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THE PREPARATION AND THERMAL ANALYSIS STUDIES ON SOME FIRST ROW TRANSITION METAL COMPLEXES OF 2-AMINOPYRIMIDINE

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Complexes of 2-aminopyrimidine with the chlorides, bromides and iodides of cobalt(II), zinc(II) and also with the chlorides and bromides of manganese(II), nickel(II) and copper(II) have been prepared. The chloride complex of iron(II) was also obtained. The stereochemical configurations of the complexes were deduced using spectral and magnetic properties. The decomposition of the complexes was studied by thermogravimetry and differential thermal analysis.

A great deal of interest has been shown in the pyrimidines due to their biological importance as components of the nucleic acids. Many compounds of therapeutic importance contain the pyrimidine ring system. Sulphadiazine, a sulphonamide of 2-aminopyrimidine, is an antibiotic, while phenobarbitol which contains the pyrimidine ring system is a barbiturate. The pyrimidines provide potential binding sites for metal ions and any information on their coordinating properties is important as a means of understanding the role of metal ions in biological systems. Several complexes have been previously prepared [1–4]. This present paper describes the preparation of the complexes formed between the halides of manganese(II), iron(II), cobalt(II), nickel(II), copper(II), zinc(II) and 2-aminopyrimidine together with the results of their thermal analysis, visible spectra, infrared spectra and magnetic measurements.

Experimental

Three methods of preparation were used:

A. The complexes were prepared by dissolving the hydrated transition metal halide in absolute ethanol and adding a saturated solution of the ligand dissolved in ethanol. The complexes were washed with ethanol and dried at 80°.

B. This method was similar to A except that the preparation was carried out under dry nitrogen.

C. A complex prepared by method A was heated on a thermobalance at a fixed temperature until constant weight was obtained.

The complexes prepared by these methods are listed in Table 1.

Magnetic susceptibility measurements were made by the Gouy method over the temperature range 300 – 100 K using a Newport variable temperature balance and as calibrant, Hg $[Co(SCN)_4]$. Each susceptibility value has been corrected for diamagnetism using Pascal's constants [5]. The values so corrected are represented by $X_{\mathrm{M}}^{\mathrm{Corr}}$ in Table 2. The reciprocals of $X_{\mathrm{M}}^{\mathrm{Corr}}$ plotted against the absolute temperature and the values of μ and θ in the Curie–Weiss equation, $\mu = 2.84\,[X_{\mathrm{M}}^{\mathrm{Corr}}(T-\theta)]^{1/2}$ are obtained [6]. Electronic spectra were obtained on a Beckman ACTA M1V spectrophotometer. Infrared absorption spectra (KBr discs) were obtained with a Perkin–Elmer 257 Infrared Spectrophotometer. Far infrared spectra were obtained on a Perkin–Elmer 577 Spectrophotometer.

Results

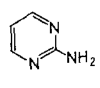
The complexes of manganese are colourless and have stoichiometry Mn(2-ampyr)X_2 (Table 1). No stoichiometric compound of manganese(II) iodide could be prepared. Thermal decomposition studies of the compounds showed no intermediate decomposition steps. The chloro-complex undergoes two exothermic

Table 1

Analysis of compounds

Compound	Method of preparation	Metal (found)	Halide (found)	Metal (theory)	Halide (theory)
Mn(2-ampyr)Cl_2	A	24.82	32.06	24.87	32.09
Mn(2-ampyr)Br_2	A	17.70	51.52	17.73	51.58
Fe(2-ampyr)Cl_2	B	25.14	31.90	25.17	31.96
Co(2-ampyr)Cl_2	A	26.20	31.50	26.20	31.52
Co(2-ampyr)$Br_2 \cdot 2H_2O$	A	13.20	35.90	13.24	35.92
Co(2-ampyr)$_2Br_2$	C	14.38	39.06	14.41	39.10
Co(2-ampyr)$I_2 \cdot 2H_2O$	A	13.24	57.16	13.28	57.18
Co(2-ampyr)I_2	C	14.42	62.18	14.45	62.26
Ni(2-ampyr)Cl_2	A	26.06	31.52	26.10	31.55
Ni(2-ampyr)$Br_2 \cdot H_2O$	A	17.64	48.16	17.70	48.19
Ni(2-ampyr)Br_2	C	18.68	50.96	18.71	51.0
Ni(2-ampyr)$_2Br_2$	A	14.32	39.12	14.35	39.13
Cu(2-ampyr)Cl_2	A	27.64	30.84	27.68	30.89
Cu(2-ampyr)Br_2	A	19.91	50.14	19.95	50.18
Zn(2-ampyr)$_2Cl_2 \cdot 3H_2O$	A	17.16	18.60	17.19	18.66
Zn(2-ampyr)$_2Cl_2$	C	20.02	21.71	20.04	21.76
Zn(2-ampyr)$_2Br_2$	A	15.72	38.48	15.75	38.22
Zn(2-ampyr)$_2I_2$	A	12.81	49.82	12.84	49.86

