, in DMF

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Research Article

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Abstract

The field of chemosensing has been experiencing an exponential expansion in recent times, due to increased demands for simpler and user-friendly analytical techniques, in order to combat and confront the challenges of industrial pollutions in the 21 st century. Metal complex-based chemosensors have received little attention while exhibiting excellent sensing properties, comparing to their organic counterparts. Thus, a thiosemicarbazone-based (H) and its cadmium complex (P) were synthesized, characterized and their photophysical and chemosensing properties were investigated in DMF solvent. The addition of molar equivalents of selected cations (of nitrates or chloride salts) to H and P , produced visually detectable colour changes as well as remarkable spectral shifts. Explicitly, the two probes (H and P) were able to collectively discriminate heavy metal cations such as Cd^{2+} , Co^{2+} , Zn^{2+} , Cu^{2+} , Ni^{2+}, and Ag^{+} , both in DMF, among all other heavy metal cations tested. None of the anions could be detected by H or P , even when the tetrabutylammonium salts (TBAs) were used, the action presumably ascribed to the solvent effect. Thus, H and P can be used to selectively and sensitively detect the presence of heavy metal cations, via naked-eye detectable colour changes in an aqueous soluble solvent such as DMF.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the latest manuscript can be downloaded and accessed as a PDF.

Figures

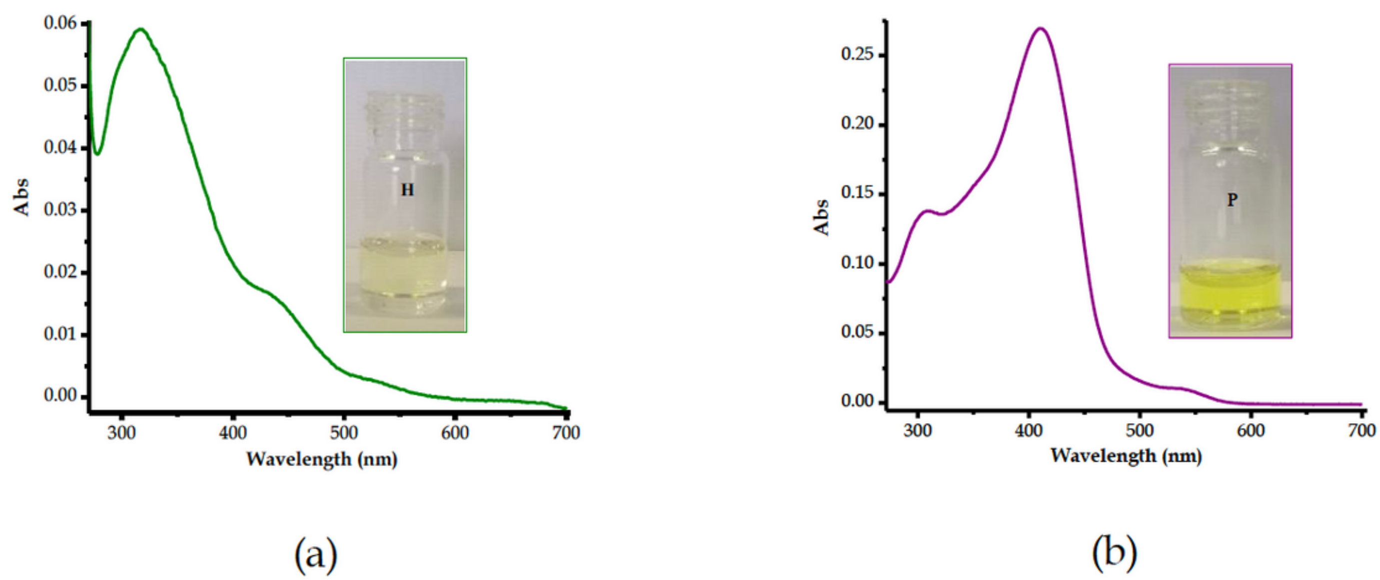


Figure 1

Absorption spectra of (a) H and (b) P in DMF at 1 x 10-5 M, room temperature

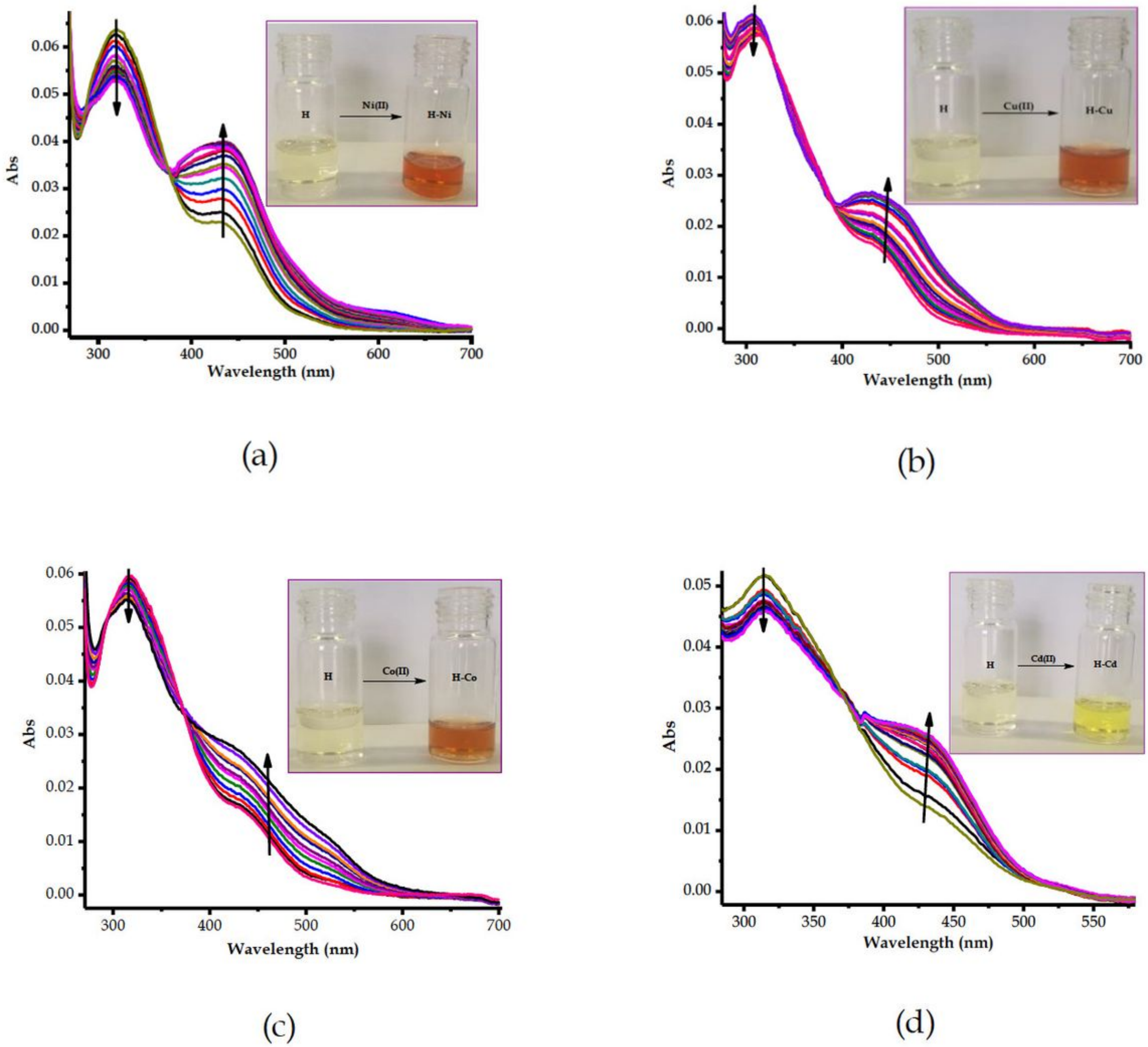


Figure 2

The absorption titration spectra of H (1 x 10-5 M) in DMF, with 5 equiv. of (a) Ni2+, (b) Cu2+, (c) Co2+ and (d) Cd2+ at room temperature

