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# Eco-friendlyand Efficient Synthetic Approach and Antimicrobial Activityof Cu(II) Complexes of Quinazolin-4(3H)-one Derived Schiff Base Ligands

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Abstract: A rapid, efficient, clean and environmentally benign exclusive synthesis of two Schiff bases as new ligands and their complexes with Cu(II) have been developed using condensation of 3-phenyl-2-propyl-quinazolin-4(3H)-one with semicarbazide (ppgs, L) and thiosemicarbazide (ppqt, L') efficiently using alkali catalyst with excellent yields under microwave irradiation. This method provides several advantages such as environmental friendliness, simple work-up procedure, short reaction times, non-hazardous and excellent vield of products. The results are compared with conventional methods for their vield and reaction time. The Schiff base ligands and the complexes were characterized by microanalytical, conductometric, magnetic and spectroscopic studies. All the Schiff bases were bidentate (NO donor) ligands. All complexes were found to be six co-ordinate and ML<sub>2</sub>[1:2 (metal: ligand) ratio] type. The complexes are coloured and stable in air.Besides, ambient conditions, excellent product yields and MWI as a universal method display both economic and environmental advantages. Antimicrobial data suggests that the metal complexes are betterantibacterial agents as compared to their ligands. The complexes also inhibit thegrowth of bacteria to a greater extent as the concentration is increased. Keywords : Schiff bases; Microwave irradiation; Copper; Semicarbazone;

Thiosemicarbazone.

## Introduction

The development of efficient and environmentally benign processes for the preparation of biologically active molecules constituents a major challenge for chemists working in the field of pharmaceutical chemistry [1]. In addition, benign safe, readily available and environmentally friendly method, MWI has also been recognized as an effective reaction method with unique properties and possibilities for many organic/inorganic reactions [2].

The bioinorganic chemistry paid greatattention to the Schiff base complexes because many of these complexes have biologically important species [3-4]. So, the synthesis of new ligands and complexes would be important step in the development of coordination chemistry which exhibit novel properties and reactivity.

Quinazolinones and their derivatives constitute an important class of heterocyclic compounds. Many of them show insecticidal, analgesic, antifungal, antibacterial, anticancer, anti-inflammatoryactivities [5-6]. Quinazolinone nucleus is found in many bioactive natural products. So, because of these reasons much attention is being paid for the synthesis of quinazolinone derivatives. Looking at the biological significance of quinazolinone nucleus it was thought to design and synthesize new quinazolinone derivatives with semicarbazone and their Cu(II) complexes and screen them for their antibacterial activity.

As part of our ongoing program [7-9] to develop more efficient and environmentally benign methods for organic / inorganic syntheses using economic and ecofriendly materials as catalysts, we have looked into the synthesis of Schiff bases as ligands and the Cu(II)-complexes usingalkali catalyst with excellent yields under microwave irradiation.

### Experimental

#### **Materials & Methods**

All the chemicals and solvents used for the synthesis wereof analytical grade. The solvents were purified by standard methods. The infrared spectra of the ligands and metal complexes were run as KBr discs in the range 4000-400 cm<sup>-1</sup> on a Shimadzu Infrared Spectrophotometer. Electronic spectra in the solid state as well as in solution were recorded on a Shimadzu UV-160, UV-visible spectrophotometer. Conductivity measurements of the metal complexes were done inDMFbridge model PW 9501 using Philips PW 9515/10 conductivity cell.Melting points were measured on an Electro-thermal 9100 apparatus and are uncorrected.Elemental analyses were recorded on a Carlo-Erba EA1110CNNO-Sanalyzer. Magnetic susceptibility of the complexes was carried out by Gouy's method using Hg[Co(NCS)<sub>4</sub>] as standard. ESR measurements were carried out on a Varian E-109 X-band spectrometer, working at a microwave frequency of 9.05 GHz.Microwave assisted synthesis were carried out in open glass vessel on a modified microwave oven model 2001 ETB with rotating tray and a power source 230 V, at output energy of 800W and 2450 MHz frequency. A thermocouple device was used to monitor the temperature inside the vessel of the microwave. The microwave reactions were performed using on/off cycling to control the temperature.