2am pyr =



reactions at 635 K and 785 K with mass loss corresponding to the organic material and halogen. The bromide compound undergoes an endothermic reaction at 605 K followed by an exothermic reaction at 780 K with mass loss corresponding to organic material and halogen. The visible absorption spectra (Table 3) show bands of low intensity. The bands in the spectrum are weak since any excitation of the ground state, which is ^6S in the free ion, causes spin pairing and the formation of quartet or doublet states. Since the excited states have different spin multiplicities from the ground state, the transitions are spin-forbidden and are thus observed as weak transitions. The bands have been assigned to the transitions $^6A_{1g} \rightarrow$ $\rightarrow {}^4T_{1g}(G)$; $^6A_{1g} \rightarrow {}^4T_{2g}(G)$; $^6A_{1g} \rightarrow {}^4E_g(G)$, $^4A_{2g}(G)$. The magnetic moment of the bromide complex is similar to the spin only value for manganese(II) ions ($\approx$ 5.9 BM). This results from the fact that there are no higher T terms having the same multiplicity as the $^6A_{1g}$ ground state term so that no mixing occurs between the $^6A_{1g}$ term and the higher T terms. The chloride complex has a magnetic moment of 6.51 BM. This is probably due to some ferromagnetic impurity in the sample. The compounds obey the Curie–Weiss law (Table 2) with positive θ values. The far infrared spectra (Table 4) support an essentially octahedral environment for the manganese [7].

The iron complex has stoichiometry Fe(2-ampyr)Cl_2 (Table 1). No stoichiometric complexes of iron(II) bromide and iron(II) iodide could be prepared. The preparations were carried out in a dry nitrogen atmosphere. Thermogravimetric studies showed that the chloro compound exhibited no intermediate decomposition steps. At 543 K the compound undergoes an exothermic reaction with loss of organic material and halogen. The visible spectrum (Table 3) showed an absorption band at 10.640 cm^{-1} which corresponds to the transition $^5T_{2g} \rightarrow {}^5E_g$. This would suggest an octahedral environment for the iron. The compound has a

Table 2

Magnetic data

Compound	Temp., K	Diamagnetic correction, 10^{-6}	χ_M^{Corr}, 10^{-6}	μ/B. M.	θ
Mn(2-ampyr)Cl_2	293	84.05	17 946	6.51	26.4
Mn(2-ampyr)Br_2	293	106.45	15 514	6.06	3.35
Fe(2-ampyr)Cl_2	293	84.05	11 376	5.19	−38.8
Co(2-ampyr)Cl_2	293	84.05	11 773	5.28	12.7
Co(2-ampyr)$_2Br_2 \cdot 2H_2O$	292	156.9	10 647	5.01	−0.26
Co(2-ampyr)$_2Br_2$	294	136.76	8 801	4.57	−20.8
Co(2-ampyr)$I_2 \cdot 2H_2O$	288	142.38	7 861	4.27	2.78
Ni(2-ampyr)Cl_2	294	84.05	4 962	3.43	− 5.22
Ni(2-ampyr)$Br_2 \cdot H_2O$	290	122.38	4 826	3.36	2.66
Ni(2-ampyr)$_2Br_2$	298	150.9	2 997	2.68	− 14.3
Cu(2-ampyr)Cl_2	296	84.05	1 301	1.76	14.6
Cu(2-ampyr)Br_2	296	106.45	1 140	1.65	51.7

