iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** VI **Month of publication:** June 2018

DOI: http://doi.org/10.22214/ijraset.2018.6112

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue VI, June 2018- Available at www.ijraset.com

Antibacterial and Antifungal activities of (1E, 2E)-1, 2-Diphenylethane-1, 2-Diene Hydrazone Oxime ligand and its Zn(II), Cd(II) and Hg(II) metal complexes.

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The present work reports the synthesis and characterization of HBMOH along with its metal complexes with Zn(II), Hg(II), and Cd(II). The compounds synthesized have been characterized on the basis of various physico - chemical techniques. Electrical conductance studies on the metal complexes reveal their non-electrolytic nature. All compounds have been screened for their antibacterial and antifungal activities and have been found to exhibit significant antibacterial and antifungal activities.
Keywords: Zinc(II), Cadmium(II), Mercury(II), Antibacterial activity, Antifungal Activities.

I. INTRODUCTION

Ligands containing oxime also function as Schiff base containing an additional oxime group are interesting as ligand both on account of the structural variation[1-5] of the metal complexes as well as wide range of application ranging from analytical to biological activities[1-5]. Oxime function is ambidentate i.e. nitrogen and oxygen with almost equal probability. The second function due to the Schiff base moiety provides interesting complexation possibilities; it can coordinate with metal ion through nitrogen. A number of benzilmonoximates which have been reported to shows antibacterial activities[6-10]. Spectrochemical studies of hydrazonyl derivative of α- benzilmonoximehydrazone and its metal complexes reported[6-10]. In this view we wish to report Synthesis, Antibacterial and Antifungal activities of α- benzilmonoximehydrazone ligand and its Zn(II), Cd(II) and Hg(II) metal complexes. IUPAC name of the title ligand is (1E,2E)-1,2-Diphenylethane-1,2-Diene Hydrazone-Oxime, for sake of convenience able as HBMOH is likely to yield metal complexes with a variety of metal ions. Bonding in these complexes is also likely to show interesting features. The synthesized ligand and its metal complexes were screened by antibacterial and antifungal activities.

II. MATERIALS AND METHODS

All chemical used were of analytical reagent grade. Distilled water obtained from a glass distillation unit. Conductivity measurements were made on EQ-660 laboratory conductivity meter using Nitrobenzene as solvent. UV-Visible spectra of the ligand and its metal complexes were recorded on JASCO V-650 spectrophotometer, methanol/ 0.1N NaOH was used as solvents to record UV spectrum of the ligand, while Chloroform was used as solvent to record the spectra of the complexes in the UV-Visible region. FTIR spectra in KBr discs were recorded on Perkin–Elmer spectrum 100 model.

III. EXPERIMENTAL

The title ligand and its Zn(II), Cd(II), Hg(II) metal complexes are prepared by reported method[6].

A. Antibacterial Screening:

Antibacterial activities of synthesized compounds were studied against six human pathogenic bacteria, viz. E. coli(G^-), S. aureus(G^+), S. typhi(G^+), B. subtilis(G^+), K. pneumoniqe(G^+), P. aeruginosa(G^+) (Table:2). For the detection of antibacterial activities, the agar cup method. Nutrient agar (NA) was used as basal medium for test bacteria.

The agar media were inoculated with 0.5ml of 24 h liquid cultures containing 10^7 microorganisms/ml. diffusion times was 24 h at 5^0C for all bacteria, and incubation time was 24 h at 37^0C. Discs with only DMF were used as solvent.

Inhibitory activity was measured (in mm) as the diameter of the observed inhibition zones.

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B. Determination of the Minimum Inhibitory Concentration (Mic)

Minimum inhibitory concentration means as the lowest concentration that inhibits bacterial growth. To determine minimum inhibitory concentration (MIC), the serial dilution technique was followed using nutrient broth medium. MIC values of the all synthesized compounds were determined against all six bacteria.

C. Antifungal Activity

Antifungal activities of synthesized compounds towards five plant pathogenic and mould fungi were studied, viz. Colletotrichum Gloeosporiodes penz, Canilida Albicans, Aspergillus Niger, Aspergillus Flaves and penicillium sp. Antifungal activity was assessed by the poisoned food technique[12], in a modified condition[13]. Fluconazole (200µg/disc) was used as standard fungicides. Proton dextrose sugar (PDA) was used as basal medium for test fungi. Glass petri dishes used were sterilized. Sterilized melted PDA medium at 45^{o}C was poured at the rate of 15mL into each petri dish (90mm). After solidification of the medium small portions of the mycelium of each fungus were spread carefully over the center of each PDA plate with the help of sterilized needles. Thus, each fungus was transferred to a number of PDA plates, which were then incubated at 25^{o}C (± 2) and ready for use after five days of incubation. Prepared disc of sample were placed gently on solidified agar plates, freshly seeded with the test organisms with sterile forceps. A control disc was also placed on the test plates compare the effect of solvent respectively. The plates were then kept in a refrigerator at 4^{o}C for 24hrs, so that the materials had sufficient time to diffuse over a considerable area of the plates. After this the plates were incubated at 37^{o}C for 72hrs DMF was used as solvent to prepare desired solutions I10mg/mL) of the compounds initially and also to maintain proper control.

