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MOLECULAR STRUCTURE OF AZINES OF 3-ACETYL-4-HYDROXY-2-METHOXY-4-PHENYLCROTONIC ACID LACTONES

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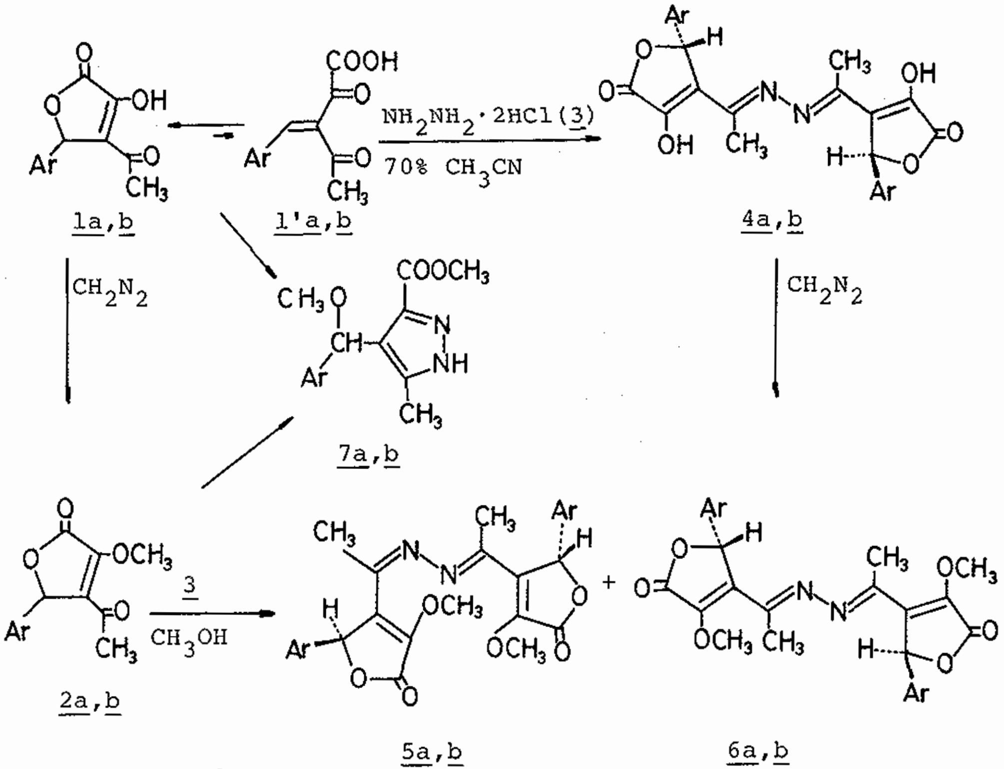
Reaction of 3-acetyl-4-hydroxy-2-methoxy-4-phenylcrotonic acid lactones(2a,b) with hydrazine dihydrochloride(3) gave a mixture of azines(5a,b and 6a,b), and these structures were definitely determined by crystallographic analyses of 5b and 6b.

Recently we reported[1] that the reaction of benzaldehydes with ethyl 2,4-dioxopentanoate gave 3-acetyl-2,4-dihydroxy-4-phenylcrotonic acid lactones(e.g., 1a,b), and these lactones take the open form structures,3-benzylidene-2,4-dioxopentanoic acids(1'a,b), in water because these are soluble in $NaHCO_3$ solution under the evolution of carbon dioxide. The present paper describes the reactions of 1a,b and their methyl ethers(2a,b) with hydrazine dihydrochloride(3).