Table 3

Electronic spectra, cm^{-1}

Manganese compounds

Octahedral environment (ground state $^6A_{1g}$)

Compound	$^6A_{1g} \rightarrow {}^4T_{1g}(G)$	$^6A_{1g} \rightarrow {}^4T_{2g}(G)$	$^6A_{1g} \rightarrow {}^4E_g(G), {}^4A_{1g}(G)$
$Mn(2\text{-ampyr})Cl_2$	18 520	21 645	23 810
$Mn(2\text{-ampyr})Br_2$	18 620	21 835	23 530

Iron compound

Octahedral environment (ground state $^5T_{2g}$)

Compound	$^5T_{2g} \rightarrow {}^5E_g$
$Fe(2\text{-ampyr})Cl_2$	10 640

Cobalt compounds

(i) Octahedral environment (ground state $^4T_{1g}(F)$)

Compound	$^4T_{1g}(F) \rightarrow {}^4T_{2g}(F)$	$^4T_{1g}(F) \rightarrow {}^4A_{2g}(F)$
$Co(2\text{-ampyr})Cl_2$	6666	17 545
$Co(2\text{-ampyr})_2Br_2 \cdot 2H_2O$	6330, 7140, 8620	15 265, 15 950, 16 835

(ii) Tetrahedral environment (ground state $^4A_2(F)$)

Compound	$^4A_2(F) \rightarrow {}^4T_1(F)$	$^4A_2(F) \rightarrow {}^4T_1(P)$
$Co(2\text{-ampyr})I_2$	6850, 8335	14 285
$Co(2\text{-ampyr})_2Br_2$	6329, 7140, 8620	15 265, 15 950, 16 835

Nickel compounds

Octahedral environment (ground state $^3A_{2g}(F)$)

Compound	$^3A_{2g}(F) \rightarrow {}^3T_{2g}(F)$	$^3A_{2g}(F) \rightarrow {}^3T_{1g}(F)$	$^3A_{2g}(F) \rightarrow {}^3T_{1g}(P)$
$Ni(2\text{-ampyr})Cl_2$	7810	13 160	22 990
$Ni(2\text{-ampyr})_2Br_2$	6800	12 660	21 740
$Ni(2\text{-ampyr})Br_2$	6710	12 740	23 150

Copper compounds

Octahedral environment (ground state ^2E_g)

Compound	$^2E_g \rightarrow {}^2T_{2g}$
$Cu(2\text{-ampyr})Cl_2$	14 285
$Cu(2\text{-ampyr})Br_2$	14 495

magnetic moment which agrees with an octahedral configuration for the iron and obeys the Curie–Weiss law with a negative value for θ. The variation of the magnetic moment with temperature is due to the presence of electron delocalization [7]. The far infrared spectrum (Table 4) supports an essentially octahedral environment for the iron [7].

The cobalt complexes have stoichiometry $Co(2\text{-ampyr})Cl_2$, $Co(2\text{-ampyr})Br_2 \cdot 2H_2O$ and $Co(2\text{-ampyr})I_2 \cdot 2H_2O$. Thermal decomposition studies show that the chloro compound has no intermediate decomposition steps but undergoes an exothermic reaction at 644 K with loss of organic ligand and halogen. The bromo and iodo complex (Figs 1 and 2) have two stage decompositions. The bromo complex undergoes an endothermic reaction at 465 K with mass loss corresponding to two molecules of water, followed by an exothermic reaction at 565 K with mass loss corresponding to organic ligand and halogen. The iodo complex undergoes an endothermic reaction at 480 K with mass loss corresponding to organic ligand and halogen. The compounds $Co(2\text{-ampyr})Cl_2$, and $Co(2\text{-ampyr})_2Br_2 \cdot 2H_2O$ have electronic spectra which are typical of octahedrally coordinated cobalt atoms [7]. The observed transitions are $^4T_{1g}(F) \rightarrow {}^4T_{2g}(F)$ and $^4T_{1g}(F) \rightarrow {}^4A_{2g}(F)$. The magnetic data for the compounds (Table 2) agree with the suggestion of an octahedral arrangement of ligands around the cobalt atom with temperature dependent magnetic moments in the range 4.9–5.2 BM. The compounds obey the Curie–Weiss law with a positive θ value for the chloro compound and a negative θ value for the bromo compound. The far infrared spectra support an essentially octahedral environment for the cobalt [7]. The compounds $Co(2\text{-ampyr})_2Br_2$ and $Co(2\text{-ampyr})I_2$ have electronic spectra which would suggest tetrahedral structures. The observed transitions are $^4A_2(F) \rightarrow {}^4T_1(F)$ and $^4A_2(F) \rightarrow {}^4T_1(P)$. The magnetic data (Table 2) for the compounds would support a tetrahedral configuration with magnetic moments between 4.2–4.8 BM. The compounds obey the Curie–Weiss law with negative and positive values for θ. The far infrared spectra also supports a tetrahedral environment for the cobalt [12].

