

Synthesis Characterization and structure of Cu(II), Ni(II) and Co(II) Quinazoline metal complexes

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ABSTRACT

Transition metals form complexes with ligands easily through donor atoms of the ligand. Cu(II), Ni(II) and Co(II) complexes of 3-amino-2-methylquinazolin-4-phenylhydrazine have been synthesized in the laboratory. The ligand 3-amino-2-methylquinazolin-4-phenylhydrazine (HAQP) was prepared from 3-amino-2-methylquinazolin-4-one and phenyl hydrazine. Synthesized metal complexes, Bis (3-amino-2-methylquinazolin-4-phenylhydrazine) – diaquoM(II) were characterized by magnetic moment, elemental analysis, conductivity measurements, infrared and nuclear magnetic resonance verified the chemical composition of products. The NMR spectra show different signals due to different ring protons. Signals were attributed also due to methyl proton at 2-position in ligand and due to methyl proton of acetone. The asymmetric peaks and magnetic moment values also have been described. Magnetic susceptibilities and spectroscopic studies suggested the predicted geometry of the HAQP complexes as octahedral geometry of Cu(II), Ni(II) and Co(II) complexes.

Key Words : *Transition metals, band, NMR, I.R., Asymmetric Peaks, Synthesis, Characterization etc.*

INTRODUCTION

The formation of transition metal complexes is based on the interaction of a transition metal ion with different ligands. Researches on complexing behaviour of ligands with transition metals have become very interesting. Ligands with sulphur, phosphorous, nitrogen, and oxygen as donor atoms are very frequently used with transition metal to form complexes. The transition metals under study here is Copper(II), Nickel(II) and Cobalt(II) which the ligands directly link. The ability of donor atom is governed by its size, polarizability, electron affinity *etc.* Ionic radius and electronegativity also decide the tendency to form covalent bond. Polarizability data are also important in view of ligand capability to bind metals.

The increasing dipole moment of a ligand causes an increase in the Crystal field and thus increasing dipole moment of a ligand corresponds to the increasing Co-ordination ability of the ligands. The stability constant is calculated also to assess the stability of complexes. Bidentate and tridentate ligands are used to form chelates of transition metals. Very few work have been

done with quadridentate, pentadentate and hexadentate ligands. The study of the stability of complexes reveals that complexes containing ring structures *i.e.* Chelates are more stable than similar complexes without rings.

Natural complexes of copper are Known. The Protophyrin ring around Copper (Cu) is structurally same as in chlorophyll and hemoglobin. Now a days, chelating agents have got much importance in analytical chemistry.

The present paper deals with 3-amino-2-methylquinazolin-4-Phenylhydrazone as ligand and with this complexes of Cu(II), Co(II) and Ni(II) have been synthesized. These complexes have been characterized by elemental analysis, molar conductivity, infrared spectra, NMR, magnetic moment and electronic transition.

Materials and Methods

Materials

All chemicals were used of A.R. grade for synthesis of ligand and metal complexes.

Synthesis of Ligand

The ligand had been synthesized in two steps.