IV. RESULTS AND DISCUSSION

The complexes are intense colored and thermally stable at room temperature, non-hygroscopic, insoluble in water and show solubility in common organic solvents like $CHCl_3$, CCl_4, DMSO, Acetonitrile, Nitrobenzene etc. The analytical data (Table-1) for ligand and its complexes is consistent with proposed structures. The molar conductance values of 10-3M solution in nitrobenzene are 0.96 and 1.33$\Omega^{-1}cm^2mol^{-1}$ indicating theirnon-electrolyte nature[11].

Table-1:Analytical and physical data for HBMOH and its Zn(II), Cd(II), Hg(II) metal complexes

Compound	Color (M.P. in °C)	% Yield	Percentage Expected(Found)Conductance C	H	N	O	M	Ω^{-1}
HBMOH	Colorless (172)	72.03	70.29 (70.0)	5.44 (5.21)	17.57 (17.92)	6.69 (6.29)	- -	
$Zn(BMOH)_2$	Colorless (199)	83.12	63.83 (63.52)	4.45 (4.81)	15.68 (15.29)	5.88 (6.01)	10.98 (10.21)	1.90
$Cd(BMOH)_2$	Colorless (203)	79.63	62.29 (62.82)	4.41 (4.00)	15.58 (15.03)	5.96 (5.28)	19.10 (18.62)	5.99
$Hg(BMOH)_2$	Yellow (198)	79.99	49.66 (49.11)	3.54 (3.92)	12.41 (12.90)	4.72 (4.18)	29.65 (29.02)	1.78

A. Antibacterial Activities

the antibacterial activities of synthesized compounds have been assayed at the concentration of 500 µg/disc against six human pathogenic bacteria[14-15]. Among them five were gram positive and one is gram negative. The inhibitory effects of compounds against these organisms are given in Table-2. The screening results indicate that synthesized compounds showed antibacterial activity to the bacteria used. All synthesized compounds showed low antibacterial activity to the gram negative bacteria as compare to gram positive bacteria (Table-2). From the above result, it can be concluded that the antibacterial activities of all synthesized compounds.

B. Minimum Inhibitory Activity

The minimum inhibitory concentration of synthesized compounds were determined against E. coli(G^-), S. aureus(G^+), S. typhi(G^+), B. subtilis(G^+), K. pneumoniqe(G^+), P. aeruginosa(G^+)(Table:5) by the serial dilution method. The MIC levels were found 50 µg/mL against synthesized compounds.

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Table-2:Antibacterial activities of HBMOH and its metal complexes [Minimum inhibitory concentration (MIC)]

Pathogen	Zone of inhibition in mm															
	HBMOH					$Zn(BMOH)_2$					$Cd(BMOH)_2$				$Hg(BMOH)_2$			
	1000	500	200	100	50	1000	500	200	100	50	1000	500	200	100	50	1000	500	200	100	50
E. coli	23	13	7	-	-	22	11	6	2	-	26	15	8	-	-	30	18	12	6	4
S. aureus	31	18	10	6	3	21	14	10	8	5	19	11	-	-	-	21	15	11	9	6
S. typhi	35	21	14	9	7	27	17	11	6	-	22	13	7	4	-	29	14	9	-	-
B. subtilis	30	18	10	7	4	27	13	6	-	-	33	23	15	9	7	24	16	11	7	-
K. pneumoniqe	28	14	7	5	-	25	16	10	7	-	24	13	8	6	-	26	16	10	8	5
P.aeruginosa	22	14	9	6	4	20	14	8	-	-	18	9	-	-	-	17	8	-	-	-

C. Antifungal Screening

The antifungal activities of all compounds have been assayed at concentration of 500ppm against five plant pathogens and mould fungi. The inhibitory effects of all compounds against these organisms are given in Table-3. The screening results indicate that all synthesized compounds show good antifungal activities against Colletotrichum Gloeosporiodes penz, Canilida Albicans, Aspergillus Niger, Aspergillus Flaves and penicillium sp.

