Vol II Issue VIII Feb 2013

Impact Factor : 0.1870

ISSN No :2231-5063

Monthly Multidisciplinary Research Journal

Golden Research Thoughts

Chief Editor
Dr.Tukaram Narayan Shinde

Publisher
Mrs.Laxmi Ashok Yakkaldevi

Associate Editor
Dr.Rajani Dalvi

Honorary
Mr.Ashok Yakkaldevi

IMPACT FACTOR : 0.2105

Welcome to ISRJ

RNI MAHMUL/2011/38595 **ISSN No.2230-7850**

Indian Streams Research Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial Board readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

International Advisory Board

Flávio de São Pedro Filho
Federal University of Rondonia, Brazil

Kamani Perera
Regional Centre For Strategic Studies, Sri Lanka

Janaki Sinnasamy
Librarian, University of Malaya [Malaysia]

Romona Mihaila
Spiru Haret University, Romania

Delia Serbescu
Spiru Haret University, Bucharest, Romania

Anurag Misra
DBS College, Kanpur

Titus Pop

Mohammad Hailat
Dept. of Mathmatical Sciences,
University of South Carolina Aiken, Aiken SC 29801

Abdullah Sabbagh
Engineering Studies, Sydney

Catalina Neculai
University of Coventry, UK

Ecaterina Patrascu
Spiru Haret University, Bucharest

Loredana Bosca
Spiru Haret University, Romania

Fabricio Moraes de Almeida
Federal University of Rondonia, Brazil

George - Calin SERITAN
Postdoctoral Researcher

Hasan Baktir
English Language and Literature Department, Kayseri

Ghayoor Abbas Chotana
Department of Chemistry, Lahore University of Management Sciences [PK]
Anna Maria Constantinovici
AL. I. Cuza University, Romania

Horia Patrascu
Spiru Haret University, Bucharest, Romania

Ilie Pintea,
Spiru Haret University, Romania

Xiaohua Yang
PhD, USA
Nawab Ali Khan
College of Business Administration

Editorial Board

Pratap Vyamktrao Naikwade
ASP College Devrukh,Ratnagiri,MS India

R. R. Patil
Head Geology Department Solapur University, Solapur

Rama Bhosale
Prin. and Jt. Director Higher Education, Panvel

Salve R. N.
Department of Sociology, Shivaji University, Kolhapur

Govind P. Shinde
Bharati Vidyapeeth School of Distance Education Center, Navi Mumbai

Chakane Sanjay Dnyaneshwar
Arts, Science & Commerce College, Indapur, Pune

Awadhesh Kumar Shirotriya
Secretary, Play India Play (Trust),Meerut

Iresh Swami
Ex - VC. Solapur University, Solapur

N.S. Dhaygude
Ex. Prin. Dayanand College, Solapur

Narendra Kadu
Jt. Director Higher Education, Pune

K. M. Bhandarkar
Praful Patel College of Education, Gondia

Sonal Singh
Vikram University, Ujjain

G. P. Patankar
S. D. M. Degree College, Honavar, Karnataka

Maj. S. Bakhtiar Choudhary
Director,Hyderabad AP India.

S.Parvathi Devi
Ph.D.-University of Allahabad

Sonal Singh

Rajendra Shendge
Director, B.C.U.D. Solapur University, Solapur

R. R. Yalikar
Director Managment Institute, Solapur

Umesh Rajderkar
Head Humanities & Social Science YCMOU, Nashik

S. R. Pandya
Head Education Dept. Mumbai University, Mumbai

Alka Darshan Shrivastava
Shaskiya Snatkottar Mahavidyalaya, Dhar

Rahul Shriram Sudke
Devi Ahilya Vishwavidyalaya, Indore

S.KANNAN
Ph.D , Annamalai University,TN

Satish Kumar Kalhotra

Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.isrj.net

Golden Research Thoughts
Volume 2, Issue. 8, Feb. 2013
ISSN:-2231-5063
Available online at www.aygrt.net

ORIGINAL ARTICLE

"SYNTHESIS, CHARACTERIZATION AND ANTIBACTERIAL ACTIVITIES OF CR, MO, W METAL CARBONYL COMPLEXES WITH BIDENTATE N-DONOR SCHIFF'S BASES"

AMIT SINGHAL , MANISH KAUSHIK , MUNESH KUMAR AND MANOJ AGARWAL

Department of Chemical Sciences, Jagdishprasad Jhabarmal
Tibrewala University, Jhunjhunu, Rajasthan
Department of Applied Sciences, Accurate Institute of
Management & technology, Gr. Noida (U.P.)
Department of Chemistry, Agrasen P.G. College, Sikandrabad,
Bulandshahr (U.P.)
Department of Applied Sciences, Accurate Institute of
Management & technology, Gr. Noida (U.P.)

