Synthesis and characterization of o-phenolnaphthylimine and its application as metal sensor with β-cyclodextrin

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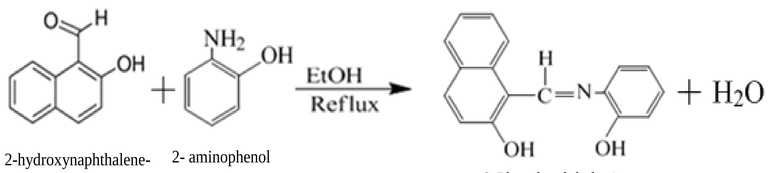
ABSTRACT

➢O-phenolnaphthylimine (PNI) was synthesized by the condensation reaction of 2-hydroxynaphthalene-1-carbaldehyde and 2-aminophenol in ethanol with 90% yield.

➢The structural elucidation of the compound was done by using IR, ^{1}H NMR, ^{13}C NMR and Mass spectral techniques.

➢The chemosensory ability of β-CD:PNI inclusion complex was investigated thoroughly for various metal cations and we found the emission of complex showed a linear increase in the intensity for Al^{3+} with the linearity range of 20 µM to 300 µM For selectivity and Sensitivity analysis of β-CD:PNI inclusion complex with Al^{3+} , Competitive experiment was carried out and it shows good sensing with Al^{3+} with the limit of detection of 44.9 µM and limit of quantification of 136 µM.

MATERIALS AND METHODS



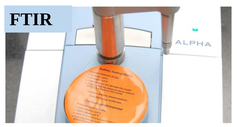
2-hydroxynaphthalene-1-carbaldehyde

2- aminophenol

O-Phenolnaphthylimine

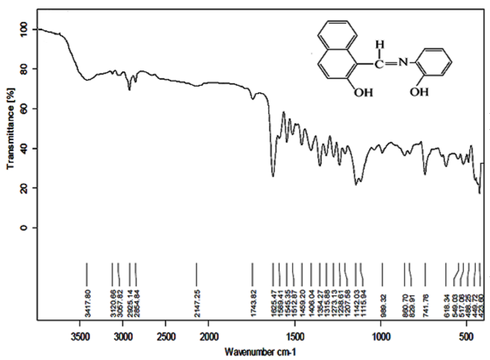
IUPAC: 1-{[(2-hydroxyphenyl)imino]methyl} -2-naphthol

Scheme: 1 – The Synthetic route of (PNI)



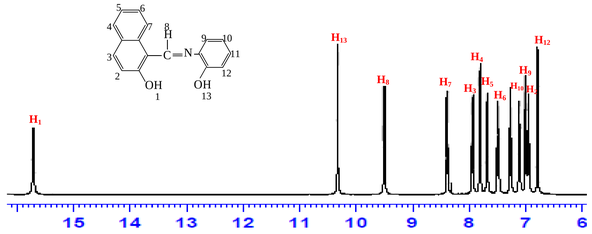
RESULTS AND DISCUSSIONS

FTIR spectral studies



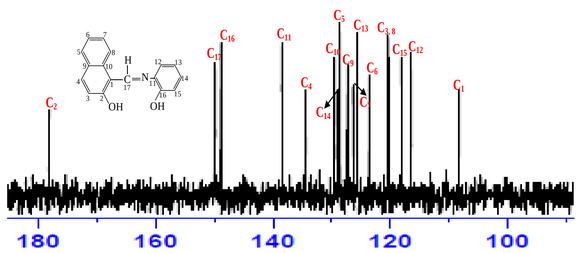
Vibrational frequencies	PNI
ν(OH) stretching 3500-3200cm^{-1}	3417cm^{-1}
ν(-C=N-) stretching 1612-1632cm^{-1}	1625 cm^{-1}
ν(C-N) 1200-1350cm^{-1}	1273 cm^{-1}
ν(C-C) stretching in ring 1400-1560cm^{-1}	1459 cm^{-1}
ν(C-H) bending 690-900cm^{-1}	741 cm^{-1}
ν(C=C) stretching in ring 1450-1560cm^{-1}	1459 cm^{-1}