#### Synthesis of Ligands

Ligands were prepared by treating ethanolic solution of 3-phenyl-2-propyl-quinazolin-4(3H)-one hydrochloride (0.01m) and ethanolic solution of semicarbazide hydrochloride/thiosemicarbazide hydrochloride (0.01 M)under microwave irradiation for 5 min. The reaction was completed in a short time (3-5 min) with higher yields showing clear coloured solution. The resulting Schiff base ligands were then recrystallized with DMF and finally dried under reduced pressure over anhydrous CaCl<sub>2</sub> in a desiccator.The progress of the reaction and purity of the products were monitored by TLC using silica gel G (yield: 85-89%)(Scheme-1).

	MWI	
$O_{17} O_{16} O_{2} O_{7} O_{16} O_$	3-5 minutes	ر ار
	MWI NO LL NU	_
$C_{17} \Gamma_{16} \Gamma_{2} O + \Gamma_{11} \Gamma_{2} O \Gamma_{10} O O \Gamma_{2}$	3-5 minutes	Э
	PPQT	

Scheme-1: Microwave irradiated synthesis of ligands

#### Synthesis of metal complexes

The ethanolic solution of ligand and the Cu(II) salts were mixed thoroughly in 1:2 (metal: ligand) ratio and then irradiated in the microwave oven by taking 3-4 ml solution. The reaction was completed in a short time (3-5 min.) with higher yields. The resulting coloured products were then recrystallized with ethanol and DMF and finally dried under reduced pressure over anhydrous CaCl<sub>2</sub> in a desiccator. The progress of the reaction and purity of the product was monitored by TLC using silica gel G (yield: 70-88%) (**Scheme-2**).

	21	MWI	
CuX <sub>2</sub> +	ZL	3-5 minutes	[CuL <sub>2</sub> X <sub>2</sub> ] colouerd complex

Where  $X = Cl^{-}$ ,  $Br^{-}$ ,  $I^{-}$ ,  $NO_3^{-}ClO_4^{-}$  and L = PPQS & PPQT

#### Scheme-2: Microwave irradiated synthesis of complexes

#### **Biological Evaluation**

The *in vitro* biological activity of the investigated Schiff base ligands (L - L') and their metal complexes were tested against two bacteria *B.subtilis, E.coli, S.aureus* and*Ralstonia solanacearum*by disc diffusion method [10] using nutrient agar as medium. The bacteria were sub-cultured in the agar medium and were incubated for 24h at 37 °C. Standard antibacterial drug (Chloramphenicol) was used for comparison. The discs having a diameter of 4 mm were soaked in the test solutions and were placed on an appropriate medium previously seeded with organisms in petri plates and stored in an incubator at the above mentioned period of time. The inhibition zone around each disc was measured and the results have been recorded in the form of inhibition zones (diameter, mm) showed in Table 4. In order to clarify any effect of DMF on the biological screening [11], separate studies were carried out with solutions alone of DMF and they showed no activity against any microbial strains. The stock solution (1 mg/ml<sup>-1</sup>) of the test compounds was prepared in DMF. Each test was performed in triplicate in individual experiments and the average is reported.

#### **Results And Discussion**

As a result of microwave assisted synthesis, it was observed that the reaction was completed in a short time with higher yields compared to the conventional method. In the microwave method homogeneity of reaction mixture was increased by the rotating of reaction platform tray. The confirmation of the results was also checked by the repeating of the synthesis process. Comparative study results obtained by microwave assisted synthesis; versus conventional heating method is that some reactions which required 2-3 h. by conventional method, was completed within 2-5 min. by the microwave irradiation technique, yields have been improved from 37-48% to 73-89%.

All the metal complexes are coloured, solid and stable towards air and moisture at room temperature. They do not possess sharp melting points and decompose on heating at high temperature. The complexes are insoluble in common organic solvents butsoluble in DMF and DMSO. The comparative results of conventional and microwave methods, analytical data of the compounds, together with their physical properties are consistent with proposed molecular formula are given in **Table-1**. The micro-analytical data suggest that the composition of all the metal complexes corresponds to 1:2 (metal: ligand) stoichiometry and have one or two water molecules i.e. hydrated. The observed molar conductance values  $(3.5 - 8.7 \text{ ohm}^{-1}\text{cm}^2\text{mole}^{-1})$  are too low to account for any dissociation of the complexes in DMF at room temperature, indicating non-electrolytic nature of the complexes [12].

