



PS5.28 — TU

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NMR AND SPECTROSCOPIC STUDIES ON THE PYRIDOXAL/GLYCINE/ /DIOXOURANIUM(VI) SYSTEM

In previous communications we have reported some results on formation of dioxouranium(VI) complexes of pyridoxal and pyridoxylideneglycine [1-5].

As it is known, pyridoxal and its derivatives are able to catalyze, in the presence of metal ions, important metabolic reactions of aminoacids through the intermediary formation of Schiff bases metal complexes [6-10].

The pyridoxal/glycine/dioxouranium(VI) system is studied both in the solid state and in solution by IR, electronic, ^1H and ^{13}C NMR spectra.

The results obtained in the solid state are in accord with the formation of a 1:1:1 ternary complex: $\text{UO}_2(\text{C}_{10}\text{H}_{11}\text{N}_2\text{O}_4)\text{XH}_2\text{O}$ (where $\text{X}=\text{CH}_3\text{COO}^-$ or NO_3^-). IR spectra exhibit changes in the regions where the azomethine $\text{C}=\text{N}$ stretching ($\nu_{\text{CN}}=1610\text{ cm}^{-1}$), phenolic $\text{C}=\text{O}$

($\nu_{\text{CO}}=1510\text{ cm}^{-1}$) and the asymmetric carboxyl stretching ($\nu_{\text{COO}^-}=1570\text{ cm}^{-1}$) respectively occur.

The electronic spectra of an equimolar methanol solution of pyridoxal and glycine exhibit bands near 360 nm and 320 nm. Such absorptions markedly increase as a function of time when dioxouranium(VI) is added in equimolar amount and are shifted to 390 nm and 343 nm respectively. Furthermore two isosbestic points are formed at 290 nm and 275 nm. The final spectrum is very near to that of the complex prepared at the solid state. The ^1H and ^{13}C NMR spectra of the pyridoxal/glycine/dioxouranium(VI) system has been then examined in D_2O at pH 3.55 (at higher pH values precipitation occurs) in order to verify the formation of aldimine complexes induced by UO_2^{2+} .

Tables I and II show respectively proton and ^{13}C chemical shifts of pyridoxal and glycine solutions at varying molar ratios with uranyl nitrate. Large chemical shift changes are observed for C-4'-H, C-6-H and 2'- CH_3 pyridoxal protons and for $\alpha\text{-CH}_2$ glycine protons (Table I) upon complex formation and metal ion binding. In order to gain informations on the pyridoxylideneglycine complex, ^1H chemical shifts were measured in DMSO-d_6 . In addition to the remarkable proton chemical shift variation, in particular of the aldehydic C-4'-H hydrogen ($\Delta=1.14\text{ ppm}$), the progressive disappearance of the $-\text{NH}_2$ resonance signal is in accord with the formation of the Schiff base and metal ion complexation. Furthermore, a new signal of intensity one appears at 9.60 ppm, characteristic of a proton bound to the pyrimidine nitrogen donor.

Table I

^1H NMR chemical shifts (δ/ppm)^{a)} of free pyridoxal hydrochloride (HPL)/glycine (Gly) system and UO_2 nitrate solutions in D_2O at pH=3.55

Compound	molar ratio	C-6-H	C-4'-H	5'- CH_2	$\alpha\text{-CH}_2$	2'- CH_3
HPL + Gly	1:1	8.08,1H	6.67,1H	5.22,2H	3.69,2H	2.60,3H
HPL + Gly + UO_2 nitrate	1:1:0.25	8.00,1H	6.62,1H	5.18,2H	3.66,2H	2.60,3H
HPL + Gly + UO_2 nitrate	1:1:0.50	7.90,1H	6.85,1H	5.20,2H	3.60,2H	2.70,3H
HPL + Gly + UO_2 nitrate	1:1:1	7.78,1H	7.30,1H	5.12,2H	3.56,2H	2.87,3H
HPL + Gly + UO_2 nitrate	1:1:2	7.77,1H	7.28,1H	5.28,2H	3.37,2H	2.86,3H
$\Delta\text{ ppm}$	=	-0.31	+0.61	+0.06	-0.32 *	+0.26

a) ^1H NMR chemical shifts are measured downfield from TMS, using dioxane as an internal standard.