The chloro and iodo complexes of nickel(II) have stoichiometry $Ni(2\text{-ampyr})Cl_2$ (Table 1). The reaction of nickel(II) bromide and 2-aminopyrimidine in ethanolic solution resulted in the isolation of a yellow complex of stoichiometry $Ni(2\text{-ampyr})Br_2 \cdot H_2O$ and green complex of stoichiometry $Ni(2\text{-ampyr})_2Br_2$. No stoichiometric compound of nickel(II) iodide could be prepared. Thermogravimetric studies on the chloro and the green bromo complex showed no intermediate decomposition steps. The chloro complex undergoes two exothermic reactions at

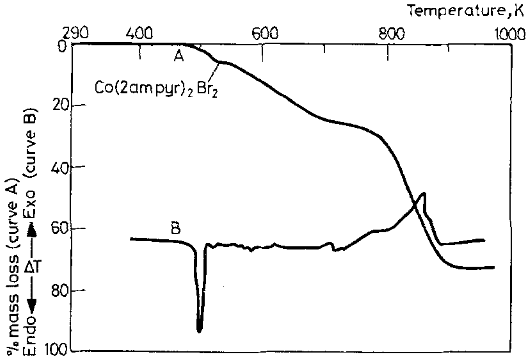


Fig. 1. TG (Curve A) and DTA (Curve B) of Co(2-ampyr)$_2$Br$_2$·2H$_2$O. Sample weight: 93.0 mg. Atmosphere: Static air. Heating rate: 4 deg min^{-1}

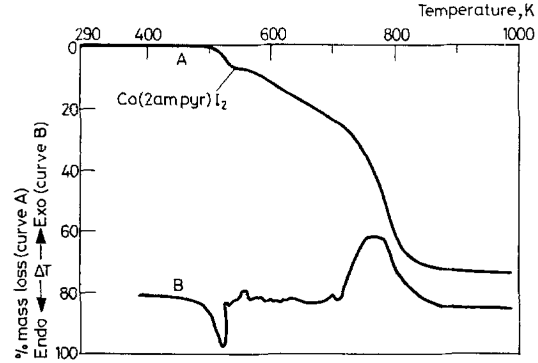


Fig. 2. TG (Curve A) and DTA (Curve B) of Co(2-ampyr)I$_2$·2H$_2$O. Sample weight: 108.8 mg. Atmosphere: Static air. Heating rate: 4 deg min^{-1}

673 K and 880 K with mass loss corresponding to organic ligand and halogen. The bromo complex undergoes two exothermic reactions at 665 K and 822 K with mass loss corresponding to organic ligand and halogen. The yellow bromo complex (Fig. 3) undergoes an endothermic reaction at 390 K with loss of a water molecule. A further endothermic reaction takes place at 620 K immediately followed by an exothermic reaction at 695 K with mass loss corresponding to organic ligand and halogen. The electronic absorption spectra (Table 3) is characteristic of nickel(II) in an octahedral environment. The observed transitions are $^3A_{2g}(F) \rightarrow {}^3T_{2g}(F)$, $^3A_{2g}(F) \rightarrow {}^3T_{1g}(F)$, $^3A_{1g}(F) \rightarrow {}^3T_{1g}(P)$. The magnetic moments (Table 2) of the compounds are again typical of nickel(II) in an octahedral environment. The compounds obey the Curie–Weiss law with a positive θ value for the yellow bromo compound and negative θ values for the green bromo and chloro compounds. The far infrared spectra (Table 4) also support an essentially octahedral configuration for nickel [7].