Compounds	Reactio	Yiel	Elemental analysis			Mol.	Conductance		
(Colour)	n Time	d		Found (Calculated) %				Mass	$(ohm^{-1} cm^2 mol^{-1})$
		(%)						(amu)	
	СМ	СМ	С	Н	Ν	S	Cu		
	(MM)	(M							
		<b>M</b> )							
LH=PPQS	2.0	45	67.28	5.91	21.81			321	4.5
(Orange)	(2.5)	(89)	(66.9)	(6.05)	(22.05)				
L'H=PPQT	2.5	42	64.09	5.64	20.77	9.49		337	3.5
(Yellow-	(3.0)	(83)	(64.5)	(5.50)	(21.25)	(9.50)			
orange)									
[CuL <sub>2</sub> Cl <sub>2</sub> ]	2.5	35	55.63	4.89	18.03		8.17	776	8.7
(Blue)	(3.0)	(75)	(56.1)	(5.05)	(18.20)		(7.10)		
$[CuL_2Br_2]$	3.0	40	49.91	4.39	16.17		7.33	865	8.5
(Green)	(3.0)	(79)	(50.2)	(4.50)	(16.50)		(7.00)		
. ,									
[CuL <sub>2</sub> I <sub>2</sub> ]	2.5	45	45.02	3.96	14.59		6.61	959	7.9
(Green)	(5.0)	(85)	(45.50)	(4.10)	(15.00)		(6.20)		

# Table-1 The comparative results of conventional and microwave methods, analytical and physical data of the compounds under investigation

[CuL <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> ] (Green)	3.0 (4.5)	43 (83)	52.08 (52.5)	4.58 (4.70)	16.87 (17.10)		7.65 (7.20)	829	8.6
$[CuL_2(ClO_4)_2]$ (Yellowish red)	3.5 (4.0)	46 (89)	47.67 (48.0)	4.20 (4.10)	15.47 (15.50)		7.05 (6.70)	904	8.4
[CuL' <sub>2</sub> Cl <sub>2</sub> ] (Blue)	3.0 (4.0)	35 (73)	53.43 (53.8)	4.70 (4.80)	17.31 (17.50)	3.95 (4.20)	7.84 (7.40)	808	6.4
[CuL' <sub>2</sub> Br <sub>2</sub> ] (Greenish blue)	3.0 (4.0)	40 (79)	48.13 (48.5)	4.23 (4.30)	15.59 (15.70)	3.56 (3.70)	7.07 (6.60)	897	6.7
[CuL' <sub>2</sub> I <sub>2</sub> ] (Green)	2.5 (4.5)	45 (85)	43.57 (43.8)	3.83 (4.0)	14.12 (14.20)	3,22 (3.30)	6.39 (6.20)	991	6.9
[CuL' <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> ] (Green)	3.0 (4.0)	45 (86)	50.14 (50.5)	4.41 (4.50)	16.25 (16.50)	3.71 (3.80)	7.36 (7.00)	861	8.5
[CuL' <sub>2</sub> (ClO <sub>4</sub> ) <sub>2</sub> ] (Blue)	3.5 (4.0)	48 (88)	46.13 (46.50	4.05 (4.20)	14.95 (15.10)	3.41 (3.50)	6.77 (6.40)	936	6.3

	CM =	Conventional	method, t	time in <b>I</b>	hours; N	MM = 1	Microwave	method,	time in	minutes
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#### **IR Spectral Studies**

The data of the IR spectra of investigated Schiff base ligands and their metal complexes are listed in **Table-2**. The IR spectra of the complexes were compared with those of the free ligand in order to determine the involvement of coordination sites in chelation. Characteristic peaks in the spectra of the ligand and complexes were considered and compared. The FT-IR spectra of the investigated complexes contained all the absorption bands from the ligands and some new absorption bands indicative of coordination of the ligands with metal ion through N & O and N & S. The IR spectra of both the ligands (ppqs & ppqt) show a broad band of medium intensity at 3200 cm<sup>-1</sup> and 3480 cm<sup>-1</sup>, respectively which may be assigned to v(N-H). The IR spectra of all the investigated complexes also show this band without any change in position and intensity, clearly indicating non-involvement of N atom of either amino or imino group in the coordination with Cu(II) ion.