Abstract:

We have synthesized fifteen polynuclear complexes {M(CO)$_4$*[L]}1a-1c, 2a-2c, 3a-3c, 4a-4c and 5a-5c (1a, M = Cr, L=SB1, R = H; 1b, M = Mo, L=*SB^1*, R = H; 1c, M = W, L=*SB^1*, R = H; 2a, M = Cr, L=*SB^2*, R = Me; 2b, M = Mo, L=*SB^2*, R = Me; 2c, M = W, L=*SB^2*, R = Me; 3a, M = Cr, L=*SB^3*, R = Eth; 3b, M = Mo, L=*SB^3*, R = Eth; 3c, M = W, L=*SB^3*, R = Eth; 4a, M = Cr, L=*SB^4*, R = n-pr; 4b, M = Mo, L=*SB^4*, R = n-pr; 4c, M = W, L=*SB^4*, R = n-pr; 5a, M = Cr, L=*SB^5*, R = Ph; 5b, M = Mo, L=*SB^5*, R = Ph; 5c, M = W, L=*SB^5*, R = Ph) by photochemical displacement of two CO group from M(CO)6 by phenyl-N-((pyridin-2-yl)methylene)methanamine [*SB^1*], (Z)-phenyl-N-(1-(pyridin-2-yl)ethylidene)methanamine [*SB^2*], (Z)-phenyl-N-(1-(pyridin-2-yl)propylidene)methanamine [*SB^3*], (Z)-phenyl-N-(1-(pyridin-2-yl)butylidene)methanamine [*SB^4*] and (Z)-phenyl-N-(phenyl(pyridin-2-yl)methylene)methanamine [*SB^5*] . The synthesized complexes exhibit variable degree of antibacterial activity. The complexes have been characterized by elemental analysis, IR, [*^{1}*H]-NMR spectroscopy and magnetic studies. The spectroscopic studies suggest a bidentate behavior of the ligand via pyrimidine-N and imine-N donor atoms with the metal (0).*

KEY-WORDS:

Schiff bases, coordination chemistry, N-donor Schiff bases, antibacterial activity.

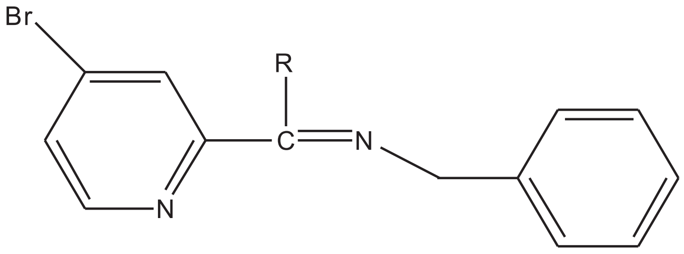
INTRODUCTION

A Schiff base is a functional group that contains a -nitrogen double bond with the nitrogen atom connected to an aryl or alkyl group but not hydrogen. Schiff bases are of the general formula $R_1R_2C=N-R_3$, where R_3 is an aryl or alkyl group that makes the Schiff base a stable imine. Monodentate Schiff's bases are less known to form stable complexes, probably due to the insufficient basic strength of the imino nitrogen of the C=N group. Ploydentate Schiff bases with phenolic OH or nitrogen or sulphur of the ring, suitably

Title :"SYNTHESIS, CHARACTERIZATION AND ANTIBACTERIAL ACTIVITIES OF CR, MO, W METAL CARBONYL COMPLEXES WITH BIDENTATE N-DONOR SCHIFF'S BASES" Source:Golden Research Thoughts [2231-5063]AMIT SINGHAL , MANISH KAUSHIK , MUNESH KUMAR AND MANOJ AGARWAL yr:2013 vol:2 iss:8

near to the imino nitrogen, may stabilize the metal-nitrogen bond through the formation of chelate rings. Schiff bases which are unaided by those donors but contain two azomethine nitrogen atoms, in spite of their facile ligating capabilities due to easy chances of chelation, have also been used in the CO displacement reactions of group VI metal carbonyls [1].