The chloro and bromo complexes of copper are green and have stoichiometry Cu(2-ampyr)X_2 (Table 1). Thermal decomposition studies show that no intermediate compounds are produced. By 530 K the mass loss corresponds to complete loss of organic ligand. The electronic spectra of the compounds are typical of copper in an octahedral environment [7]. The magnetic moments (Table 2) of the complexes are less than the spin only value. This indicates some copper-copper magnetic interaction in the compounds [8]. The compounds obey the Curie–Weiss law with positive values for θ. The far infrared spectra (Table 4) also support an octahedral configuration for these compounds [7].

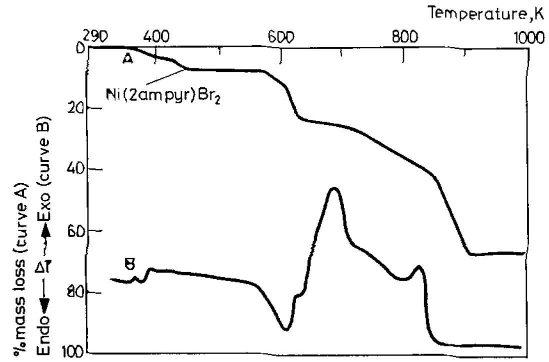


Fig. 3. TG (Curve A) and DTA (Curve B) of Ni(2-ampyr)$Br_2 \cdot H_2O$. Sample weight: 82.1 mg. Atmosphere: Static air. Heating rate: 4 deg min^{-1}

Table 4

Infrared spectra (4000—200 cm^{-1})

Compound	$\nu_a(NH_2)$	$\nu_s(NH_2)$	$\delta(NH_2)$	Ring vibrations	$\nu(M - X)$
2-ampyr	3310	3165	1628	1550, 1450	—
Mn(2-ampyr)Cl_2	3440	3360	1640	1575, 1495	226
Mn(2-ampyr)Br_2	3440	3360	1630	1570, 1490	206
Fe(2-ampyr)Cl_2	3430	3360	1625	1570, 1490	215
Co(2-ampyr)Cl_2	3430	3360	1630	1570, 1495	210
Co(2-ampyr)$Br_2 \cdot 2H_2O$	3360	—	1645	1590, 1565, 1485	242
Co(2-ampyr)$_2Br_2$	3320	—	1635	1590, 1560, 1475	336
Co(2-ampyr)I_2	3440	3310	1630	1590, 1560, 1485	226
Ni(2-ampyr)Cl_2	3455	3365	1635	1575, 1495	240
Ni(2-ampyr)Br_2	3440	—	1615	1570, 1480	232
Ni(2-ampyr)$_2Br_2$	3405	3305	1615	1575, 1485	224
Cu(2-ampyr)Cl_2	3375	3320	1645	1575, 1500	246
Cu(2-ampyr)Br_2	3400	3285	1630	1568, 1490	235
Zn(2-ampyr)$_2Cl_2$	3300	3180	1635	1595, 1560, 1485	328, 310, 290
Zn(2-ampyr)$_2Br_2$	3360	3184	1645	1595, 1555, 1480	232
Zn(2-ampyr)$_2I_2$	3360	3124	1632	1590, 1565, 1490	210

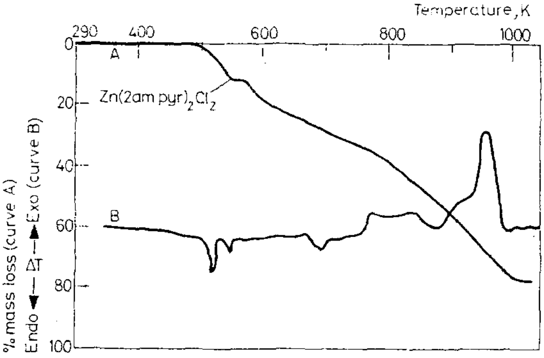


Fig. 4. TG (Curve A) and DTA (Curve B) of Zn(2-ampyr)$_2$Cl$_2$·3H$_2$O. Sample weight: 64.2 mg. Atmosphere: Static air. Heating rate: 4 deg min^{-1}