When a solution of 1a in 70% CH_3CN was refluxed with an equimolar of 3, the compound 4a, yellow needles of mp 190-191°, was obtained in 85% yield as a single product. Anal. Calcd. for

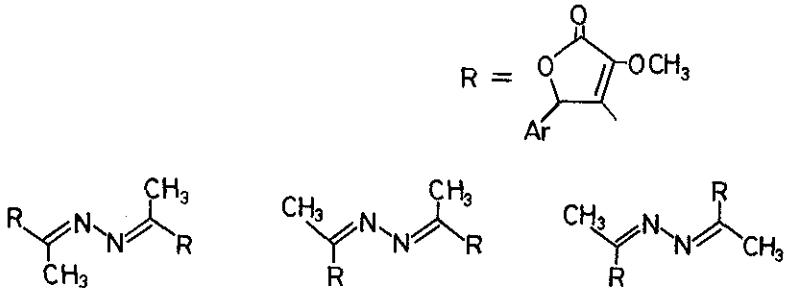
$C_{24}H_{20}N_2O_6$: C, 66.66; H, 4.66; N, 6.48. Found : C, 66.46; H, 4.67; N, 6.48. Azine(4a) was not soluble in $NaHCO_3$ solution but soluble in dil. NaOH solution, and gave wine-red color when treated with a solution of $FeCl_3$. Similarly, reaction of 1b with 3 gave the compound 4b, yellow needles of mp 158-160°, in good yield. On the other hand, 2a was treated with an equimolar of 3 in MeOH at room temperature to give a mixture of 5a, yellow needles of mp 187-189° [$C_{26}H_{24}N_2O_6$ (460 M^+)] and 6a, red needles of mp 183-185° [$C_{26}H_{24}N_2O_6$ (460 M^+)] in a ratio of 57 : 43 in 83% yield.



a : Ar=phenyl

b : Ar=o-chlorophenyl

Similarly, treatment of 2b with 3 gave a mixture of 5b, yellow needles, and 6b, red needles, in a ratio of 50 : 50 in 90% yield. Methylation of 4a,b by action of diazomethane afforded 6a,b. From these results, 4a,b, 5a,b and 6a,b were supposed to be azine derivatives. Theoretically, three stereostructures are possible for azine as shown in Fig. 1.



anti-anti　　syn-anti　　syn-syn

Fig. 1

The syn and anti designation in this paper refers to the relationship of the bond of C-R and N-N.

Spectral data and Rf-value of azines(4a,b-6a,b) were listed on Table I and it should be noted that on the pmr spectra the signals of each two methyl protons on C=N bond, methoxy protons and methine protons appeared as singlet, and C-methyl resonances of 5a,b were observed upfield shift of 0.38-0.40 ppm than that of 6a,b. Since these data, however, did not provide the definitive evidence of the structure of azines, we decided to determine the crystal structures of 5b and 6b. The crystal data are followings : a= 18.899(3) Å, b=17.250(3) Å, c=15.490(3) Å and space group, Pbca, for 5b and a=20.132(4) Å, b=6.162(1) Å, c=19.954(3) Å and space

Table I. Physical Properties of Azines

	4a	4b	5a	5b	6a	6b
Color	Yellow	Yellow	Yellow	Yellow	Red	Red
Formula (Mass m/e)	$C_{24}H_{20}N_2O_6$	$C_{24}H_{18}N_2O_6Cl$	$C_{26}H_{24}N_2O_6$ (460 M^+)	$C_{26}H_{22}N_2O_6Cl$ (493 M^+)	$C_{26}H_{24}N_2O_6$ (460 M^+)	$C_{26}H_{22}N_2O_6Cl$ (493 M^+)
Mp (°C) (Recryst. Solvent)	190-191 (DMF-H_2O)	158-160 (DMF-H_2O)	187-189 (MeOH)	187-188 (AcOEt)	183-185 (AcOEt)	190-192 (AcOEt)
IR ν_{max}^{KBr} cm^{-1}	1780 1760 1600	1785 1760 1600	1760 1640 1255 1170	1765 1660 1255 1165	1755 1630 1260 1170	1765 1650 1260 1170
UV λ_{max}^{EtOH} nm (log ε)	253 (4.16) 317 (3.80) 455 (4.01)	250 (4.10) 318 (3.94) 463 (4.15)	304 (4.43) 327 (4.29)	308 (4.40) 330 (4.35)	305 (4.40) 325 (4.37)	310 (4.31) 330 (4.32)
PMR δ (DMSO-d_6)						
2 × $-C\underline{H}_3$	1.94 (s)	1.91 (s)	1.32 (s)	1.35 (s)	1.70 (s)	1.75 (s)
2 × $-OC\underline{H}_3$			4.11 (s)	4.13 (s)	4.13 (s)	4.15 (s)
2 × $-C\underline{H}$	6.25 (s)	6.54 (s)	6.21 (s)	6.54 (s)	6.24 (s)	6.56 (s)
Rf-value (Al_2O_3/Benzene)	0	0	0.48	0.67	0.61	0.70