The spectrum of the ligand ppqs also shows a sharp and strong band at  $1645 \text{cm}^{-1}$  which can be assigned to v(C=O). This band has shifted to a higher frequency region with slightly reduced intensity in the spectra of investigated complexes. The shift of band and the change in intensity suggest the coordination of carbonyl group of semicarbazone to Cu(II) ion.

The spectrum of the ligand ppqs also shows a sharp and strong band at  $\sim 800 \text{ cm}^{-1}$  which can be assigned to v(C=S). This band has shifted to a lower frequency region in the spectra of investigated complexes. The downward shift of band suggests the coordination of thiocarbonyl group of thiosemicarbazone to Cu(II) ion.

The other IR band of structural significance in the spectra of both ligands (ppqs/ppqt) appears ~1480 cm<sup>-1</sup>, which can assigned to the v(C=N) group. This band also suffered a downward shift by 20-30 cm<sup>-1</sup> in the investigating complexes indicating the coordination of the N to the Cu(II) ion.

The coordination through azomethine N and O/S atoms of either semicarbazone/thiosemicarbazone moiety are further confirmed by the appearance of bands in the far IR region at 530-495, 470-455and 430-405cm<sup>-1</sup> which may be assigned to v(M-O), v(M-S) and v(M-N), respectively. The coordination through meal-halogen are confirmed by the appearance of a band in the region 325-275 cm<sup>-1</sup> which may be assigned to v(M-X) (where X=Cl, Br or I). The coordination bands at 1460 and 1340 cm<sup>-1</sup> with a separation of 120 cm<sup>-1</sup> confirming the monodentate nature of the nitrate group. The monodentate nature of perchlorate group is confirmed by the presence of far IR bands at 650 and 620 cm<sup>-1</sup> in the complexes [13-14].

On the basis of above discussion of IR spectral data, it is proposed that the ligands PPQS/PPQT acts as a bidentate ligand and coordination is proposed through azomethine N atom and O/S atoms of either semicarbazone/thiosemicarbazone moiety. The remaining coordination centers of the metal ions are satisfied by  $Cl^{-}$ ,  $Br^{-}$ ,  $I^{-}$ ,  $NO_{3}^{-}$  and  $ClO_{4}^{-}$  ions.

Compound	υ(C=O)	υ(C=N)	υ(M-O)	υ(M-N)	v(M-X)	
PPQS	1665 (s,b)	1475(s,m)				
[CuL <sub>2</sub> Cl <sub>2</sub> ]	1695	1455(m,b)	495 (m)	410(m)	315(m)	
	(m,b)					
$[CuL_2Br_2]$	1700	1450(m,b)	500 (m)	420(m)	285(m)	
	(m,b)					
[CuL <sub>2</sub> I <sub>2</sub> ]	1695	1455(m,b)	505 (m)	405(m)	280(m)	
	(m,b)					
$[CuL_{2}(NO_{3})_{2}]$	1690	1460(m,b)	495 (m)	415(m)		
	(m,b)					
$[CuL_2(ClO_4)_2]$	1695	1455(m,b)	505 (m)	410(m)		
	(m,b)					
Compound	υ(C=N)	υ(C=S)	υ(M-S)	υ(M-N)	υ(M-X)	υ(M-O)
PPQT	1480(s,m)	800(s,b)				
[CuL' <sub>2</sub> Cl <sub>2</sub> ]	1455(m,b)	755(m,b)	465(m)	425(m)	295(m)	
[CuL' <sub>2</sub> Br <sub>2</sub> ]	1455(m,b)	750(m,b)	470(m)	430(m)	390(m)	
[CuL' <sub>2</sub> I <sub>2</sub> ]	1455(m,b)	760(m,b)	455(m)	410(m)	315(m)	
$[CuL'_2(NO_3)_2]$	1450(m,b)	755(m,b)	470(m)	415(m)		510 (m)
$[CuL'_2(ClO_4)_2]$	1455(m,b)	750(m,b)	470(m)	420(m)		530 (m)

