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# AZLACTONES IN HETEROCYCLIC SYNTHESIS: REACTION OF $\Delta^2$-OXAZOLIN-5-ONE WITH FURYLACROLEIN ANILS

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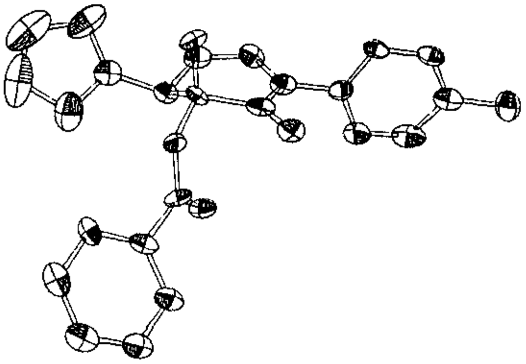
Abstract —— Reaction of furylacrolein anils with mesoionic oxazolin-5-one gave α-pyridones and there was no evidence for the formation of β-lactams. The pyridone structures were fully supported by spectral data and the X-ray analysis of (4b).

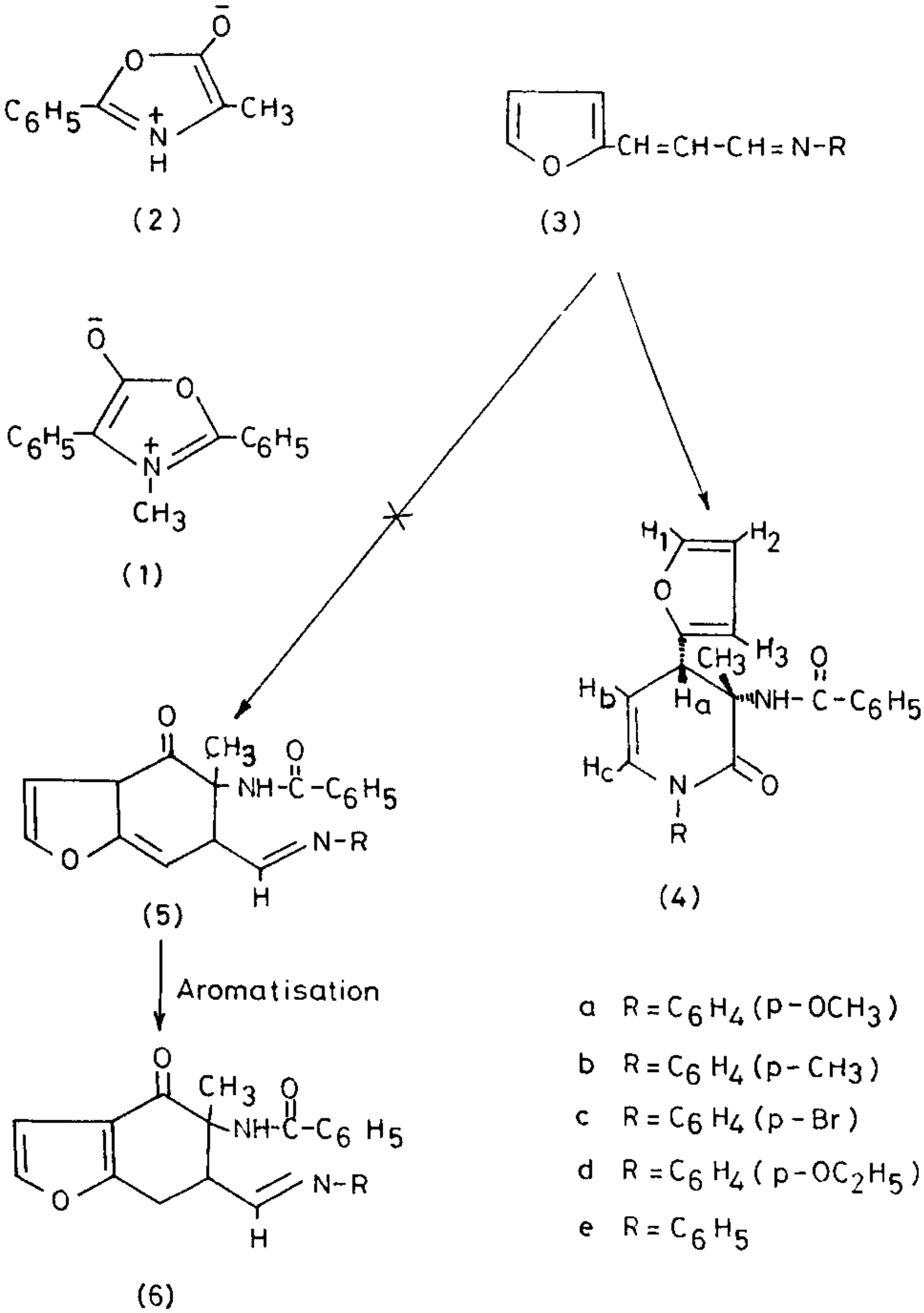
Azlactones have provided a useful way of synthesising novel heterocycles. In this connection mesoionic oxazolin-5-one (1) (Münchnone) has been thoroughly investigated. It reacts with a variety of multiple bonds which can act as typical dipolarophiles to give 1 : 1 cycloadducts which in turn may loose carbon dioxide to give stable heterocycles. Overall, in these reactions mesoionic compound (1) behaves as a typical 1,3-dipole[1-3]. The azlactone (1) is also proposed to react in its valence tautomer ketene form with a number of typical ketenophiles like carbodiimides, enamines and unconjugated imines[4]. The proposed intermediacy of tautomeric ketene has recently been disputed[5] and has become a point of considerable debate. Recently, Huisgen has reasserted his postulate regarding the intermediacy of a ketene in the formation of β-lactams[6]. We have investigated the reactions of azlactone (2) with various 1-aza-1,3-butadienes and here we wish to report the reaction of furylacrolein anils with (2). The azlactone (2) has also been added to the class of mesoionic oxazolones on the basis of its physical as well as chemical properties. It participates as a typical 1,3-dipole in its reactions with various alkenes and alkynes[8-10].