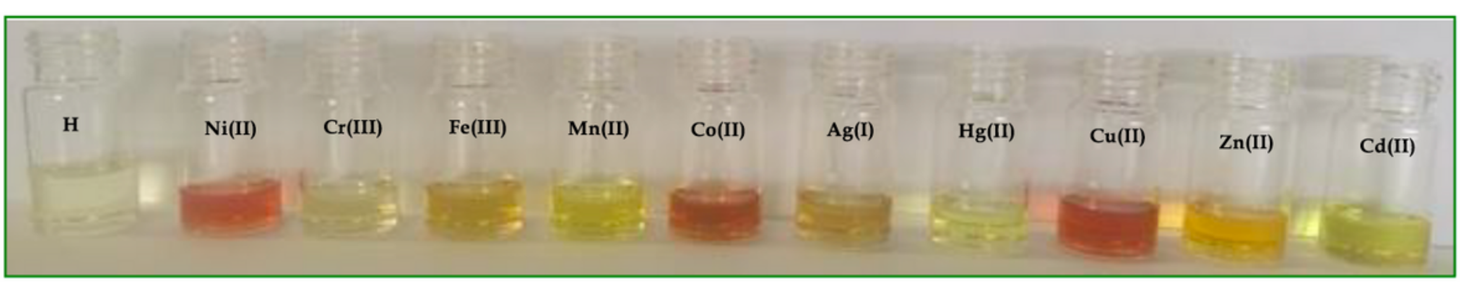


Figure 3

Visually observable color changes H (1 x 10-5 M) upon interacting with cations in DMF, at room temperature