The chloro compound of zinc has stoichiometry Zn(2-ampyr)$_2$Cl$_2$ · 3H$_2$O while the bromo and iodo compounds have stoichiometry Zn(2-ampyr)$_2$X$_2$ (Table 1). Thermal decomposition studies show that the chloro compound undergoes an endothermic reaction at 380 K with loss of three molecules of water followed by a further endothermic reaction at 523 K and an exothermic reaction at 654 K with mass loss corresponding to organic material and halogen. The bromo and iodo complexes have no intermediate stages in their decomposition. They undergo endothermic reactions at 499 K and 477 K with loss of organic material followed by exothermic reactions at 702 K and 721 K with loss of halogen. The complexes show bands in their far infrared spectra at 303–328 cm^{-1} and 277–291 cm^{-1} for ν(Zn–Cl), 232–242 cm^{-1} for ν(Zn–Br) and 207–211 cm^{-1} for ν(Zn–I). The values (Table 4) agree with literature values [9] for ZnX frequencies of tetrahedral compounds.

Discussion

The stoichiometry of the compounds show that the maximum number of 2-aminopyrimidine molecules present in any one compound is two. All of the compounds are anhydrous with the exception of Co(2-ampyr)Br$_2$ · 2H$_2$O, Co(2-ampyr)I$_2$ · 2H$_2$O, Ni(2-ampyr)Br$_2$ · H$_2$O and Zn(2-ampyr)$_2$Cl$_2$ · 3H$_2$O. The infrared spectra of these compounds show medium absorption bands present in the region 3470–3450 cm^{-1}, ν(OH) and 1640–1630 cm^{-1}, δ(HOH) which clearly confirm the presence of water of crystallisation. Evidence that the presence of water is purely lattice water in the compounds Co(2-ampyr)I$_2$ · 2 H$_2$O Ni(2-ampyr)Br$_2$ · H$_2$O, Zn(2-ampyr)$_2$Cl$_2$ · 3H$_2$O is given by the absence of typical bands of coordinated water [10]. However the presence of a weak band at 310 cm^{-1} in Co(2-ampyr)Br$_2$ · 2 H$_2$O would suggest that the water molecules are coordinated to the cobalt atom [11]. Furthermore the water is lost in the compounds Co(2-ampyr)I$_2$ · 2H$_2$O, Ni(2-ampyr)Br$_2$ · H$_2$O, Zn(2-ampyr)$_2$Cl$_2$ · 3H$_2$O at around

373 K whereas the water in the compound $Co(2\text{-ampyr})_2Br_2 \cdot 2H_2O$ is lost at 465 K. In general terms the sequence of decomposition of the complexes from TG studies (Table 5) is:

Table 5

TG data of complexes showing expected and actual percentage mass loss for water and 2-aminopyrimidine

Compound	Ligand removed	Expected loss	
		calc., %	actual, %
$Co(2\text{-ampyr})_2Br_2 \cdot 2H_2O$	H_2O	8.09	5.59
	2-ampyr + Br_2	78.66	74.73
$Co(2\text{-ampyr})I_2 \cdot 2H_2O$	H_2O	8.12	7.9
	2-ampyr + I_2	78.61	74.26
$Ni(2\text{-ampyr})Br_2 \cdot H_2O$	H_2O	5.43	5.48
	2-ampyr + Br_2	76.87	69.55
$Zn(2\text{-ampyr})_2Cl_2 \cdot 3H_2O$	H_2O	14.19	13.71
	2-ampyr + Cl_2	68.63	69.47

(i)

$$\begin{array}{lcl} M(2\text{-ampyr})X_2 \cdot nH_2O & \rightarrow & M(2\text{-ampyr})X_2 \\ M(2\text{-ampyr})X_2 & \rightarrow & \text{Metal halide} \\ & & \text{or} \\ & & \text{Metal oxide} \end{array}$$