The choice of studying (3) was made because of the interesting chemistry of the furan unit itself as well as when it is coupled with a diene system. Furan and vinylfuran compounds are well known to behave as dienophiles as well as possessing typical alkene character[11].

When azlactone (2) reacted with the imine in equimolar proportions in dry benzene at room temperature and the reaction mixture was stirred for 24 h, removal of solvent gave a residue which on repeated crystallisations from benzene-light petroleum ether gave a white crystalline material (4). The yields, mp and elemental data of these pyridones are given in Table 1 and spectral data in Table 2. The structural assignment (4a) was established by elemental as well as spectral data. IR (KBr) showed the presence of amido carbonyl groups at 1670 and 1665 $cm^{-1}$ and there was no evidence for the formation of β-lactams. In this case no carbonyl group around 1745 $cm^{-1}$ was present. Also spectral data clearly ruled out the possibility of furan ring involvement, i.e. the formation of product (5) or (6). $H^1$NMR (360 MHz $CDCl_3$) δ : 1.40 (s, 3H, $CH_3$), 3.80 (s, 3H, $OCH_3$), 5.17 (dd, J=3 and 8.5 Hz, 1H, $H_b$), 5.41 (t, unresolved 1H, $H_a$), 6.15 (s, 1H, NH), 6.2 (d, J=3 Hz, 1H, furan $H_3$), 6.35 (dd, J=3 and 8.5 Hz, 1H, $H_c$), 6.41 (dd, J=1 and 3 Hz, 1H, furan $H_2$), 6.98 - 7.80 (unresolved, m, 10H, 9 aromatic and furan $H_1$). The azomethine proton which was present in imine (3a) at 8.2 (d, 1H) was not present, this conclusively proving that cyclo-addition has involved the azomethine function which ruled out structures (5) and (6). C.I.M.S. (m/z), $M^+$ 402 and other major fragments at 281,228 and 198. The stereochemistry of the resulting pyridones (4) was unambiguously established besed on the result obtained from the X-ray analysis of (4b)[12].

Molecular Structure of One of Enantiomers
of the Pyridone (4b)





a $R = C_6H_4(p\text{-}OCH_3)$

b $R = C_6H_4(p\text{-}CH_3)$

c $R = C_6H_4(p\text{-}Br)$

d $R = C_6H_4(p\text{-}OC_2H_5)$

e $R = C_6H_5$

Table 1. Characteristics of Pyridones

| Compound No. | R | Melting Point (Furylacrolein Anil) °C | Yield Pyridone % | Melting Point (Pyridone) °C | Formula | Analysis(%) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Calculated | | | | Found | | |
| | | | | | | C | H | N | Halogen | C | H | N |
| 4a | $C_6H_4(P\text{-}OCH_3)$ | 66 | 72 | 185 | $C_{24}H_{22}N_2O_4$ | 71.64 | 5.47 | 6.96 | - | 71.59 | 5.38 | 6.50 |
| 4b | $C_6H_4(P\text{-}CH_3)$ | 75 | 72 | 221 | $C_{24}H_{22}N_2O_3$ | 74.61 | 5.69 | 7.25 | - | 74.38 | 5.60 | 7.10 |
| 4c | $C_6H_4(P\text{-}Br)$ | 84 | 62 | 205 | $C_{23}H_{19}N_2O_3Br$ | 61.20 | 4.21 | 6.21 | 17.73 | 61.5 | 4.15 | 6.00 |
| 4d | $C_6H_4(P\text{-}OC_2H_5)$ | 96 | 63 | 135 | $C_{25}H_{24}N_2O_4$ | 72.11 | 5.77 | 6.73 | - | 72.01 | 5.2 | 6.35 |
| 4e | $C_6H_5$ | 65.5 | 55 | 125 | $C_{23}H_{20}N_2O_3$ | 67.74 | 5.38 | 7.53 | - | 67.32 | 5.30 | 7.38 |