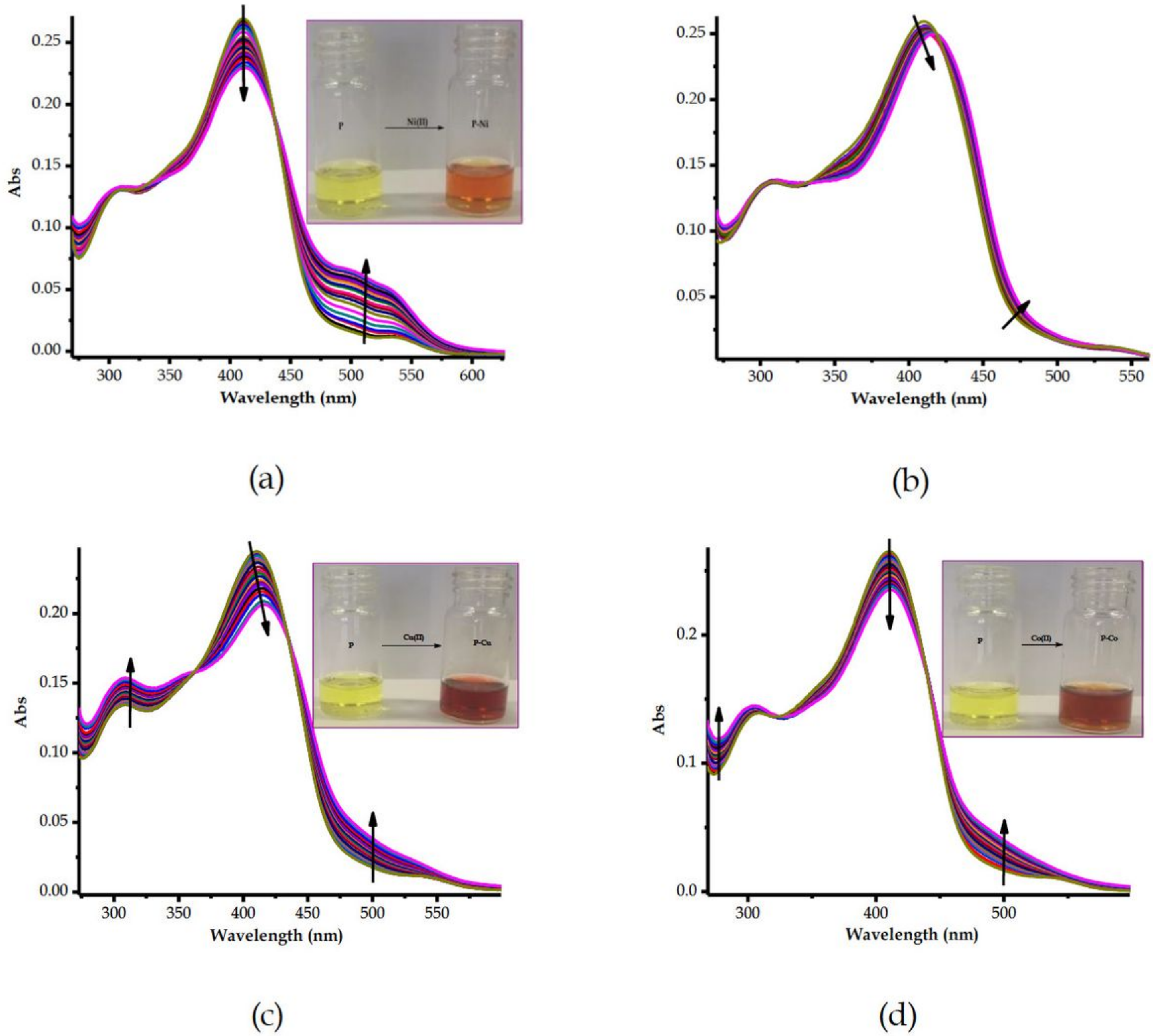


Figure 4

The absorption titration spectra of P (1 x 10-5 M) in DMF, with 5 equiv. of (a) Ni^{2+}, (b) Hg^{2+}, (c) Cu^{2+} and (d) Co^{2+} at room temperature

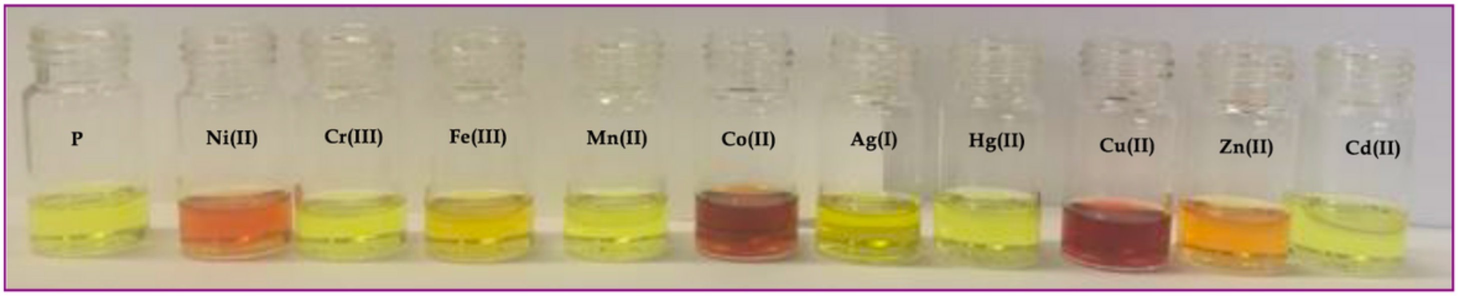
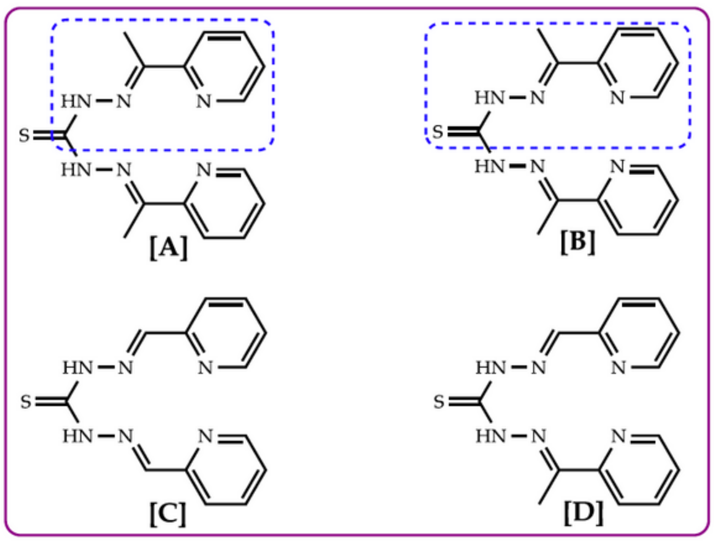