(Where $n = 1$ or 2)

(ii)

$$\begin{array}{lcl} M(2\text{-ampyr})_2Br_2 \cdot 2H_2O & \rightarrow & M(2\text{-ampyr})_2Br_2 \\ M(2\text{-ampyr})_2Br_2 & \rightarrow & \text{Metal oxide} \\ (M = Co, Ni) & & \end{array}$$

Without X-ray analysis, no definite structures can be described. However spectroscopic and magnetic data available enable us to predict structures. When the infrared spectrum of the solid free ligand is compared to that of the complexes in the region 2000–625 cm^{-1} it is found that the bands due to $\nu_s(NH_2)$, $\nu_a(NH_2)$ $\delta(NH_2)$ and ring vibrations (Table 4) move to higher frequency suggesting that coordination takes place through one of the nitrogen atoms in the pyrimidine ring and the nitrogen atom of the amine group. The exceptions are $Co(2\text{-ampyr})_2Br_2 \cdot 2H_2O$, $Co(2\text{-ampyr})_2Br_2$ and $Ni(2\text{-ampyr})_2Br_2$ where little change in frequency is observed for the N–H vibration of the amine group, thus suggesting that in these compounds coordination takes place through a nitrogen atom of the pyrimidine ring. The compound $Co(2\text{-ampyr})_2Br_2 \cdot 2H_2O$ has an octahedral structure. For the compounds of stoichiometry $M(2\text{-ampyr})X_2$ an octahedral structure of a metal halogen chain with each metal having four bonds to halogen atoms giving the formula MX_2 and the pyrimidine ligands attached above and below the planes of the MX_2 chain through the lone pairs of electrons on the nitrogen atoms to two adjacent metal atoms giving a formula of MX_2(LIGAND).

For the compound Ni(2-ampyr)$_2$Br$_2$ the structure suggested is again a chain structure of metal-halogen atoms, MX$_2$ with two ligands bonded above and below the plane of the chain to each metal atom through a lone pair of electrons on the pyrimidine ring nitrogen giving a formula of MX$_2$(LIGAND)$_2$. The bands corresponding to ν(MX) in the low frequency infrared spectra of these two types of structure are consistent with similar modes in the halogen bridged polymeric octahedral compounds (12). The compounds Co(2-ampyr)$_2$Br$_2$, Co(2-ampyr)I$_2$ and Zn(2-am-pyr)$_2$Cl$_2$, Zn(2-ampyr)Br$_2$ and Zn(2-ampyr)I$_2$ have tetrahedral structures.

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RÉSUMÉ — Les complexes de l'amino-2 pyrimidine avec les chlorures, bromures et iodures de cobalt(II), zinc(II) ainsi qu'avec les chlorures et bromures de manganèse(II), nickel(II) et cuivre(II) ont été préparés. Le complexe formé avec le chlorure de fer(II) a aussi été obtenu. Les configurations stéréochimiques des complexes ont été déduites des propriétés spectrales et magnétiques. La décomposition thermique des complexes a été étudiée par thermogravimétrie et analyse thermique différentielle.

ZUSAMMENFASSUNG — Komplexe von 2-Aminopyrimidinen mit den Chloriden, Bromiden und Jodiden von Kobalt(II), Zink(II) und den Chloriden und Bromiden von Mangan(II), Nickel(II) und Kupfer(II) wurden hergestellt. Der Chloridkomplex von Eisen(II) wurde ebenfalls erhalten. Die stereochemischen Konfigurationen der Komplexe wurden aus spektralen und magnetischen Eigenschaften abgeleitet. Die Zersetzung der Komplexe wurde durch Thermogravimetrie und Differentialthermoanalyse untersucht.

Резюме — Получены комплексы 2-аминопиримидина с хлоридами, бромидами и иодидами кобальта(II) и цинка(II), а также с хлоридами и бромидами марганца(II), никеля(II) и меди(II). Получен также комплекс с хлоридом железа(II). Исследование спектральных и магнитных свойств этих комплексов позволило установить их стереохимические конфигурации. Разложение комплексов изучено с помощью термогравиметрии и термического анализа по производной.