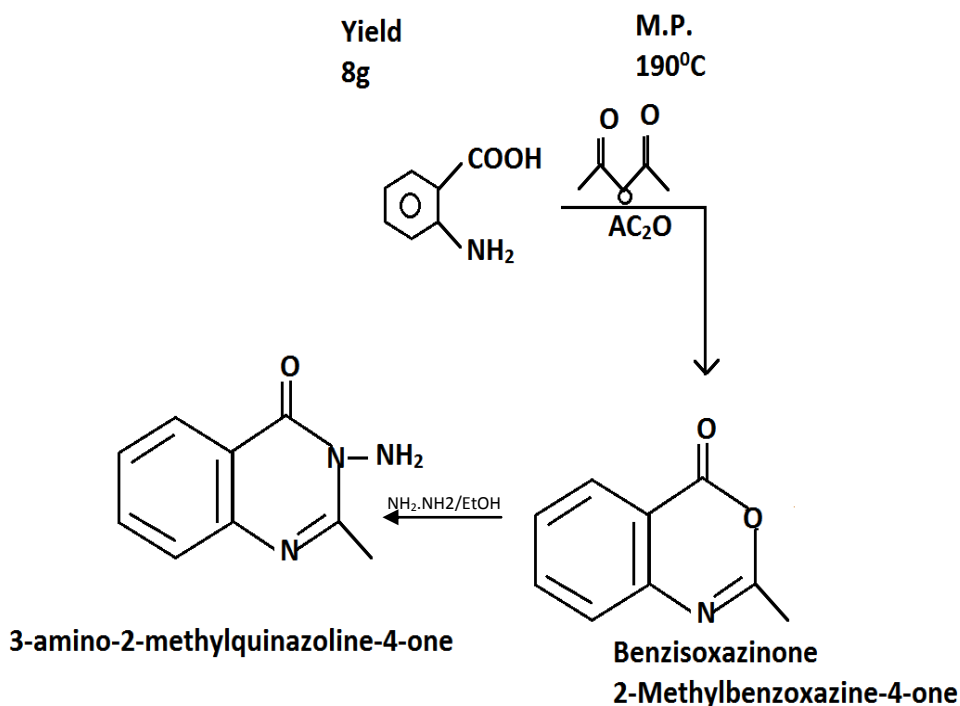
(A) Synthesis of 3-amino-2-methylquinazolin-4-one.

13.7g (0.1 mole) Anthranilic acid was dissolved in 30 c.c. acetic anhydride and the solution was heated under reflux condition for about one hour. Excess acetic anhydride was distilled off. The concentrated solution was taken into a beaker and cooled on ice bath. Crystals precipitated out. It was separated out and dried by sucking with blotting paper. In other beaker 100 c.c. (50% aqueous) solution of hydrazine hydrate was taken and the prepared acetanthralin was added gradually with continuous stirring. The mixture was allowed to cool at room temperature and kept over one night to get the crystal. Needle type crystal was separated out. It was filtered and recrystallized from aqueous ethanol and dried in vacuum desiccators.

(B) Synthesis of hydrazone derivatives

Now ethanolic solution of 8g of 3-amino-2-methylquinazolin-4-one was mixed with alcoholic solution of 10g Phenyl hydrazine and few drops of conc. H_2SO_4 was also added. The mixture was heated about 8 hours under reflux condition. The brownish red solid settled below. It was filtered and recrystallized from acetic acid. Crystals possess brownish red colour but when dried it become yellow.

It was analysed as $C_{15}H_{15}N_5$ (3-amino-2-methylquinazolin-4-Phenylhydrazone, HAQP). The chemical reaction related to synthesis of ligand, HAQP is given below :



Synthesis of metal complexes :

Synthesis of Bis (3-amino-2-methylquinazoline-4-Phenylhydrazone)–diaquo Copper(II)

1.25g (0.005 mol) Copper Sulphate pentahydrate was dissolved in minimum volume of aqueous ethanol. This was mixed with a solution of 3.54g (0.01 mol) 3-amino-2-methylquinazolin-4-phenylhydrazone in ethanol and acetone (4:1). The mixture was refluxed for four hours and pH was maintained 7.8 during the complex formation by adding sufficient amount of NaOH solution. It was concentrated and then left for over night. Dark blue crystals appeared. It was filtered and washed with minimum amount of alcohol followed by ether and dried at room temperature. It was analysed as $\text{Cu}(\text{C}_{15}\text{H}_{15}\text{N}_5)_2 (\text{H}_2\text{O})_2$.

Synthesis of Bis(3-amino-2-methylquinazolin-4-Phenylhydrazone)-diaquo Nickel(II)

Alcoholic solution of 1.316g (0.005 mol) Nickel sulphate hexahydrate was added to 10 c.c. solution of 3.54g (0.01 mol) 3-amino-2-methylquinazolin-4-Phenylhydrazone in alcohol and acetone (4:1). This was heated under reflux about six hours and pH was maintained about 8 during complex formation. It was concentrated and was left for cooling. On cooling needless

crystals separated out. It was filtered and washed with minimum volume of alcohol and then with ether and dried in air oven at nearly room temperature. It was analysed as $\text{Ni}(\text{C}_{15}\text{H}_{15}\text{N}_5)_2 (\text{H}_2\text{O})_2$.