Table II

¹³C NMR chemical shifts (δ/ppm)^{a)} of free pyridoxal hydrochloride (HPL)/glycine (Gly) system and UO₂ nitrate solutions at pH=3.55

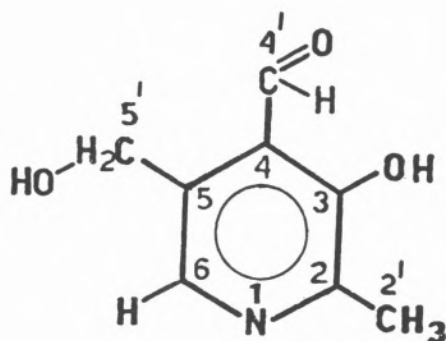
Compound	molar ratio	-COO ⁻	C-3	C-2	C-4	C-5	C-6	C-4'	C-5'	α-CH ₂	C-2'
HPL + Gly	1:1	172.70	150.75	144.85	140.45	138.70	125.40	99.35	70.60	42.06	15.00
HPL + Gly + UO ₂ nitrate	1:1:0.25	172.82	155.80	145.08	140.79	138.64	125.82	163.20	70.60	58.90	15.00
HPL + Gly + UO ₂ nitrate	1:1:0.50	173.14	163.40	146.00	141.21	138.57	126.50	163.20	70.62	58.92	15.13
HPL + Gly + UO ₂ nitrate	1:1:1	177.97	163.69	146.69	141.90	138.35	126.68	163.30	70.68	59.17	15.50
HPL + Gly + UO ₂ nitrate	1:1:2	179.73	163.81	147.48	142.47	138.34	128.21	163.40	70.70	59.91	15.87
Δ ppm	=	+ 7.03	+ 13.06	+ 2.63	+ 2.02	- 0.36	+ 2.81	+ 64.05	+ 0.10	+ 17.85	+ 0.87

a) ¹³C NMR chemical shifts are measured downfield from TMS, using dioxane as an internal standard.

Such results are supported by the ¹³C NMR data reported in Table II. The downfield shift of the C-4' pyridoxal carbon from 99.35 ppm to 163.40 ppm (that is to the resonance value exhibited by a large number of pyridoxal aldimines [11]) and of phenolic C-3 carbon (Δ=13.06 ppm) together with the significant displacement of the resonance signals of α-CH₂ (Δ=17.85 ppm) and -COO⁻ glycine carbon atoms (Δ=7.03 ppm) point out the direct involvement of the uranyl ion to promote the aldimine formation between pyridoxal and glycine and to give rise to the pyridoxylideneglycine metal complex too.

REFERENCES

- [1] A. MARZOTTO, F. BRAGA, III Conv. Naz. Radiochim., 167 (1980).
- [2] A. MARZOTTO, *Inorg. Chim. Acta*, **40**, X72 (1980).
- [3] A. MARZOTTO, XXI Internat. Conf. Coord. Chem., 120 (1980).
- [4] A. MARZOTTO, *Inorg. Chim. Acta*, **62**, 183 (1982).
- [5] A. MARZOTTO, H. KOZLOWSKI, *Inorg. Chim. Acta*, **94**, 96 (1984).
- [6] D.E. METZLER, E.E. SNELL, *J. Am. Chem. Soc.*, **74**, 979 (1952).
- [7] D.E. METZLER, M. IKAWA, E.E. SNELL, *J. Am. Chem. Soc.*, **76**, 648 (1954).
- [8] G.L. EICHORN, J.W. DAWES, *J. Am. Chem. Soc.*, **76**, 5663 (1954).
- [9] H.N. CHRISTENSEN, *J. Am. Chem. Soc.*, **79**, 4073 (1957).
- [10] S. MATSUMOTO, Y. MATSUSHIMA, *J. Am. Chem. Soc.*, **96**, 5228 (1974).
- [11] R.C. HARRUFF, W.T. JENKINS, *Org. Magn. Resonance*, **8**, 548 (1976).