Figure 5

Visually observable color changes P (1 x 10-5 M) upon interacting with cations in DMF, at room temperature



(a)

Fragment	m/z
[NC(S)NH]$^+$	73
[A+H]$^+$	147
[B-H]$^+$	177
[C]$^+$	281
[D+H]$^+$	296

(b)

Figure 6

Summary of more fragments observed in the mass spectra of H compound

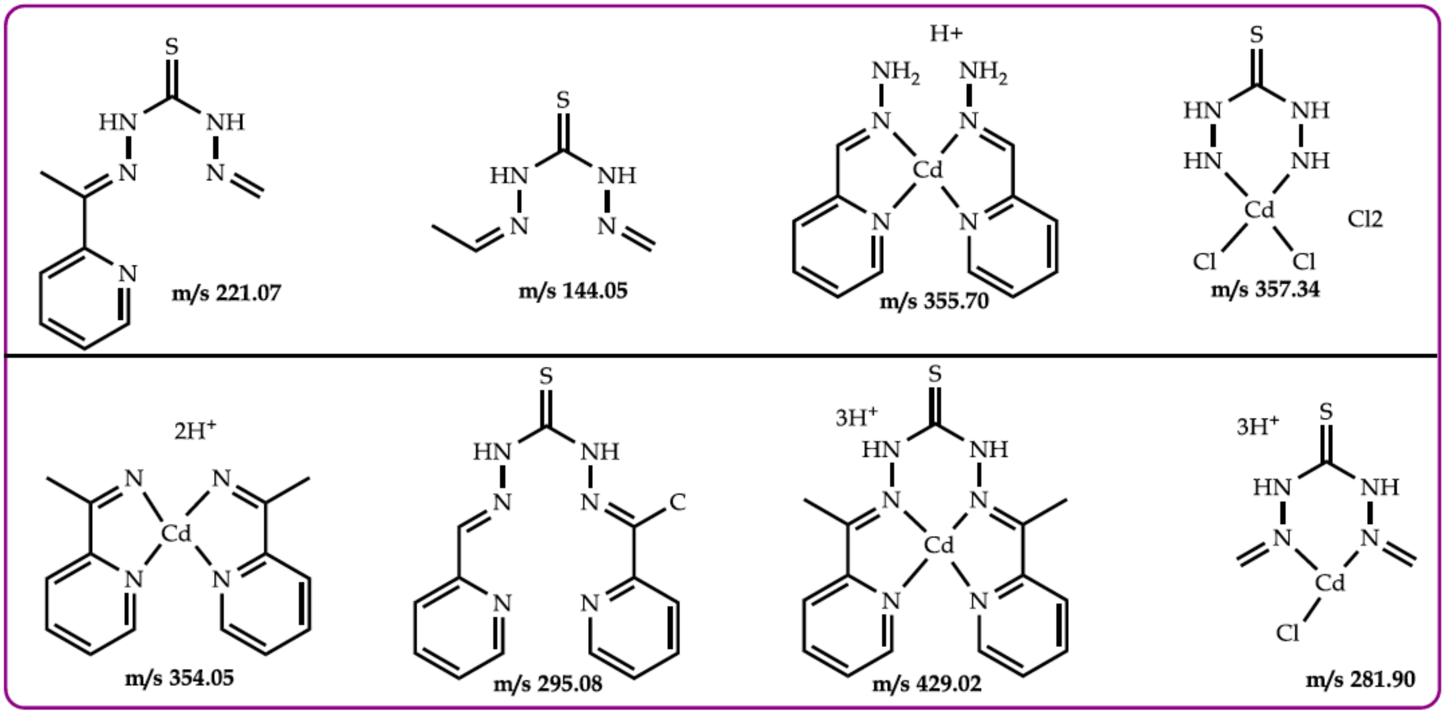


Figure 7

Summary of more prominent fragments observed in the mass spectra of P compound

Supplementary Files

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- Scheme1.png