Synthesis of Bis(3-amino-2-methylquinazolin-4-Phenylhydrazone)-diaquo Cobalt(II)

1.4g (0.005 mol) cobaltous sulphate heptahydrate was dissolved in minimum volume of aqueous alcohol and this was added to solution of 3.54g (0.01 mol) 3-amino-2-methylquinazolin-4-Phenylhydrazone prepared in alcohol and acetone solution (4:1). P^{H} was maintained 8.4. The resulting mixture was heated under reflux about five hours. On cooling yellowish crystals separated out. It was filtered and washed with alcohol and then ether and finally dried in air oven. It was analysed as $\text{Co}(\text{C}_{15}\text{H}_{15}\text{N}_5)_2 (\text{H}_2\text{O})_2$.

Physical measurements

The analytical data (C,H,N) for the ligand and their metal complexes were analyzed through Carlo Erba 1108 elemental analyzer. The metal content in the complexes after heating to decomposition was determined by the author using standard procedures (vogel 1961). Molar conductance measurements of the complexes in DMF (dimethyl formamide) were made at a concentration of 10^{-3} M using Digisum Digital Conductivity Meter Model DI-909 with Philips dip type conductivity cell. The magnetic susceptibility measurements of the complexes in the solid state were made on a Guoy Balance at room temperature using $\text{Hg}[\text{Co}(\text{NCS})_4]$ as the calibrant. The infrared spectra of the ligand and their metal complexes were recorded by using nuzol mull Technique (Beckman I.R. 20 Infrared Spectrophotometer) in the range $4000\text{-}200\text{ cm}^{-1}$.

Nuzol gives two characteristics sharp peaks at 3000 cm^{-1} to 2800 cm^{-1} and 1500 cm^{-1} to 1300 cm^{-1} and a very small peak about 700 cm^{-1} .

Characterization

Ligand and metal complexes were characterized on the basis of elemental analysis, molar conductivity data, Thermogravimetric analysis, Nuclear magnetic resonance, infrared and electronic spectroscopic under investigation and their results in the light of the structure determination of complexes.

All the metal complexes are stable at room temperature, non-hygroscopics, insoluble in water and many of the common organic solvents, but soluble in DMF and DMSO. The molar conductance values of all the three complexes viz., $[\text{Cu}(\text{AQP})_2 (\text{H}_2\text{O})_2]$, $[\text{Ni} (\text{AQP})_2 (\text{H}_2\text{O})_2]$ and $[\text{Co} (\text{AQP})_2 (\text{H}_2\text{O})_2]$ are less than $26\text{ ohm}^{-1}\text{ cm}^2\text{ mol}^{-1}$ indicating their non electrolytic behavior (Geasy 1971). The analytical data of the ligand and metal complexes are given in table -1.

Thermogravimetric analysis

Synthesized complexes loose weight on heating 0.1g $[\text{Cu}(\text{AQP})_2(\text{H}_2\text{O})_2]$ on heating up to 180°C loses mass by 5 mg which is equivalent to two moles of water present in one mole of complex. The loss in weight shows that water molecules are in co-ordination. Complex decomposes at 275°C .

0.1g $[\text{Ni}(\text{AQP})_2(\text{H}_2\text{O})_2]$ on heating up to 220°C loses 4.3 mg weight which is equivalent to two moles of water per mole of complex. The loss in weight indicates that water molecules are co-ordinated to metal ion. Complex decomposes at 295°C .

Similarly, $[\text{Co}(\text{AQP})_2(\text{H}_2\text{O})_2]$ on heating up to 240°C loses weight that shows water molecules are in co-ordination. The complex decomposes at 355°C .

Table-1

Analytical and conductivity data of the ligand and metal complexes.