Metal-organic complexes containing bridged ligands are of current interest because of their continued interest due to their interesting molecular structure and their different functionalities [2-8]. Due to the versatile coordination modes of the ambidentate thiocyanate and azide ligands, these pseudohalide ligands have become the most extensively studied building blocks in the multi-dimensional complexes [9-10]. We have synthesized polynuclear complexes of the type 1a-1c, 2a-2c, 3a-3c, 4a-4c and 5a-5c (1a, M = Cr, L=SB^1, R = H; 1b, M = Mo, L=SB^1, R = H; 1c, M = W, L=SB^1, R = H; 2a, M = Cr, L=SB^2, R = Me; 2b, M = Mo, L=SB^2, R = Me; 2c, M = W, L=SB^2, R = Me; 3a, M = Cr, L=SB^3, R = Eth; 3b, M = Mo, L=SB^3, R = Eth; 3c, M = W, L=SB^3, R = Eth; 4a, M = Cr, L=SB^4, R = n-pr; 4b, M = Mo, L=SB^4, R = n-pr; 4c, M = W, L=SB^4, R = n-pr; 5a, M = Cr, L=SB^5, R = Ph; 5b, M = Mo, L=SB^5, R = Ph; 5c, M = W, L=SB^5, R = Ph) has been synthesized by photochemical displacement of two CO groups in group-6 metal carbonyls with by phenyl-N-((pyridin-2-yl)methylene)methanamine [SB^1], (Z)-phenyl-N-(1-(pyridin-2-yl)ethylidene)methanamine [SB^2], (Z)-phenyl-N-(1-(pyridin-2-yl)propylidene)methanamine [SB^3], (Z)-phenyl-N-(1-(pyridin-2-yl)butylidene)methanamine [SB^4] and (Z)-phenyl-N-(phenyl(pyridin-2-yl)methylene)methanamine [SB^5]. Both the ligands & their complexes were characterized on the basis of physical properties, elemental analysis data, magnetic studies, infrared and nuclear magnetic resonance spectroscopy. It was found that the ligands have bidentate nature coordinating through two N donor atom. Thus replacing two CO group to maintain charge density on metal centre.



Ligand SB^{1-5} (Z)-N-(1-(4-bromopyridin-2-yl)alkylidene)(phenyl)methanamine

EXPERIMENTAL

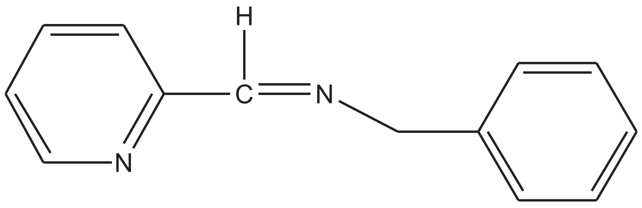
Reactions were carried out under dry argon or in vacuo. All solvents were dried and degassed prior to use. Infrared spectra were recorded on a Perkin-Elmer spectrophotometer (Model-577) in KBr discs and CH_2Cl_2. All the melting points were determined in an open capillary and are uncorrected. All glassware was oven dried at 120°C, molecular weight of the complexes were determined cryoscopically in benzene, cyclooctadiene (COD), n-hexane, n-pentane, benzene were purchased from E. Merck, and $M(CO)^6$ (M = Cr, Mo, W), dichloromethane were purchased from Aldrich and were used as supplied.

Magnetic susceptibility measurements of the complexes were carried out by Gouy method. UV irradiation were performed with a medium pressure 400W mercury lamp through a quartz bulb.

SYNTHESIS OF THE LIGANDS-

Synthesis of ligand phenyl-N-((pyridin-2-yl)methylene)methanamine [Sb^1]

The ligand phenyl-N-((pyridin-2-yl)methylene)methanamine [SB^1] was prepared by literature method [11] as followed. 0.107 g, (1.0 mmol) of picolinaldehyde was refluxed with 0.107 g (1.0 mmol) benzylamine (phenylmethamine) in 20ml dehydrated alcohol. After 10h, the reaction mixture was evaporated under reduced pressure to yield gummy mass, which was dried and stored in vacuo. Yield 78.7%. Analysis Calc. for $C_{13}H_{12}N_2$ Mol. Wt. 196.25, C, 79.56; H, 6.16; N, 14.27 found Mol. Wt. 195.62, C, 78.97; H, 5.90; N, 14.19.



phenyl-*N*-((pyridin-2-yl)methylene)methanamine

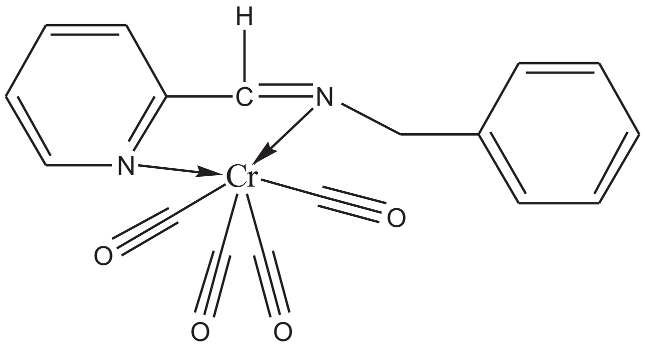
The other ligands were prepared similarly.