group, Pbcn, for 6b. From these data and density(1.414 g. cm^{-3}), the molecular weight of 6b was equal to half of that determined by mass spectrometry, suggesting that the molecule of 6b, itself, has a center of symmetry on the middle of =N-N= bond. On the other hand, the crystal of 5b occupied one molecule per asymmetric unit, judging from the crystal data and density(1.388 g. cm^{-3}). Firstly, we determined the crystal structure of 6b. As might have been expected from these data, 6b has a center of symmetry in a molecule, as shown in Fig. 2, corresponding to anti-anti form of Fig. 1.

From this result and the data of pmr spectrum, the structure of 5b should have the syn-anti form of Fig. 1, although crystal determination is undergoing at present. The details of these crystal structure will be published elsewhere.

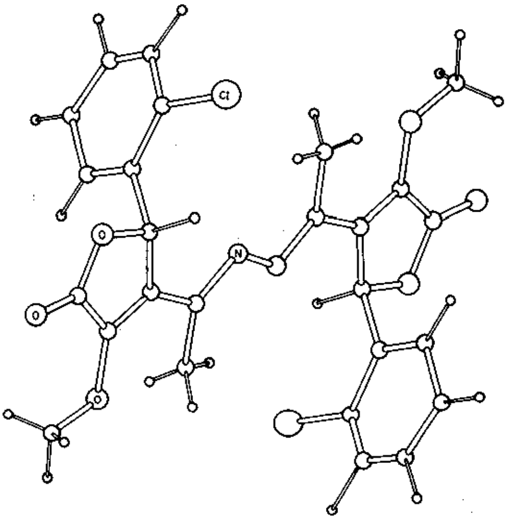


Fig. 2

Molecular Structure of Azine(6b)

When a solution of 2a,b in MeOH was refluxed with 3 for 3 hr, the ratio of the products 5a : 6a and 5b : 6b changed to 72 : 28 and 55 : 45, respectively. Furthermore, refluxing in MeOH for 72 hr, methyl 4-(α-methoxybenzyl)-5-methylpyrazole-3-carboxylates(7a,b) [7a : oil, IR $\nu_{max}^{CHCl_3}$ cm^{-1} : 3480(NH), 1720(CO). Pmr($CDCl_3$) δ : 2.20(3H, s, $C\underline{H}_3$), 3.40(3H, s, $OC\underline{H}_3$), 3.85(3H, s, $COOC\underline{H}_3$), 6.15(

1H, s, CH), 9.90(1H, bs, NH). Mass spectrum : m/e 260(M^+). 7b : $C_{14}H_{15}N_2O_3$(294 M^+) : mp 155-156°. IR ν_{max}^{KBr} cm^{-1} : 3280(NH), 1720 (CO). Pmr($CDCl_3$) δ : 2.10(3H, s, CH_3), 3.50(3H, s, OCH_3), 3.90(3H, s, $COOCH_3$), 6.35(1H, s, CH), 10.50(1H, bs, NH)] were obtained in 75-80% yield. Analogously, refluxing a MeOH solution of 1a,b with 3 for 24 hr gave pyrazoles(7a,b) in 70-75% yield.

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