Pyridoxal



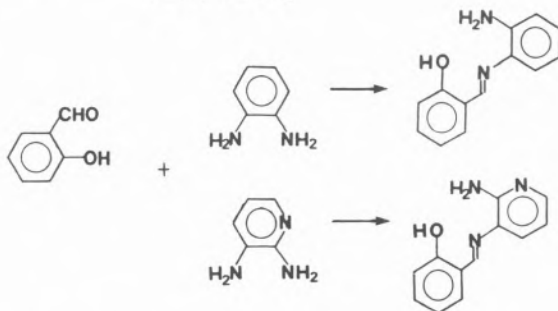
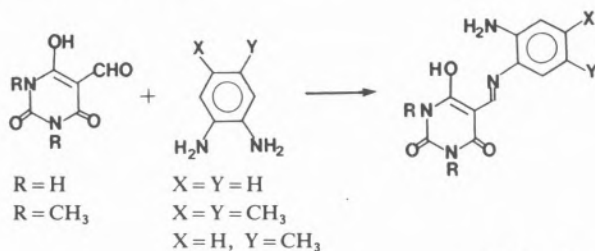
PS5.29 — TH

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SYNTHESIS OF COBALT(II) COMPLEXES WITH NON-SYMMETRIC SCHIFF BASES

As models for oxygenases, we have undertaken the synthesis of copper and cobalt complexes with Schiff bases derived from pyrimidine bases [1-3]. In order to study the influence of the aromatic ring on the half-wave potentials and on their catalytic efficiency, we have prepared non-symmetric Schiff bases with aromatic diamines. Condensation of the carbonyl function with only one end of the diamine is obtained in the presence of a tertiary amine with 5-formyl barbituric acid, 5-formyl 1,3-dimethyl barbituric acid or with salicylaldehyde.



Further condensation of these half-units with various aromatic hydroxy aldehydes leads to non-symmetric Schiff bases.

The corresponding cobalt(II) complexes have been prepared and studied by usual spectroscopic methods. Their ability to catalyse the oxidation of phenols will be described.

REFERENCES

- [1] I. SASAKI, M.N. DUFOR, A. GAUDEMER, *Nouv. J. Chim.*, **6**, 341 (1982).
- [2] I. SASAKI, M.N. DUFOR, A. GAUDEMER, A. CHIÁROI, C. RICHE, D. PARQUER-DECROUEZ, P. BOUCLY, *Nouv. J. Chim.*, **4**, 237 (1984).
- [3] I. SASAKI, A. GAUDEMER, A. CHIARONI, C. RICHE, *J. Chem. Soc., Dalton Trans.*, submitted for publication.



PS5.30 — MO

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COORDINATION CHEMISTRY OF IRON BIS-PYRIDOXAL ISONICOTINOYL HYDRAZONE: STEREOCHEMICAL AND ELECTRO- CHEMICAL CONSIDERATIONS

Isoniazid can interact with the body pyridoxal to form pyridoxal isonicotinoyl hydrazone (PIH) shown to be an efficient iron chelator which can deplete the body of iron and cause an anemia («pyridoxine-responsive anemia»). It was identified recently as a promising candidate for removal of toxic accumulation of iron from the body when given orally [1]. This is an advantage over desferrioxamine (desferal) a drug in current use being administered by injection.

We report the synthesis and the X-ray crystal structure of a 2:1 PIH:Fe(III) complex which emerged from a neutral aqueous solution