Table-3: Antifungalscreening (500ppm) for HBMOH and its metal complexes

Compound	[a]C.G.	[b]C.A.	[c]A.N.	[d]A.F.	[e]P.S.
HBMOH	06	08	-	05	06
$[Zn(BMOH)_2]$	09	08	06	07	10
$[Cd(BMOH)_2]$	10	08	06	06	09
$[Hg(BMOH)_2]$	09	08	07	07	10

Where:**a** = Colletotrichum Gloeosporiodes penz, **b** = Canilida Albicans, **c** = Aspergillus Niger, **d** = Aspergillus Flaves and **e** = Penicillium sp.

V. CONCLUSION

The title ligand is soluble in most of the organic solvents and dilute alkali, but its Zn(II), Cd(II) and Hg(II) metal complexes are insoluble in ethanol and soluble in methanol, chloroform, DMF etc. Zn(II), Cd(II) and Hg(II) metal complexes are non electrolytic nature. Ligands and its metal complexes show good antibacterial and antifungal activities.

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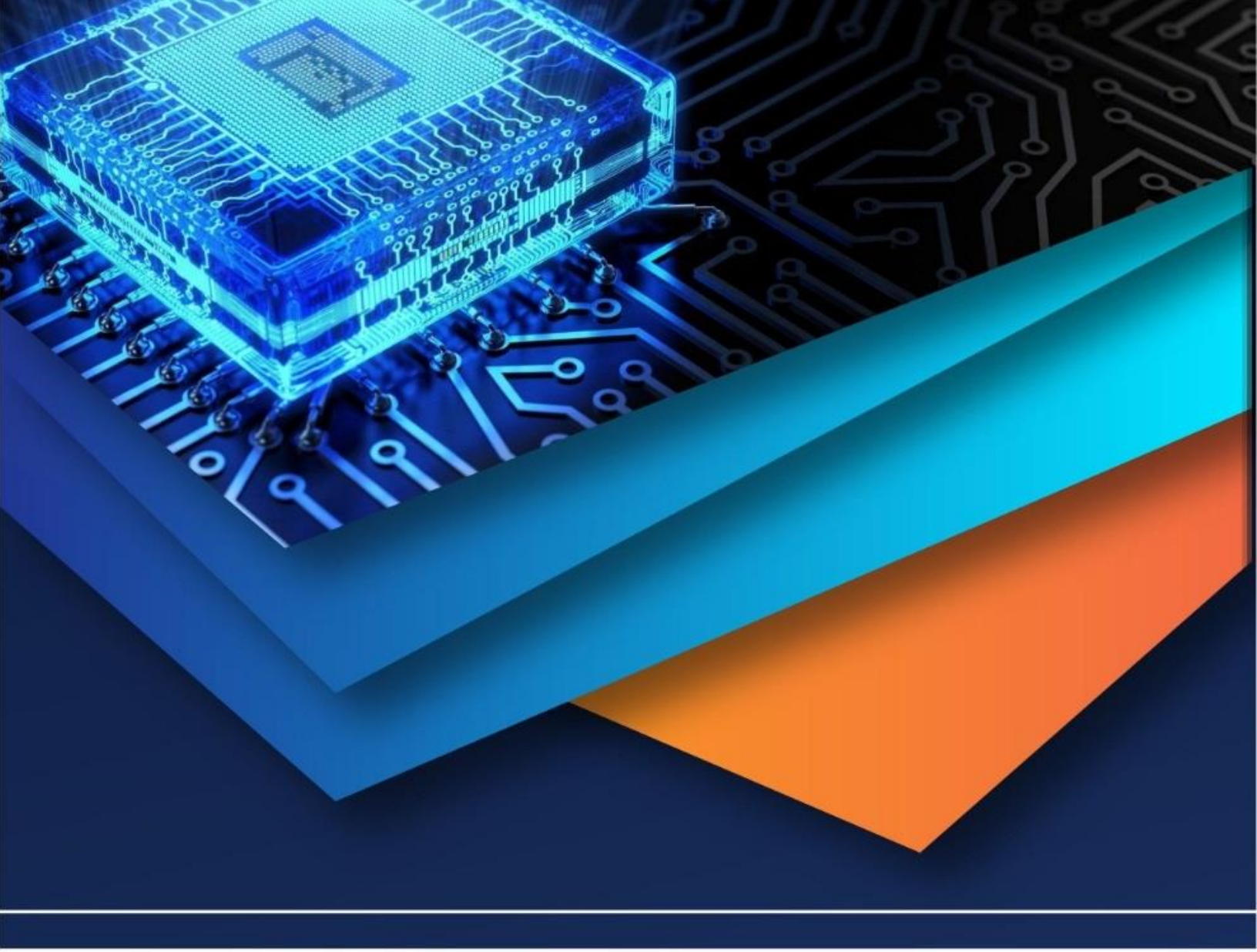

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