Found (Theoretical) (%)

Ligand/Complexes	Metal	C	H	N	Molar conductance $\text{Ohm}^{-1}\text{cm}^2\text{mol}^{-1}$
HAQP	-	70.52 (70.88)	5.28 (5.48)	23.42 (23.64)	-
$[\text{Cu}(\text{AQP})_2(\text{H}_2\text{O})_2]$	10.24 (10.59)	55.98 (56.04)	4.33 (4.67)	23.21 (23.35)	17
$[\text{Ni}(\text{AQP})_2(\text{H}_2\text{O})_2]$	9.33 (9.92)	56.04 (56.78)	4.53 (4.73)	23.44 (23.66)	20
$[\text{Co}(\text{AQP})_2(\text{H}_2\text{O})_2]$	9.49 (9.91)	56.21 (56.47)	4.23 (4.70)	23.33 (23.52)	22

Infrared Spectra of ligand

The important absorption frequencies of ligand (3-amino-2-methylquinazolin-4-Phenylhydrazone) is presented in table -2. The infrared spectra of ligand was recorded by Nuzol mull Technique by using Beckman I.R. 20 Infrared Spectrophotometer. The I.R. absorption band is observed in the range of 4000 cm^{-1} to 200 cm^{-1} .

I.R. spectra of ligand shows a sharp band at 1650 cm^{-1} is attributed to stretching vibration, $\nu_{\text{C=N}}$. There is no band between 1700 cm^{-1} to 1800 cm^{-1} indicating absence of carbonyl group ($>\text{C=O}$). The band at 3300 cm^{-1} , 3160 cm^{-1} and 1470 cm^{-1} were attribute to ν_{aNH_2} , ν_{sNH_2} and ν_{dNH_2} stretching vibrations in solid state of amino group. The band at 3090 cm^{-1} and above indicating the stretching vibration frequency of the following moiety.

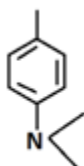


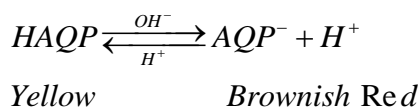
Figure : I

The band at 1650 cm^{-1} is due to aromatic c-c stretching. I.R. bands of structural importance are given in table -2.

Nuclear Magnetic Resonance Spectra

The NMR spectra was recorded on a 200 MHz varian Gemini instruments. The Proton NMR spectra of free ligand have been recorded in neutral solution (acetone) shows signals at $\tau = 1.00, 1.50, 1.65, 1.75, 1.90$ and 2.10 which are attributed to different aromatic ring protons. Signals appear at $\tau = 8.1$ due to methyl proton present at 2- position in ligand and $\tau = 7.6$ due to methyl proton of acetone. Signals at $\tau = 7.3$ and $\tau = 6.9$ were assigned to amino and anilino protons respectively.

The NMR spectra of ligand recorded in alkaline medium shows nearly same signals due to ring protons. The doublet signals appeared in neutral solution at $\tau = 7.5$ without resolution indicative of deprotonation due to removal of aniline proton and diminishing of spin interaction of $-\text{NH}_2$ proton. So, only one unresolved signal was appeared at $\tau = 7.5$. Thus, ligand may be represented as :



The ligand changes its colour from yellow to brownish red in alkaline medium and again restores its colour in neutral or acidic medium. This clearly indicates the deprotonation and appearance of new chromophoric group in the ligand. The NMR data for different types of proton is presented in table -3.

On the basis of elemental analysis, I.R. spectra and NMR signals, the structure of ligand may be proposed as :

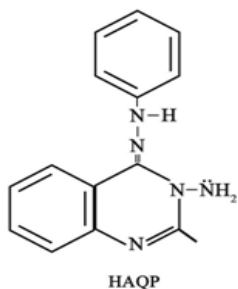


Figure : II

The possible way of co-ordination may occur through amino nitrogen, anilino nitrogen and azomethine nitrogen. The deprotonation and complex formation in alkaline medium support the Co-ordination through anilino nitrogen (not by azomethine nitrogen) and amino nitrogen. This is further supported by I.R. spectra of complexes where there is no shift in the azomethine ($>C=N$) frequency.