Table-2 Observed IR bands (cm<sup>-1</sup>) of Schiff base ligands and their Cu-complexes (Where s = sharp, m = medium & b = broad)

#### **Magnetic Moment Studies**

The magnetic moments of the complexes under investigation were observed as expected and given in table-3. The complexes showed  $\mu_{eff}$  values in the range of 1.87 – 1.94 B.M., indicative of oneunpaired electron per Cu(II) ion suggesting that these investigated complexes may have structures within the range consistent to mononuclear octahedral, tetrahedral or square planar geometry [15-16]. Thus, no conclusion can be drawn from the magnetic moment values. However, electronic spectra proves to be decisive for predicting the geometry of the investigated complexes.

#### **Electronic Spectral Studies**

The investigated Cu(II) complex exhibits three bands in the region 10330-11200 cm<sup>-1</sup>(v<sub>1</sub>), 15300-17500 cm<sup>-1</sup>(v<sub>2</sub>) and 19500-23000 cm<sup>-1</sup>(v<sub>3</sub>) are of equal energy and giving rise to single broad band which may be assigned to the transitions  ${}^{2}B_{1g} \rightarrow {}^{2}A_{1g}(v_{1})$ ,  ${}^{2}B_{1g} \rightarrow {}^{2}B_{2g}(v_{2})$ ,  ${}^{2}B_{1g} \rightarrow {}^{2}E_{g}(v_{3})$  respectively. The broadness of the band is due to the ligand field and the John-Teller effect [17]. These observations favor the distorted octahedral geometry for the Cu(II) complexes [18-19].

#### **ESR Spectral Studies**

The ESR spectra of the copper complexes as polycrystalline sample have been recorded at room temperature (table-4), (ESR chart was calibrated with DPPH). The observed average g values for the Cu(II) complexes of the ligand L are  $\mathbf{g}_{\parallel}=2.2277$ ,  $\mathbf{g}_{\perp}=2.1228$ ,  $g_{av}=2.1932$  and G = 4.314 and of L' are  $\mathbf{g}_{\parallel}=2.052$   $\mathbf{g}_{\perp}=2.024$   $g_{av}=2.030$  and G = 4.22. The isotropic g values have been calculated by Kneubuhl's methods [20] and methods reported earlier that G measures the exchange interaction between copper centers. According the Hathaway [21] if the G value is greater than 4, the exchange interaction is negligible, while a value of G less than 4 indicates a considerable exchange in the solid complexes. As G=4.314 and G= 4.22 for Cu (L)and Cu (L') complexes respectively, indicates that there is no spin exchange interaction in the complexes and hence distorted octahedral geometry is proposed for the copper complexes.

Compound	Band posit	ion with assign	Magnetic	Proposed	
	$^{2}B_{1g} \rightarrow$	$^{2}B_{1g} \rightarrow$	$^{2}B_{1g} \rightarrow$	moments	geometry
	${}^{2}A_{1g}(v_{1})$	$^{2}B_{2g}(v_{2})$	$^{2}E_{g}(v_{3})$	μ (BM)	of
					complexes
LH=PPQS					
L'H=PPQT					
[CuL <sub>2</sub> Cl <sub>2</sub> ]	10330	15800	20100	1.92	Octahedral
[CuL <sub>2</sub> Br <sub>2</sub> ]	10400	15500	22100	1.94	Octahedral
[CuL <sub>2</sub> I <sub>2</sub> ]	10900	16210	19500	1.91	Octahedral
$[CuL_2(NO_3)_2]$	10600	16545	21050	1.90	Octahedral
$[CuL_2(ClO_4)_2]$	11300	16700	21520	1.87	Octahedral
[CuL' <sub>2</sub> Cl <sub>2</sub> ]	10700	15300	22855	1.89	Octahedral
[CuL' <sub>2</sub> Br <sub>2</sub> ]	11100	15480	23500	1.94	Octahedral
[CuL' <sub>2</sub> I <sub>2</sub> ]	11150	17500	23345	1.93	Octahedral
$[CuL'_2(NO_3)_2]$	11200	16480	21015	1.87	Octahedral
$[CuL'_2(ClO_4)_2]$	10120	16520	22558	1.91	Octahedral