PREPARATION OF COMPLEXES

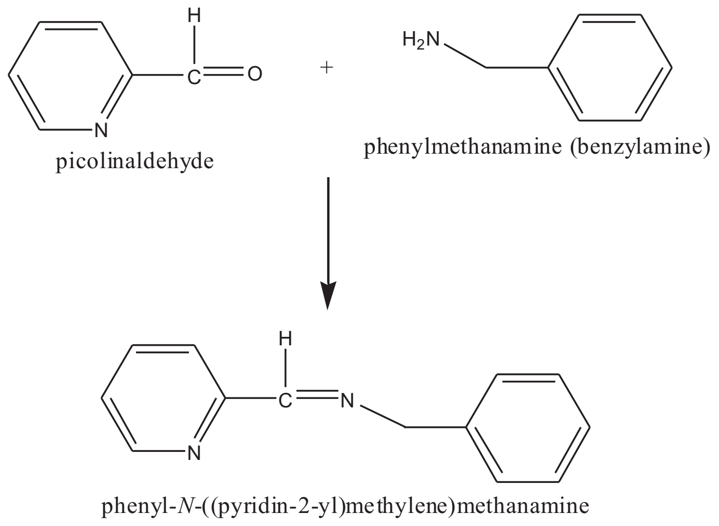
Complexes {$M(CO)_4[SB^{1-5}]$} were prepared by the photochemical reactions of $M(CO)_5THF$ (M=Cr, Mo, W) with phenyl-N-((pyridin-2-yl)methylene)methanamine [SB^1], (Z)-phenyl-N-(1-(pyridin-2-yl)ethylidene)methanamine [SB^2], (Z)-phenyl-N-(1-(pyridin-2-yl)propylidene)methanamine [SB^3], (Z)-phenyl-N-(1-(pyridin-2-yl)butylidene)methanamine [SB^4] and (Z)-phenyl-N-(phenyl(pyridin-2-yl)methylene)methanamine [SB^5] and obtained in 75-80% yield by similar methods of which the following in typical.

Preparation of complex {$Cr(CO)_4[SB^1]$}

A solution of $Cr(CO)_6$ (0.22g; 1.0 mmole) in 70ml of THF was irradiated to obtain $Cr(CO)_5$ THF with UV light in a quartz vessel under a stream of argon for 2½Hr. at room temperature. A solution of SB^1 (0.196 g; 1.0mmole) in 25ml of THF was added to the resulting solution of $Cr(CO)_5THF$ intermediate. The reaction mixture was irradiated again at room temperature for 2½Hr. at same conditions. During this irradiation the solution changed from yellow to brown. The solvent was removed under vacuum afford a brown airstable (75% yield). Unreacted $Cr(CO)_6$ removed by washing the residue several times with light petroleum (40-60oC). The product was recrystallised in benzene.



Scheme 1 – Preparation of Ligand SB^1: Reaction of picolinaldehyde with phenylmethanamine (benzyl amine)



Scheme 2 – Preparation of Complexes: Reaction of phenyl-N-((pyridin-2-yl) methylene) methanamine (SB^1) with $Cr(CO)_6$

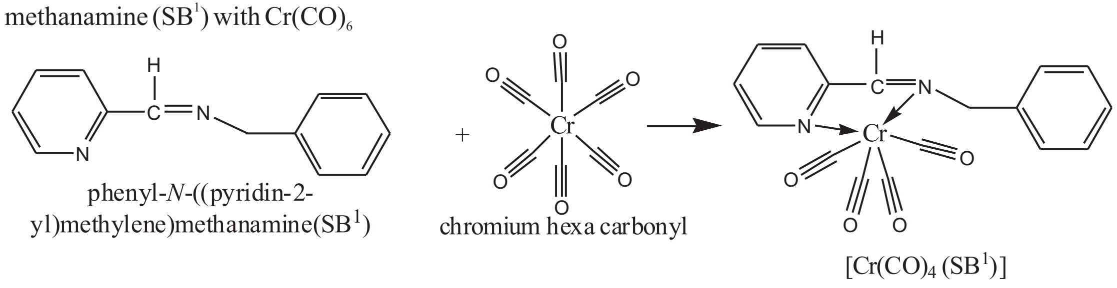


Table 1a – Physical and analytical data of Ligands (SB^{1-5})

Ligands	Molecular Formula	Yield (%)	M.p. (°C)	Colour	Found (Calcd.) (%)			Mol. Wt.
					C	H	N	
a (SB^1)	$C_{13}H_{12}N_2$	78.7	129	Cream	78.9 (79.6)	5.9 (6.2)	14.2 (14.3)	195.6 (196.3)
b (SB^2)	$C_{14}H_{14}N_2$	79.5	135	Light yellow	79.1 (79.9)	6.1 (6.7)	13.2 (13.3)	209.6 (210.3)
c (SB^3)	$C_{15}H_{16}N_2$	80.1	138	Light yellow	79.9 (80.3)	6.9 (7.2)	12.2 (12.5)	223.6 (224.3)
d (SB^4)	$C_{16}H_{18}N_2$	76.5	140	Yellow	80.2 (80.6)	7.2 (7.6)	11.4 (11.7)	237.5 (238.3)
e (SB^5)	$C_{13}H_{12}N_2$	76.7	141	Yellow	82.9 (83.8)	5.4 (5.9)	10.2 (10.3)	271.1 (272.3)