AQP⁻ ion acts as bidentate ligand in alkaline medium and co-ordinate to metal ion as :

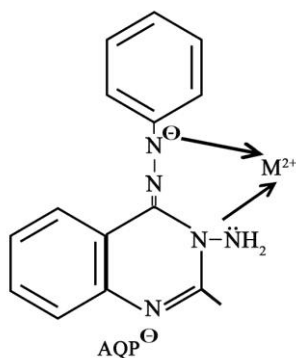


Figure : III

Infra Red and electronic spectra of complexes I.R. spectra of [Cu (AQP)₂ (H₂O)₂] complexes :

[Cu (AQP)₂ (H₂O)₂] shows bands at 3250 cm⁻¹ and 3100 cm⁻¹ which were attributed to ν_{aNH_2} (asymmetric) and ν_{sNH_2} (symmetric) stretching vibrations while it appears at 3300 cm⁻¹ and 3160 cm⁻¹ in ligand indicating Co-ordination through amino nitrogen. $\nu_{\delta NH_2}$ band (1475 cm⁻¹) in

complex gets shifted in higher energy as compared to that found in ligand (1470 cm^{-1}). No band appears at 3090 cm^{-1} in I.R. spectra of the $[\text{Cu}(\text{AQP})_2(\text{H}_2\text{O})_2]$ indicating deprotonation. Cu-N bonding is further supported by the band appears at 370 cm^{-1} . The broad band at nearly 3500 cm^{-1} is attributed to O-H stretching frequency. The band at 460 cm^{-1} is an indicative of Cu-O bonding. The important I.R. bands of structural importance are given in table -4.

Electronic spectra of $[\text{Cu}(\text{AQP})_2(\text{H}_2\text{O})_2]$

$[\text{Cu}(\text{AQP})_2(\text{H}_2\text{O})_2]$ shows only one asymmetric peak at 12900 cm^{-1} assigning to $2\text{Eg} \rightarrow 2\text{T}_{2\text{g}}$ transition with John-Teller effect which shows the octahedral geometry of complex, $[\text{Cu}(\text{AQP})_2(\text{H}_2\text{O})_2]$. 10 Dq value for $[\text{Cu}(\text{AQP})_2(\text{H}_2\text{O})_2]$ is 12600 cm^{-1} . The electronic spectral data is given in table -5.

Infrared spectra of $[\text{Ni}(\text{AQP})_2(\text{H}_2\text{O})_2]$

I.R. spectra of $[\text{Ni}(\text{AQP})_2(\text{H}_2\text{O})_2]$ shows bands at 3260 cm^{-1} , 3120 cm^{-1} and 1480 cm^{-1} which confirms the Co-ordination through amino nitrogen. These bands show shift compared to those found in ligand. There is no peak at 3090 cm^{-1} which is an indicative of deprotonation and new Ni-N bonding. The Ni-N bonding is confirm by the far infrared band appears at 340 cm^{-1} . Band appears at 3480 cm^{-1} indicates the presence of bonded O-H. Ni-O bond is supported by the band appears at 450 cm^{-1} . These infrared bands confirm Ni(II) complex formation. I.R. bands of structural importance are given in table -4.

Electronic spectra of $[\text{Ni}(\text{AQP})_2(\text{H}_2\text{O})_2]$

Ni(II) has 3F ground term. $[\text{Ni}(\text{AQP})_2(\text{H}_2\text{O})_2]$ shows three electronic transition at 8500 cm^{-1} , 14300 cm^{-1} and 25200 cm^{-1} assigned to $3\text{A}_{2\text{g}} \rightarrow 3\text{T}_{1\text{g}}(\text{F})$ transitions respectively. The value of 10 Dq for complex is 8007.9 cm^{-1} . The electronic spectra data is given table -5.

