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FUNCTIONAL DERIVATIVES OF 2-PROPENYLIDENE-1,2-DIHYDROPYRIDINE

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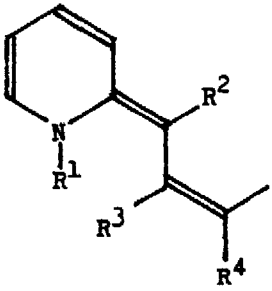
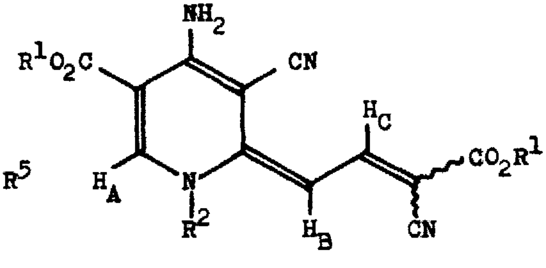
2-Propenylidene-1,2-dihydropyridine (I : $R^1 = R^2 = R^3 = R^4 = R^5 =$ H) appears to be an interesting vinylogue of 2-pyridone-methide, but little is known of this conjugated system. Only five derivatives of I have been described recently. Acheson and Woollard have reported [2] the isolation of small amounts of three compounds (II : $R^1 =$ Me, $R^2 =$ COEt or CO_2Me, $R^3 =$ H or Ph, $R^4 = CO_2Me$ or Ac, $R^5 =$ H) after the reaction of 1-methyl-2-alkylidene-1,2-dihydropyridines with electrophilic acetylenes. Kobayashi et al. have prepared [3] two derivatives III ($R^1 =$ Me, $R^2 =$ H, $R^3 =$ SMe or $N(CH_2CH_2)_2O$, $R^4 = R^5 =$ CN; stereochemically unspecified) by the condensation of malononitrile with the corresponding 2',2'-disubstituted 1-methyl-2-vinylpyridinium iodides. In the present communication we wish to report a new and simple route to the synthesis of the compounds IV.

On heating 2-alkoxymethylene cyanoacetates V with N-alkylated 3-aminocrotonitriles VI in boiling benzene and in the presence of acetic acid the precipitation of red crystals was observed. The formation of IVa-f is as a rule completed after four hours and the products can be easily isolated by suction and purified by crystallization from dimethylformamide. The general structure IV has been suggested by the authors on the basis of the following arguments : (i) Elemental analyses as well as m/e values for molecular ions in the mass spectra agree with the partial formula $C_{12}H_5N_4O_4(R^1)_2R^2$. (ii) Infrared absorption maxima (KBr technique) at 3330-3380, 3180-3200, 2200 and 1680-1700 cm^{-1} confirm the presence of amino, cyano and carbonyl groups in the investigated compounds. (iii) Pmr spectra measured at 100 MHz exhibit in addition to alkyl and amino group signals, typical peaks from the olefinic protons H_A, H_B and H_C (see Table I) with the coupling constant J_{BC} = 14 Hz, confir-



I-III



IVa-f

$R^1O-CH=C(CN)CO_2R^1$

V

$R^2NH-C(Me)=CH-CN$

VI

$MeO-CD=C(CN)CO_2Me$

VII

ming the trans orientation of both hydrogen atoms H_B and H_C. (iv) The hydrogen atoms H_A and H_C in the product IVa prepared by the condensation of VI (R^2= Me) with VII[4] are partly replaced by deuterium as shown by the pmr measurement. (v) Irradiation of the N-methyl proton singlet in the nmr spectrum of IVa leads to a positive NOE effect with respect to the signals of H_A and H_B, resulting in intensity enhancements of 15 % and 30 %, respectively. (vi) Electronic spectra of IVa-f in ethanol show the long-wave absorption maximum at 490 nm ($\varepsilon \simeq$ 29,000), which is in good agreement with the values 480-500 nm calculated by the PPP method for different quantum chemical models of IV.

Table I

Properties of Compounds IVa-f

Comp.	R^1	R^2	Yield %	M.p., °C	Chemical shifts a) H_A	H_B	H_C
IVa	Me	Me	74	302-304	8.06	5.73	8.81
IVb	Et	Me	76	289-290	8.08	5.71	8.81
IVc	Me	Et	74	288-289	8.01	5.72	8.82
IVd	Et	Et	64	272-273	8.04	5.72	8.89
IVe	Me	n-Pr	65	295-297	8.09	5.71	8.94
IVf	Et	n-Pr	72	263-266	8.09	5.71	8.98

a) δ-Values for d_6-DMSO solutions, relative to TMS

The above structural considerations enable us to suggest that formation of IVa-f proceeds according to the scheme : 2 V + VI → IVa-f + 2 R^1OH. A more detailed study of the chromophoric properties of IVa-f as well as of their mass spectrometric behaviour is in progress.

REFERENCES AND FOOTNOTES

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2. R.M.Acheson and J.Woollard, J.Chem.Soc. Perkin I, 744 (1975).
3. K.Mizuyama, Y.Tominaga, Y.Matsuda and G.Kobayashi, J.Pharm.Soc.Japan, **95**, 290 (1975).
4. The synthesis of VI was accomplished in the following way: The reaction of deuteriochloroform with sodium methanolate in diethyl ether gave trimethyl orthoformate-d containing 75 % of theoretical amount of deuterium. The latter was transformed to a mixture of VII and V on heating with methyl cyanoacetate in acetanhydride as in the case of the non-labelled material (see M.E.G.de Bollemont, Bull.soc.chim.France /3/, **25**, 19 (1901)).