Table 1b – Physical and analytical data of Complexes

Complexes	Molecular Formula	Yield (%)	M.p. (°C)	Colour	Found (Calcd.) (%)			Mol. Wt.
					C	H	N	
1a	$C_{17}H_{12}CrN_2O_4$	78	146	Light Yellow	55.4 (56.1)	4.2 (4.4)	7.5 (7.7)	364.0 (364.3)
2a	$C_{17}H_{12}MoN_2O_4$	74	154	Yellow	49.1 (50.0)	3.5 (3.9)	6.7 (6.9)	408.3 (410.0)
3a	$C_{17}H_{12}WN_2O_4$	79	165	Yellow	40.5 (41.2)	3.1 (3.3)	5.1 (5.6)	496.0 (496.2)
1b	$C_{18}H_{14}CrN_2O_4$	76	147	Light Yellow	56.2 (57.1)	4.6 (4.8)	7.1 (7.4)	378.0 (378.3)
2b	$C_{18}H_{14}MoN_2O_4$	78	155	Yellow	50.8 (51.2)	4.1 (4.3)	6.2 (6.6)	422.3 (424.0)
3b	$C_{18}H_{14}WN_2O_4$	76	166	Cream	42.1 (42.4)	3.4 (3.6)	5.1 (5.5)	510.1 (510.2)
1c	$C_{19}H_{16}CrN_2O_4$	75	147	Light Yellow	57.7 (58.2)	4.9 (5.1)	6.7 (7.1)	392.1 (392.4)
2c	$C_{19}H_{16}MoN_2O_4$	70	156	Yellow	51.8 (52.3)	4.1 (4.4)	6.1 (6.4)	436.3 (438.0)
3c	$C_{19}H_{16}WN_2O_4$	78	166	Cream	42.8 (43.5)	3.4 (3.8)	5.0 (5.3)	524.1 (524.2)
1d	$C_{20}H_{18}CrN_2O_4$	78	166	Light Yellow	58.7 (59.1)	5.2 (5.5)	6.5 (6.9)	406.1 (406.4)
2d	$C_{20}H_{18}MoN_2O_4$	74	164	Yellow	53.1 (53.3)	4.6 (4.9)	6.1 (6.3)	450.3 (452.0)
3d	$C_{20}H_{18}WN_2O_4$	79	175	Yellow	44.5 (44.6)	3.7 (4.1)	5.1 (5.2)	538.1 (538.2)
1e	$C_{23}H_{16}CrN_2O_4$	76	167	Light Yellow	62.2 (62.7)	4.3 (4.6)	6.1 (6.4)	440.1 (440.4)
2e	$C_{23}H_{16}MoN_2O_4$	78	170	Yellow	56.4 (57.0)	4.0 (4.2)	5.2 (5.8)	484.4 (486.0)
3e	$C_{23}H_{16}WN_2O_4$	76	172	Cream	48.1 (48.3)	3.3 (3.5)	4.6 (4.9)	572.1 (572.3)

Table 2a. Selected IR bands (cm^{-1}) and (^{1}H)-NMR (ppm) data of SB$^{1-5}$ ligands

Ligand	Selected IR bands (cm^{-1})		^{1}H-NMR (in CDCl3) δ ppm
	Imine ν (C=N)	Pyrimidine N	
A	1590	1340	8.45 (d, 1H, -$\underline{CH}$), 3.74 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
B	1592	1338	2.42 (s, 3H, -$\underline{CH_3}$), 3.69 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
C	1589	1374	2.59 (q, 2H, -$\underline{CH_2}CH_3$), 0.92 (t, 3H, -$CH_2\underline{CH_3}$), 3.72 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
D	1594	1356	2.58 (t, 2H, -$\underline{CH_2}$ CH_2CH_3), 1.44 (m, 2H, -$CH_2\underline{CH_2}CH_3$), 0.94 (t, 3H, -CH_2 $CH_2\underline{CH_3}$), 3.70 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
E	1597	1368	7.27 (s, 5H, C_6H_5), 4.84 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)

