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# A NEW SYNTHETIC APPROACH TO THE 1,4,2-OXATHIAZOLE RING SYSTEM BY THE ACTION OF DIMETHYL ACETYLENEDICARBOXYLATE ON ARYLTHIOHYDROXAMIC ACIDS[1]

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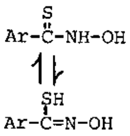
The reaction of arylthiohydroxamic acids with dimethyl acetylenedicarboxylate yields, in one step, 3-Aryl-5-methoxycarbonylmethylene-5-methoxycarbonyl-1,4,2-oxathiazoles.

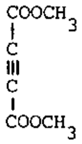
Acetylenedicarboxylic acid esters play a unique and important role in synthetic organic chemistry in that they can undergo, besides simple nucleophilic additions, cyclizations following nucleophilic additions as well as 1,2-, 1,3-, 1,4-cycloadditions leading to many an interesting carbocyclic and heterocyclic system.[4]

Over nine years ago we had occasion to examine the reaction of arylthiohydroxamic acids (I) with dimethyl acetylenedicarboxylate (II) and would now like to report our findings.

When methanolic solutions of equimolar quantities of 4-chlorophenylthiohydroxamic acid (I, Ar = 4-chlorophenyl)[5] and II were mixed, set aside at room temperature for two days, filtered to remove traces of sulfur, the filtrate stripped of the solvent under reduced pressure, the residual viscous liquid extracted repeatedly with hot pentane, and the pentane extracts cooled in dry ice-acetone bath, a solid was obtained which on recrystallization from hexane furnished a crystalline product, m.p. 88-90°, in 25% yield. The molecular formula ($C_{13}H_{12}ClNO_5S$) of the product indicated that it was a 1:1 adduct of I (Ar = 4-chlorophenyl) and II and that, consequently, it could possess any one of the structures represented by IIIa, IV, V[6] or VI.

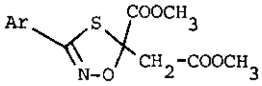


I



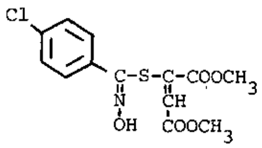
$COOCH_3-C\equiv C-COOCH_3$

II

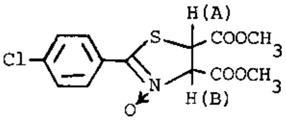


III

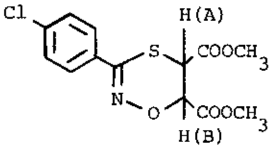
| III | yield |
|---|---|
| a. Ar = 4-chlorophenyl | 25% |
| b. Ar = 4-fluorophenyl | 40% |
| c. Ar = 4-nitrophenyl | 15% |
| d. Ar = 3,4-dichlorophenyl | 30% |



IV



V



VI

The infrared spectrum of the adduct showed no absorption in the $>$NH or -OH region and a strong and broad carbonyl absorption at 1740 $cm^{-1}$. Its 100 MHz PMR spectrum carried, besides two singlets (3 protons each) at $\delta$ 3.73 and $\delta$ 3.84 corresponding, respectively, to the two methyl groups of the two ester functions and an AA'BB' multiplet (4 protons) centered at $\delta$ 8.02 corresponding to the 4-chlorophenyl group, a highly significant AB quartet (2 protons, J = 16 Hz) centered at $\delta$ 3.46 and no protons that could be exchanged with $D_2O$ even after 15 hours.

Structure IV could be ruled out immediately for, if it were correct, it would give rise to an absorption due the hydroxyl group of the oxime function in its infrared spectrum and its PMR spectrum should exhibit a singlet due to the vinyl proton and a singlet due to the hydroxyl proton which should disappear on exposure to $D_2O$.

If the adduct possessed either of the structures V or VI, its PMR spectrum should display an AB quartet for the vicinal protons designated A and B respectively, with a coupling constant not exceeding 12Hz at the very extreme irrespective of whether their orientation is cis or trans with respect to each other. The value of the coupling constant of vicinal protons can be derived, within certain limitations, from the Karplus equation[7] which has been applied effectively by Huisgen[8] to evaluate the stereochemistry of 1,3-dipolar cycloadditions and which has since been modified by Pachler.[9] However, structures V (dihedral angle $\Theta$ = 10° for cis and 130° for trans) and VI ($\Theta$ = 40° for cis and 160° for trans) can be excluded on the basis of the observed value for the coupling constant (i.e. 16Hz) which is much larger than that could be expected for the spin-spin coupling of the vicinal protons of either of them.

In fact the observed coupling pattern with the coupling constant of 16Hz is consistent only with the structure IIIa for the adduct which with its diastereotopic methylene protons would, in its NMR spectrum, be expected to exhibit an AB quartet with a J value of 16-18 Hz.

Compounds IIIb, IIIc, and IIId were also prepared by this one step procedure which constitutes a new route to the 1,4,2-oxathiazole ring system.

Acknowledgement

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## References

1. Dedicated to Dr. T.R. Govindachari, Director, CIBA-GEIGY Research Centre, on his 60th birthday.
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