Table-3 Electronic spectral bands, magnetic moments and proposed geometry of the Cu(II) complexes

Table-4 ESR Spectral data of Cu(II) complexes

Complexes	g	g⊥	g <sub>av</sub>	G
$[CuL_2Cl_2]$	2.2277	2.1228	2.1752	4.314
$[CuL_2Br_2]$	2.2276	2.1227	2.1751	4.314
$[CuL_2I_2]$	2.2278	2.1229	2.1753	4.314
$[CuL_2(NO_3)_2]$	2.2278	2.1226	2.1752	4.314
$[CuL_2(ClO_4)_2]$	2.2277	2.1227	2.1752	4.314
$[CuL'_2Cl_2]$	2.052	2.024	2.038	4.22
[CuL' <sub>2</sub> Br <sub>2</sub> ]	2.053	2.023	2.038	4.22
$[CuL'_2I_2]$	2.052	2.025	2.038	4.22
$[CuL'_2(NO_3)_2]$	2.054	2.022	2.038	4.22
$[CuL'_2(ClO_4)_2]$	2.053	2.024	2.038	4.22

#### **Proposed Structures**

On the basis of the above observations, it is tentatively suggested that Cu(II) investigated complexes show an octahedral geometry [Figure-1] in which the Schiffbases act as bidentate [N & O/S donor] ligands.



Figure-1: Proposed octahedral structure of  $[CuL_2X_2]$  and  $[CuL'_2.X_2]$  complexes Where X= Cl<sup>-</sup>, Br<sup>-</sup>, l<sup>-</sup>, NO<sub>3</sub><sup>-</sup> and ClO<sub>4</sub><sup>-</sup> ions R = n-propyl group and R'= phenyl group

#### Anti-bacterial Activity

The difference in anti-bacterial activities of the investigated complexes, ligands and their parent drugs were studied and the results are presented in table-4.

The cursory view of the data indicates the following trend in antibacterial activity of the substances under investigation:

Cu(II)-complexes > Schiff base ligands

All the Cu(II)-complexes under investigation were more active than the ligands against all the investigated bacteria. These results substantiate our findings and the findings of some other workers [22-23] that biologically inactive compounds become active and less biologically active compounds become more active upon coordination. The higher activity of the metal complexes may be owing to the effect of metal ions on the normal cell membrane. This can be well ascribed to Tweedy's Chelation Theory [24].

Table-4 In vitro Antimicrobial Activity	of the Schiff basesligands and their Cu-comp	lexes (in µgmL <sup>-1</sup> )

Compound	Zone of inhibition (in mm)						
	B.subtilis	E.coli	S.aureus	Ralstonia solanacearum			
LH=PPQS	12	15	14	15			
L'H=PPQT	8	11	13	14			
$[CuL_2Cl_2]$	10	14	13	12			
[CuL <sub>2</sub> Br <sub>2</sub> ]	10	15	12	14			
[CuL <sub>2</sub> I <sub>2</sub> ]	9	13	11	12			
$[CuL_2(NO_3)_2]$	11	14	12	13			
$[CuL_2(ClO_4)_2]$	12	14	10	11			
[CuL' <sub>2</sub> Cl <sub>2</sub> ]	8	12	11	13			
[CuL' <sub>2</sub> Br <sub>2</sub> ]	8	12	10	12			
$[CuL'_2I_2]$	7	11	12	13			
$[CuL'_2(NO_3)_2]$	8	10	12	12			
$[CuL'_2(ClO_4)_2]$	7	9	11	13			
Chloramphenicol	29	26	25	32			

#### Conclusion

An efficient synthesis of Schiff bases derived from 3-phenyl-2-propyl-quinazolin-4(3H)-one and their Cu(II) complexes carrying potential pharmacophores have been prepared in an environmentally benign microwave protocol. The yields of the products formed under MWI were high in comparison to classical method and time required for completion of these reactions was also less in comparison to classical method.