Table 2b. Selected IR bands (cm^{-1}) and (^{1}H)-NMR (ppm) data of complexes

Complex	Selected IR bands (cm^{-1})			^{1}H-NMR (in CDCl3) δ ppm
	ν (CO)	Imine ν (C=N)	Pyrimidine N	
1a	2068, 2017, 1958, 1934	1574	1306	8.10 (d, 1H, -$\underline{CH}$), 2.60 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
2a	2067, 2015, 1957, 1932	1575	1308	8.11 (d, 1H, -$\underline{CH}$), 2.64 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
3a	2068, 2017, 1958, 1934	1577	1305	8.13 (d, 1H, -$\underline{CH}$), 2.61 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
1b	2067, 2015, 1957, 1932	1570	1308	2.40 (s, 3H, -$\underline{CH_3}$), 2.60 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)

2b	2071, 2015, 1952, 1934	1572	1310	2.38 (s, 3H, -$\underline{CH_3}$), 2.62 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
3b	2069, 2013, 1949, 1930	1574	1309	2.41 (s, 3H, -$\underline{CH_3}$), 2.56 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
1c	2072, 2018, 1959, 1935	1577	1311	2.17 (q, 2H, -$\underline{CH_2}CH_3$), 0.76 (t, 3H, -$CH_2\underline{CH_3}$), 2.60 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
2c	2072, 2018, 1958, 1935	1570	1306	2.14 (q, 2H, -$\underline{CH_2}CH_3$), 0.75 (t, 3H, -$CH_2\underline{CH_3}$), 2.59 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
3c	2069, 2019, 1957, 1933	1572	1302	2.15 (q, 2H, -$\underline{CH_2}CH_3$), 0.78 (t, 3H, -$CH_2\underline{CH_3}$), 2.61 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
1d	2068, 2017, 1958, 1934	1577	1304	2.11 (t, 2H, -$\underline{CH_2}\,CH_2CH_3$), 1.66 (m, 2H, -$CH_2\underline{CH_2}CH_3$), 0.94 (t, 3H, -$CH_2CH_2\underline{CH_3}$), 2.60 (s, 2H, -$CH_2$-), 7.36 (s, 5H, -$C_6H_5$)
2d	2067, 2015, 1957, 1932	1570	1312	2.12 (t, 2H, -$\underline{CH_2}\,CH_2CH_3$), 1.62 (m, 2H, -$CH_2\underline{CH_2}CH_3$), 0.92 (t, 3H, -$CH_2CH_2\underline{CH_3}$), 2.62 (s, 2H, -$CH_2$-), 7.36 (s, 5H, -$C_6H_5$)
3d	2071, 2015, 1952, 1934	1572	1317	2.10 (t, 2H, -$\underline{CH_2}\,CH_2CH_3$), 1.65 (m, 2H, -$CH_2\underline{CH_2}CH_3$), 0.93 (t, 3H, -$CH_2CH_2\underline{CH_3}$), 2.58 (s, 2H, -$CH_2$-), 7.36 (s, 5H, -$C_6H_5$)
1e	2069, 2013, 1949, 1930	1574	1314	7.48 (s, 5H, C_6H_5), 4.81 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
2e	2072, 2018, 1959, 1935	1577	1307	7.49 (s, 5H, C_6H_5), 4.82 (s, 2H, -CH_2-), 7.36 (s, 5H, -C_6H_5)
3e	2072, 2018, 1958, 1935	1570	1312	7.47 (s, 5H, C_6H_5), 4.80 (s, 2H, -CH_2-

RESULTS AND DISCUSSION

The ligands were prepared by condensation reaction of benzylamine (phenylmethamine) of was refluxed with corresponding 1-(pyridin-2-yl)Alkyl-1-one according to Scheme-1. Complexes (1a-3c) were prepared by photochemical reaction as shown in Scheme-2. Analytical data for {M(CO)4[SB1]} (1a-3a); {M(CO)$_4$[SB^2]} (1b-3b); {M(CO)$_4$[SB^3]} (1c-3c); {M(CO)$_4$[SB^4]} (1d-3d) and {M(CO)$_4$[SB^5]} (1e-3e) where (M= Cr, Mo & W); complexes are given in Table-1b.

In this study, photochemical reactions of M(CO)$_6$ (M=Cr, Mo & W) with phenyl-N-((pyridin-2-yl)methylene)methanamine [SB^1], (Z)-phenyl-N-(1-(pyridin-2-yl)ethylidene)methanamine [SB^2], (Z)-phenyl-N-(1-(pyridin-2-yl)propylidene)methanamine [SB^3], (Z)-phenyl-N-(1-(pyridin-2-yl)butylidene)methanamine [SB^4] and (Z)-phenyl-N-(phenyl(pyridin-2-yl)methylene)methanamine [SB^5] ligands occurs in expected manner, and gave hither to a series of complexes (1a)-(1e); (2a)-(2e) and (3a)-(3) occur via the displacement of two CO from M(CO)$_6$ (M=Cr, Mo & W) and co-ordination of metal atom via imine-N and pyridine-N donor atoms yielding M(CO)$_4$L complexes.