Infrared spectra of $[\text{Co}(\text{AQP})_2(\text{H}_2\text{O})_2]$

I.R. spectra of $[\text{Co}(\text{AQP})_2(\text{H}_2\text{O})_2]$ shows bonds at 3245 cm^{-1} , 3100 cm^{-1} and 1515 cm^{-1} assigning to ν_{aNH_2} , ν_{sNH_2} and ν_{dNH_2} stretching vibration while ligand shows bands at 3300 cm^{-1} , 3160 cm^{-1} and 1460 cm^{-1} respectively. The differences in band position indicates the Co-ordination through amino nitrogen. The disappearance of band at 3090 cm^{-1} is an indicative of deprotonation and bonding through anilino nitrogen. The Co-N bonding is supported by the band appeared at 350 cm^{-1} in far infrared frequency which indicates its nonparticipation in Co-ordination. The band appears at 3410 cm^{-1} is assigned to bonded O-H stretching frequency. Further, band at 405 cm^{-1} indicates Co-O bond. It means water molecules are within Co-ordination sphere.

Electronic spectra of [Co (AQP)₂ (H₂O)₂]

[Co (AQP)₂ (H₂O)₂] shows three electronic peaks at 9100 cm⁻¹, 19200 cm⁻¹ and 25000 cm⁻¹ which are attributed to 4T_{1g} (F)→⁴T_{2g}(F), 4T_{1g} (F)→⁴A_{2g}(F) and 4T_{1g} (F)→⁴T_{1g}(P) transition respectively. The electronic data given in table -5.

Magnetic moment of complexes

Cu(II) has 3d⁹ system. There is only one unpaired electron. The spin only magnetic moment value of Cu(II) is 1.732 BM. Mass value of Cu(II) complexes lie in the range of 1.732 to 2.20 BM and are independent of temperature. [Cu (AQP)₂ (H₂O)₂] has μ_{eff} value equal to 1.91 B.M. at room temperature. 10 Dq (crystal field parameters) value for [Cu (AQP)₂ (H₂O)₂] is 12600 cm⁻¹. This is also supported by μ_{eff} (1.91 BM) value which is in well agreement with μ_{eff} value found for octahedral Cu(II) complex.

Ni(II) has 3d⁸ system and ³F ground term. It contains two unpaired electrons. The spin only value for Ni(II) is 2.83 BM. μ_{eff} value of [Ni (AQP)₂ (H₂O)₂] is 3.10 at room temperature. This value is higher than the spin only value. This difference may be due to either the ferromagnetic interaction or due to John-Teller distortion or both. 10 Dq value for [Ni (AQP)₂ (H₂O)₂] is 8007.9 cm⁻¹

$$\frac{3A_2g(F) \rightarrow 3T_1g(P)}{3A_2g(F) \rightarrow 3T_1g(F)} = \frac{25200cm^{-1}}{14300cm^{-1}} = 1.768$$

This ratio corresponds to $\left[\frac{Dq}{B} \right] = 0.84$ in Tanabe- sugano diagram. From this the corresponding intercepts on the vertical axes that is $\frac{3A_2g(F) \rightarrow 3T_1g(F)}{B} = 15$

or

$$\frac{14300cm^{-1}}{B} = 15$$

$$\text{Therefore, } B = \frac{14300}{15} = 953.33 \text{ cm}^{-1}$$

Now,

$$\left[\frac{Dq}{B} \right] = 0.84$$

$$\text{Hence, } Dq = 0.84 \times B = 0.84 \times 953.33 = 800.79 \text{ cm}^{-1}$$

Therefore, $10 Dq = 8007.9 \text{ cm}^{-1}$

The value of B (Racah Parameter) for free Ni(II) ion is 1040 cm^{-1} . Therefore, percentage decrease in Racah parameter (B) is $\left(\frac{1040 - 953}{1040} \right) \times 100 = 8.36\%$

In present case, the reduction in B value is 8.36% which shows the complexation and appreciable covalent character in metal-ligand bond in complex. These values are in well agreement with those found for octahedral Ni(II) complexes.