The synthesized Schiff base ligands coordinated with the Cu(II) ion in a bidentate manner through the oxygen/sulfur and azomethine nitrogen. On the basis of elemental analysis, molarconductance, magnetic susceptibility measurements, electronic, IR, and ESR spectral observations, octahedral geometry with coordination number six (Fig.1) has been proposed for the Cu(II) complexes. Antimicrobial data suggests that the metal complexes are better antibacterial agents as compared to their ligands. The compounds also inhibit the growth of bacteria to a greater extent as the concentration is increased.

In conclusion, this paper describes a simple, proficient and green approach for the synthesis of Schiff bases derived from 3-phenyl-2-propyl-quinazolin-4(3H)-one and their Cu(II) complexes in aqueous media. Present methodology offers very attractive features such as simple experimental procedure, higher yields and economic viability, when compared with other method as well as with other catalysts, and will have wide scope in organic/inorganic syntheses.

#### References

- (a) R ASheldon, Green Chem. 2005, 7, 267. (b) PAnastas, TWilliamson, Green Chem. Frontiers in Benign Chemical Synthesis and Processes University Press, London 1998; (c) GW Wangand, C BMiao, Green Chem. 2006, 8, 1080.
- (a) J PGenetand, M J Savignac, Organomet. Chem. 1999, 576, 305. (b) K H Shaughnessy, R. BDevasher, Curr. Org. Chem. 2005, 9, 585. (c) N ELeadbeater, Chem. Commun. 2005, 2881. (d) C JLi, Chem. Rev. 2005, 105, 3095. (e) C I Herrerias, XYao, ZLi, C Li, J. Chem. Rev, 2007, 107, 2546.
- 3. T Singh, S Sharma, V KSrivastava, A Kumar. Ind.J. Chem. 2006; 45B: 2558-2565.
- 4. A K Nanda, S Ganguli, R Chakraborty, *Molecules*, 2007; 12: 2413-2426.
- 5. B Sambuddh, M Susmita, C Writachit, S Soma, G Ratan, JB Ray, M Z Alexandra, Slawin, M Chitra, M Samiran, *Polyhedron*,2009, 28, 2785.
- 6. S Deepak, K Lokesh, C Sulekh, Spectrochim. Acta, 2008, 71A, 746.
- 7. KPSrivastava, et al. Der Chemica Sinica, 2011, 2 (2), 66-76.
- 8. KPSrivastava, et al. ISOR Journal of Applied Chemistry; 2014, 7(4), 16-23.
- 9. KPSrivastava, et al. Orient. J. Chem.; 2014, 30(3), 1233-1241.
- 10. D Greenwood, R Snack, J Peurtherer Medical microbiology: A guide to microbial infections: Pathogenesis, immunity, laboratory diagnosis and control, 15<sup>th</sup> ed.1997.
- 11. WJ Geary, Coord. Chem. Rev., 1971, 7, 81.
- 12. CC Addison, N Logan, SC Wallwork, DC Barner, Quart, Rev, 1971.
- 13. RA Nyquist, CL Putzig, M A Leugers, *Infrared and Raman Spectral Atlas of Inorganic Compounds and Organic Salts*, Academic Press, New York, 1995.
- 14. BJ Hathaway; AE Underhill; J. Chem. Soc. 1961, 3091.
- 15. C Spinu, A.Kriza, Acta Chim. Slov, .47, 2000, 179.
- 16. RL Carlin, A J Van Dryneveledt, *Magnetic properties of transition metal compounds*, Springer-Verlag, New York, 1997.
- 17. KV Sharma, S Srivastava, Indian, J.Chem.2006, 45A, 1368.
- 18. BN Figgis, Introduction to Ligand Field, Wiley eastern Ltd, New Delhi, 1976, 279.
- 19. ABP Lever, Inorganic Electronic Spectroscopy, Elsevier, Amsterdam, 1984, 23.
- 20. F. K. Kneubuhl, J. Chem. Phys., 1963, 33, 1074,
- 21. B. J. Hathaway, D. E. Billing, Coord. Chem. Rev., 1970, 6, 143.
- 22. M Li-June, Med. Resear. Rev. 23, 2003, 697.
- 23. ZH Chohan et al., J. Enz. Inhib. Med. Chem. 2004, 19, 417.
- 24. S Belwal, Seema, N Fahmi, RV Singh. Ind. J. Chem. Sect. A, 1999, 38, 597.

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