^{1}H NMR spectral studies



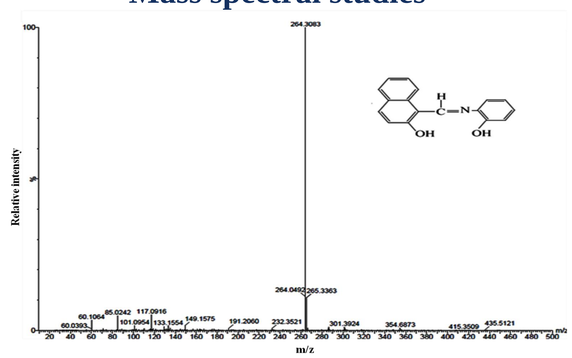
Protons	PNI δ ppm
H_1	15.74
H_2	6.99
H_3	7.95
H_4	7.82
H_5	7.69
H_6	7.48
H_7	8.40
H_8	9.51
H_9	7.29
$H_{10, 11}$	7.11
H_{12}	6.80
H_{13}	10.32

^{13}C NMR spectral studies

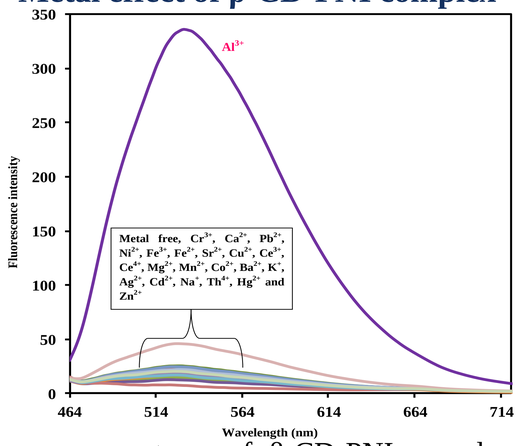


Protons	PNI δ ppm
C_1	108
C_2	178
C_3	120.2
C_4	132.4
C_5	128.5
C_6	123.5
C_7	126.2
C_8	120.1
C_9	127.2
C_{10}	129.4
C_{11}	138.2
C_{12}	116
C_{13}	125.5
C_{14}	128.9
C_{15}	118
C_{16}	148.8
C_{17}	149.8

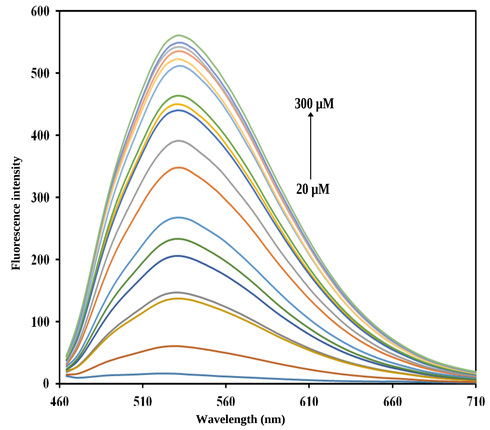
Mass spectral studies



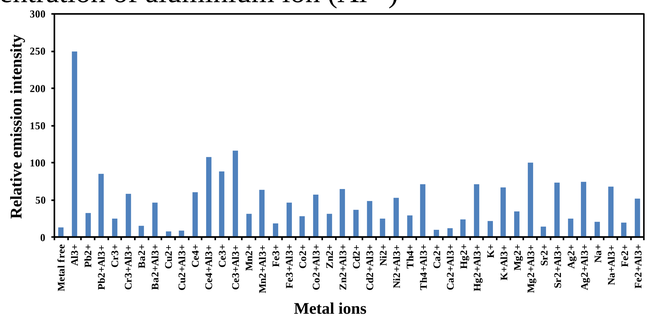
Metal effect of β-CD-PNI complex



Fluorescence spectrum of β-CD-PNI complex with various metal cations



Fluorescence spectrum of β-CD-PNI complex with different concentration of aluminium ion (Al^{3+})



Competitive study of fluorescence spectrum of β-CD-PNI –Al^{3+} with various metal cations

CONCLUSION

➢In summary we developed a new schiff base compound o-Phenolnaphthylimine (PNI) and it was characterized and confirmed by FT-IR, ^{1}H NMR, ^{13}C NMR and Mass spectral techniques.

➢The chemosensing behavior of β-CD:PNI complex was carried out using fluorescence spectroscopy. The estimated LOD: 44.9 µM and LOQ: 136 µM. This result suggests that the solid state sensor based on β-CD:PNI complex could be a promising sensory material for developing sensory device for detecting Al^{3+}.

REFERENCES

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