Co(II) has $3d^7$ system with three unpaired electrons. The spin only magnetic moment value of Cu(II) ion is 3.873 BM. The high spin octahedral Co(II) complexes have magnetic moment value in the range of 4.6 B.M. to 5.3 BM. The high μ_{eff} value is due to large orbital moment contribution. μ_{eff} values for several octahedral Co(II) complexes lie between 2.83 BM to 3.74 BM. The low values are due to existence of equilibrium mixture in two spin states. μ_{eff} value of $[\text{Co}(\text{AQP})_2(\text{H}_2\text{O})_2]$ was found 4.82 B.M. at room temperature. $10 Dq$ value for $[\text{Co}(\text{AQP})_2(\text{H}_2\text{O})_2]$ was found 9378.6 cm^{-1} . The crystal field parameter is calculated as :

$$\frac{4T_1g(F) \rightarrow 4T_1g(P)}{4T_1g(F) \rightarrow 4T_2g(F)} = \frac{25000 \text{ cm}^{-1}}{9100 \text{ cm}^{-1}} = 2.74$$

The corresponding value of Dq/B and E/B were obtained by Tanabe Sugano diagram and were found 0.98 and 9.5 respectively.

Here

$$\begin{aligned} \frac{E}{B} &= 9.5 \\ \text{or } \frac{4T_1g(F) \rightarrow 4T_2g(F)}{B} &= 9.5 \\ \text{or } \frac{9100 \text{ cm}^{-1}}{B} &= 9.5 \end{aligned}$$

$$\text{Therefore, } B = \frac{9100 \text{ cm}^{-1}}{9.5} = 957 \text{ cm}^{-1}$$

$$\text{So, } \frac{10 Dq}{B} = 0.98$$

$$\text{Therefore, } Dq = B \times 0.98 = 957 \times 0.98 = 937.86 \text{ cm}^{-1}$$

$$\text{So, } 10 Dq = 9378.6 \text{ cm}^{-1}$$

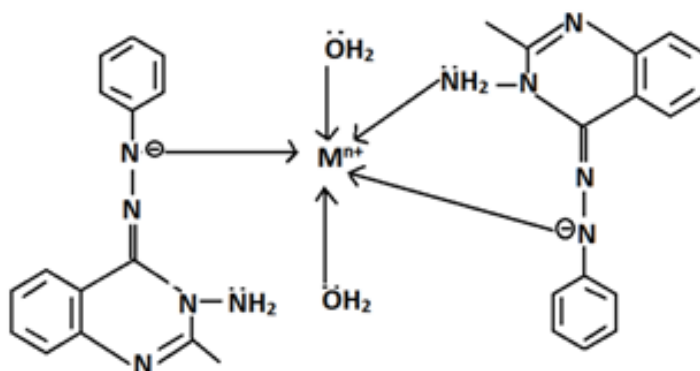
The Racah parameter value for free Co(II) ion is 1120 cm^{-1} . The % decrease in Racah parameter (B) is $\left(\frac{1120-957}{1120}\right) \times 100 = 14.55\%$

In the present case, the reduction in B value is 9.09% which shows an appreciable covalent character in the metal ligand bond in complex. These findings are in conformity with those found for octahedral Co(II) complexes.

The experimental and calculated magnetic moments of the above mentioned complexes are given in table -6.

Structure of complexes

Based on elemental analysis, molar conductivity data, thermogravimetric analysis, infrared and electronic spectral data, magnetic moment value, the structure of Cu(II), Ni(II) and Co(II) complexes with AQP⁻ ligand were proposed to have octahedral.