The i.r. spectra of ligands and the corresponding complexes provide information about the metal-ligand bonding. Important IR spectral bands M(CO)$_4$L (L = phenyl-N-((pyridin-2-yl)methylene)methanamine [SB^1], (Z)-phenyl-N-(1-(pyridin-2-yl)ethylidene)methanamine [SB^2], (Z)-phenyl-N-(1-(pyridin-2-yl)propylidene)methanamine [SB^3], (Z)-phenyl-N-(1-(pyridin-2-yl)butylidene)methanamine [SB^4] and (Z)-phenyl-N-(phenyl(pyridin-2-yl)methylene)methanamine [SB^5] and M=Cr, Mo & W) are presented in Table-2b. The evidence about metal-imine nitrogen (M–N) bond formation is the shifting of C=N vibration found at 1590 cm-1 in free ligand, shifts to lower wavelength in complexes 1a-3c, showing that the ligand coordinate to metal via the imine donor atom.[12]. The stretching vibrations found at 3020cm-1 in free ligand, shifts to lower wavelength in complexes showing that the ligand is coordinating via amine donor atom.

Four bands in the range (2068-2072 cm^{-1}), (2013-2018 cm^{-1}), (1949-1958 cm^{-1}) and (1932-1936 cm^{-1}) arising from ν (CO) vibrations are seen which presumably have local c_{2v} symmetry of M(CO)$_4$ unit in {M(CO)$_4$SB^1} (1a-3a); {M(CO)$_4$SB^2}(1b-3b) and {M(CO)$_4$SB^3} (1c-3c); {M(CO)$_4$SB^4} (1d-3d) and {M(CO)$_4$SB^5} (1e-3e); where (M= Cr, Mo & W); complexes (Scheme-2). These values are in close resemblance to the values of ν (CO) vibration for other nitrogen containing disubstituted group-6 metal carbonyls [13-16]. The presence of normal ligand bands indicated that these bands were intact in the complexes. The nature and number of CO bands resemble closely to the bands of other known trisubstituted metal carbonyls [17-20].

In addition, magnetic susceptibility measurement shows that (1a-3e) complexes were diamagnetic. Since these complexes have M(0) [M=Cr, Mo, W] with a low spin d6 configuration. Such diamagnetism might arise from further splitting of the d-orbital in the low symmetry complexes i.e. dxy2, dxz^2, dyz^2, $d(x^2-y^2)^0$, $dz^{2\,0}$ [21, 22].

ANTIBACTERIALACTIVITY

All the synthesized complexes were screened for their antibacterial activity by using agar diffusion method [23] against S. aureus , B. subtile gram positive and E. coli, S. paratyphi gram negative bacteria in nutrient agar medium. Ciprofloxacin was used as standard drug for comparison.

These schiff's Bases and their metal carbonyl complexes show antibacterial activity against E. coli, S. aureus, B. subtile and S. paratyphi. It is found that (Z)-phenyl-N-(1-(pyridin-2-yl)ethylidene)methanamine [SB^2], (Z)-phenyl-N-(1-(pyridin-2-yl)propylidene)methanamine [SB^3] studied here follow such a decomposition scheme in the cell, and diazoalkane intermediates further could alkylate the nucleophilic centres of biologically important macromolecules and in particular DNA. phenyl-N-((pyridin-2-yl)methylene)methanamine [SB^1], (Z)-phenyl-N-(1-(pyridin-2-yl) butylidene) methanamine [SB^4] and (Z)-phenyl-N-(phenyl(pyridin-2-yl)methylene)methanamine [SB^5] shows moderate activity. With the help of activity data it could be observed that complexes M(CO)$_4$SB^2(1b-3b), M(CO)$_4$SB^3(1c-3c) showed good activity against E.coli and S. paratyphi. Complexes M(CO)$_4$SB^1 (1a-1c), M(CO)$_4$SB^4 (1d-3d) and M(CO)$_4$SB^5 (1e-3e) exhibited good activity against S. paratyphi.

CONCLUSION

SB$^{1\text{-}5}$ ligands behave as a bidentate ligand via imine and pydidine N donor atom in 1a-3e. In view of above, we have now investigated the fifteen new complexes 1a-3e, which have been prepared for the first time, by the photochemical reaction of metal carbonyls M(CO)$_6$ (M=Cr, Mo & W), with (Z)-N-(1-(4-bromopyridin-2-yl)alkylidene)(phenyl)methanamine (SB$^{1\text{-}5}$).