**Table** 2. Spectral Data of Pyridones

| Compound No. | Infrared($cm^{-1}$) | Nuclear Magnetic Resonance | Mass Spectra m/e (%) |
|---|---|---|---|
| 4a | 3345, 3020, 1645, 1665, 1660 | 1.40(s,3H,$-CH_3$), 3.80(s,3H,$-OCH_3$), 5.17(dd,8.5Hz,3Hz,1$H_b$), 5.41(t,unresolved,1$H_a$), 6.15(s,1H,-NH), 6.20(d, ~3Hz,1H, furan $H_3$), 6.35(dd,8.5Hz,3Hz,1$H_c$), 6.41(dd,~3Hz,1Hz,1H, furan $H_2$), 6.98-7.80(unresolved,m,10H,9 aromatic and furan $H_1$). | 402(0.02), 281(80), 280(100), 252(10), 228(40), 226(30), 125(50), 97(30). |
| 4b | 3365, 3020, 1645, 1665, 1660 | 1.42(s,3H,$-CH_3$), 2.37(s,3H,$-CH_3$), 5.36(dd,8.5Hz,3Hz,1$H_b$), 5.43(t,unresolved,1$H_a$), 6.16(s,1H,-NH), 6.21(d, ~3Hz,1H, furan $H_3$), 6.33(dd,8.5Hz,3Hz,1$H_c$), 6.40(dd,~3Hz,1Hz,1H, furan $H_2$), 7.16-7.8(unresolved,m,10H,9 aromatic and furan $H_1$). | 336(0.05), 265(80), 266(100), 237(45), 213(50), 112(15), 84(10). |
| 4c | 3345, 3020, 1645, 1660, 1670 | 1.41(s,3H,$-CH_3$), 5.14(dd,8.5Hz,3Hz,1$H_b$), 5.39(t,unresolved, 1$H_a$), 6.14(s,1H,-NH), 6.19(d, ~3Hz,1H,furan $H_3$), 6.34(dd, 8.5Hz,3Hz,1$H_c$), 6.42(dd,~3Hz,1Hz,1H,furan $H_2$), 7.02-7.78 (unresolved,m,10H,9 aromatic and furan $H_1$). | 451(0.02), 449(0.02), 368(60), 367(100), 339 (10),315(25), 313(20), 212(50), 184(40). |
| 4d | 3340, 2950, 1645, 1660, 1670 | 1.10(t,3H,$-CH_3$), 1.45(s,3H,$-CH_3$), 3.57(q,2H,$-CH_2$),5.14(dd, 8.5Hz,3Hz,1$H_b$),5.40(t,unresolved,1$H_a$),6.15(s,1H,-NH),6.23 (d, ~3Hz,1H,furan $H_3$),6.34(dd,8.5Hz,3Hz,1$H_c$),6.39(dd, ~3Hz, 1Hz,1H,furan $H_2$),6.82-7.75(unresolved,m,9 aromatic and furan $H_1$). | 416(0.02), 295(80), 294(100), 266(10), 242(40), 240(30), 139(50), 111(20). |
| 4e | 3345, 3025, 1690, | 1.40(s,3H,$-CH_3$), 5.21(dd,8.5Hz,3Hz,1$H_b$), 5.33(t,unresolved, 1$H_a$), 6.06(s,1H,-NH), 6.12(d, ~3Hz,1H,furan $H_3$), 6.24(dd, 8.5Hz,3Hz,1$H_c$), 6.36(dd, ~3Hz,1Hz,furan $H_2$), 6.80-7.50 (unresolved,m,11H,10 aromatic and furan $H_1$). | 372(0.01), 251(80), 250(100), 223(10), 199(40), 197(30), 96(50), 68(30). |

## EXPERIMENTAL

The imines (3a-e) described in this study were prepared through known methods and melting point values agreed with those recorded in literature. All the imines used were always freshly crystallised again before and showed satisfactory IR, NMR and Mass spectra.

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12. Monoclinic, space group P21/c with a=11.239 (4), b=15.856 (6), c=11.265 (7) A;

Dcalc=1.29 g/cm for z=4. Final R value was 0.135 for 1523 effective reflections.

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