Proposed Octahedral Geometry
M= Cu, Ni, Co
n=2

Figure : IV

Table-2

Infrared spectral data of ligand (cm⁻¹)

Ligand	stretching vibration band	Frequency
HAQP	$\nu_{C=N}$	1650(s)
	ν_{aNH_2}	3300(s)
	ν_{sNH_2}	3160(s)
	$\nu_{\delta NH_2}$	1470(s)
	$\nu_{Anilino\ N-H}$	3090(w)

S = sharp, b=Broad, W=weak

Table-3

NMR signals (τ) of ligand, 3-amino-2-methylquinazolin-4-phenylhydrazine (HAQP)

¹ H NMR signals			
Aromatic Ring proton		Amino proton	Anilino proton
(A) In neutral solution	$\tau = 1.00, 1.50, 1.65, 1.75, 1.90$ and 2.10	$\tau = 7.3$	$\tau = 6.9$
(B) In alkaline solution	$\tau = 1.00, 1.50, 1.65, 1.75, 1.90$ and 2.10	$\tau = 7.5$	-

Table-4

I.R. Spectral data for ligand and its metal(II) complexes

Ligand/ complex	Spectral Bands and their frequencies(In cm ⁻¹).						
	$\nu_{C=N}$	ν_{aNH_2}	ν_{sNH_2}	$\nu_{\delta NH_2}$	ν_{N-H} (Anilino)	ν_{M-N}	ν_{M-O}
Ligand	1650(s)	3300(s)	3160(b)	1470(s)	3090 (w)	-	-
[Cu(AQP) ₂ (H ₂ O) ₂]	1660(s)	3250(w)	3100(w)	1475(b)	-	370(s)	460(s)
[Ni(AQP) ₂ (H ₂ O) ₂]	1650(w)	3260(s)	3120(s)	1480(s)	-	340(s)	450(s)
[Co(AQP) ₂ (H ₂ O) ₂]	1650(w)	3245(w)	3100(w)	1515(b)	-	350(w)	405(s)

Keys :

M = Cu, Ni, Co

S = Sharp, b= broad, w = weak

Table-5

Electronic spectral peaks of Metal(II) complexes

Complex	Electronic Transition and Spectral Peaks(In cm^{-1})		
[Cu(AQP) ₂ (H ₂ O) ₂]	$^2E_g \rightarrow ^2T_{2g}$ (12900)	-	-
[Ni(AQP) ₂ (H ₂ O) ₂]	$^3A_{2g}(F) \rightarrow ^3T_{2g}(F)$ (8500)	$^3A_{2g}(F) \rightarrow ^3T_{1g}(F)$ (14300)	$^3A_{2g}(F) \rightarrow ^3T_{1g}(P)$ (25200)
[Co(AQP) ₂ (H ₂ O) ₂]	$^4T_{1g}(F) \rightarrow ^4T_{2g}(F)$ (9100)	$^4T_{1g}(F) \rightarrow ^4A_{2g}(F)$ (19200)	$^4T_{1g}(F) \rightarrow ^4T_{1g}(P)$ (2500)

Table : 6

Magnetic moment data and crystal field splitting parameters of M(II) complexes

complex	μ_{eff} (B.M)		10 Dq (cm^{-1})	(cm^{-1})
	Expt.	Cal.		
[Cu(AQP) ₂ (H ₂ O) ₂]	1.91	1.732	12600	-
[Ni(AQP) ₂ (H ₂ O) ₂]	3.10	2.83	8007.9	953.33
[Co(AQP) ₂ (H ₂ O) ₂]	4.82	3.873	9378.6	957

10Dq = crystal field splitting parameter

B = Racah parameter

CONCLUSION :

Cu(II), Ni(II) and Co(II) complexes derived from 3-amino-2-methylquinazolin-4-phenylhydrazone have been synthesized and characterized by various physical and spectroscopic techniques. The elemental analysis shows stoichiometry as 1:2 (Metal to ligand) ratio. The Ligand, HAQP is co-ordinate to Metal(II) ions in a bidentate manner via anilino and amino nitrogen atoms that has been confirmed by I.R. spectral data. Deprotonation of anilino proton occurred in alkaline medium and complex formation also in same medium further supports coordination through anilino and amino nitrogen. Water molecules also co-ordinate to M(II) ions in the synthesized complexes. The crystal field parameters mentioned in table six are in well agreement with those found for octahedral complexes. The complex was formulated as [M(AQP)₂(H₂O)₂] and proposed to assume octahedral geometry.

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