The results show that (Z)-N-(1-(4-bromopyridin-2-yl)alkylidene)(phenyl)methanamine and its metalcarbonyl derivatives exert a moderate inhibitory effect on different bacterial activity, thus confirming our previous data about the cytotoxic activity of these compounds.

ACKNOWLEDGEMENTS

Sincere thanks are due to Head, Dept. of Chemistry, A. I. M. T., Greater NOIDA, Head, Dept. of Chemical Sciences, JJTU, Rajasthan and Gaurav Pharma Limited, Pitampura, New Delhi for providing research facilities. Authors are also thankful to Dr. Vivek Kumar, Professor, IIT Roorkee, (Saharanpur Campus) for his constant encouragement to carry out such research work. Special thanks are also due to CDRI, Lucknow, Intertek, Mumbai, I.I.T., Roorkee, Research Lab, Delhi University and TIFR, Mumbai for allocation of time for various analyses.

REFERENCES:

1.A. Srivastava et. al., Indian Journal of Chemistry, 41A, 785 (2002), A. Singh, M. Kumar, M. Kaushik, Int. J. Applied Chem., 6(1), 49-58 (2010)
2.H. Abourahma, B. Moulton, V. Kravtsov, M.J. Zaworotko, J. Am. Chem. Soc., 124, 9990 (2002), A. Singh, M. Kumar, M. Kaushik, Int. J. Applied Chem., 6(1), 49-58 (2010)
3.S. R. Batten, R. Robson, Angew. Chem., 110, 1558 (1998).
4.S. R. Batten, R. Robson, Angew. Chem. Int. Ed., 41, 1561 (2002).
5.S. Konar, P.S. Mukherjee, E. Zangrando, F. Lloret, N.R. Chaudhuri, Angew. Chem., 114, 1631 (2002).
6.S. Konar, P.S. Mukherjee, E. Zangrando, F. Lloret, N.R. Chaudhuri, Angew. Chem. Int. Ed., 41, 1561 (2002).
7.S.K. Dey, N. Mondal, M.S. El. Fallah, R. Vicente, A, Escuer, X. Solans, M. Font-Bardia, T. Matsushita, V. Gramlich, S. Mitra, Inorg. Chem., 43, 2427 (2004).
8.You Z-L & Zhu H-L, Z. Anorg. Allg. Chem., 632, 140 (2006).
9.S. K. Dey, N. Mondal, M.S. El Fallah, R. Vicente, A. Escuer, X. Solans, M. Font-Bardia, T. Matsushita, V. Gramlich, S. Mitra, Inorg. Chem., 43, 2427 (2004).
10.S. Sailaja, K. R. Reddy, M. V. Rajasekharan, C. Hureau, E. Riviere, J. Cano, J-J. Girerd, Inorg. Chem., 42, 180 (2003).
11.H. Chowdhury, R. Ghosh, B.N. Sarkar, S.P Banerjee & B. K. Ghosh, Ind. J. of. Chem., 46A, 1397-1400 (2007).
12.J. E. Kovacic, Spectrochim, Acta 23A, 182 (1967).
13.S. W. Kirtley, in G. Eilkinson, F. G. A. Stone, E. W. Abel, (eds): “Comprehensive Organometallic Chemistry”, Pergamon Press, Oxford, Vol. 3, p 1079, 1255 (1982).
14.A. S. Cavallo, G. Solladie, E. Tsano, Journal of Organometallic Chemistry, 144, 181 (1978).
15.R. Lal Sc. K. Samanta (nee Bera), I. Banerjee, Indian Journal of Chemistry, 40A, 144 (2001).
16.W. Kaim, S. Kohlmann, Inorganic Chemistry, 26, 68 (1987).
17.Cotton F.A., Kraihanzel, C.S., J.Am. Chem. Soc., 84, 4432 (1962).
18.Zahida OZER, Saim. OZKAR, Turk. J. Chem., 23, 9-14, (1999).
19.Timmers, F.J., Wacholtz, W.F., J.Chem. Ed., 71, 987 (1994), King, R.B., Organometallic Syntheses, Vol. 1, Academic Press, New York, 125(1965).
20.Abel E., Bennett, W.M.A., Burton, R. Wilkinson G., J. Chem. Soc., 4559 (1958).
21.Senem Karahan, Ploinkose, and Elif Subasi Hamdi Temel; Synthesis and reactivity in Inorganic, Metal-organic, and Nano-Metal Chemistry, 38, 422-427 (2008).
22.Ayodhya Singh, Munesh Kumar, Manish Kaushik, Seema Singh and Anjali Singh; Oriental Journal of Chemistry, 26(2), 601-606 (2010).
23.A. L. Barry, “The antimicrobial susceptibility Test: Principal and practice”, Edited by Illus Lea and Febiges, Philadelphia, Pa. U.S.A., 148-193 (1976).