A New Class of Sultones and Related Compounds

Kenneth D. Paull and C. C. Cheng

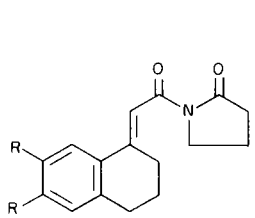
Midwest Research Institute, Kansas City, Missouri 64110

Received December 26, 1972

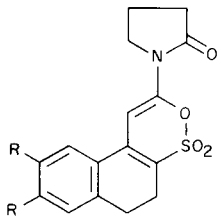
Sir:

As part of a study relating to the synthesis of novel azasteroids, it was found that treatment of the imide Ia with a mixture of concentrated sulfuric acid and excess acetic anhydride at room temperature gave a 58% yield of an *N*-pyrrolidinonyl-*o*-oxathiin 2,2-dioxide (IIa) as yellow needles, m.p. 186.5-187.5° (corr.). Structural assignment for IIa was based on the following information: mass spectrum m/e 377 (M^+, 42%), 313 (M^+-SO_2, 100%), 284 (31%), 230 (80%), 228 (61%) and 201 (29%); nmr (deuteriochloroform) τ 3.00 (*s*, 2p), 3.33 (*s*, 1p), 6.06 (*t*, 2p, J = 7 cps), 6.12 (*s*, 6p), 7.03-8.25 (*m*, 8p); uv λ max (ethanol) 315 nm (log ϵ 4.25), 255 (4.37); ir (chloroform) ν max 1722, 1633, 1501, 1376, 1288, 1177, and 1147 cm^{-1}.

Anal. Calcd. for $C_{18}H_{19}NO_6S$ (377.42): C, 57.28; H, 5.07; N, 3.71. Found: C, 57.00; H, 5.12; N, 3.86.



Ia R = CH_3O
b R = H

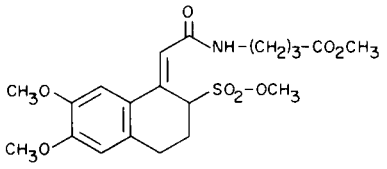


IIa R = CH_3O
b R = H

In a similar manner, treatment of Ib with sulfuric acid and acetic anhydride yielded the corresponding oxathiin derivative IIb, m.p. 180.5-181.5° (corr.).

Stirring a suspension of IIa in methanol containing a small amount of aqueous potassium hydroxide at room temperature formed the sulfonate ester III, m.p. 188.5-190° (corr.), mass spectrum m/e 441 (M^+, 7%), 346 (M^+-SO_3CH_3, 100%), 229 (21%), 101 ($CH_2CH_2CH_2$-CO_2CH_3, 26%); uv λ max (pH 1) 247 nm (log ϵ 4.03), 357 (4.16), λ max (*p*H 11) 233 nm (4.04), 276 (4.12), 313 (4.04).

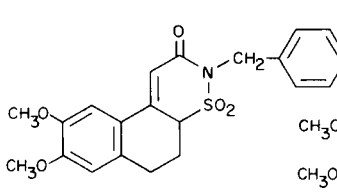
Anal. Calcd. for $C_{20}H_{27}NO_8S$ (441.51): C, 54.41; H, 6.16; H, 3.17. Found: C, 54.48; H, 6.36; N, 3.11. The methyl sulfonate moiety of III was probably formed by nucleophilic attack of the methoxide ion on the sulfur atom of IIa, thereby regenerating the acyclic imide, which underwent methanolysis to form III. Compound III further substantiated the structure assignment for IIa.



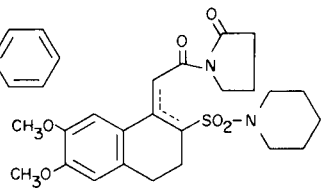
III

Treatment of IIa with benzylamine in refluxing chloroform readily yielded the sulfonamide IV, m.p. 198-199° (corr.), mass spectrum m/e 401 (M^++2, 8%), 400 (M^++1, 24%), 399 (M^+, 95%), 335 (M^+-SO_2, 91%), 244 (M^+-SO_2-C_7H_7, 34%), 231 (94%), 91 ($C_7H_7^+$, 100%). Ir (chloroform) ν 1669, 1589, 1501, 1353, 1331, 1278, 1256, 1156, 1137 cm^{-1}.

Anal. Calcd. for $C_{21}H_{21}NO_5S$ (399.47): C, 63.14; H, 5.30; N, 3.51. Found: C, 63.13; H, 5.56; N, 3.51.



IV



V

As expected, warming a mixture of IIa with piperidine in chloroform gave an imide-sulfonamide V which did not undergo cyclization. Compound V melted at 117-118° (corr.), nmr and ir studies revealed that the product consisted of both the exo- and the endo-double bond isomers; λ max (ethanol) 238 nm (log ϵ 4.27), 322 (4.11); λ sh (ethanol) 300 nm (4.00); ν 1722, 1689, 1656, 1510, 1350, 1254, and 1147 cm^{-1}.

Anal. Calcd. for $C_{23}H_{30}N_2O_6S$ (462.58): C, 59.72; H, 6.54; N, 6.06. Found: C, 59.66; H, 6.46; N, 5.97.

A search of the literature for the oxathiin ring system revealed that only the aryl-, alkyl-, or halogen-substituted oxathiin dioxides were reported. These compounds were usually obtained from either α,β- or β,γ- unsaturated ketones (1-3). The presently reported condensed ring system represents a heretofore unknown class of compounds.

Acknowledgments.

This investigation was supported by Contract PH-43-65-94 from the Division of Cancer Treatment, National Cancer Institute, National Institutes of Health, U.S.A.

REFERENCES

(1) D. S. Breslow and H. Skolnik, "Multi-sulfur and Sulfur and Oxygen Five- and Six-membered Heterocycles," Part II of Vol. 21 in "The Chemistry of Heterocyclic Compounds," Ed. by A. Weissberger, Interscience Publishers, New York, 1966, p. 789.

(2) A. Mustafa, *Chem. Revs.*, **54**, 195 (1954).

(3) W. E. Barnett and J. McCormick, *Tetrahedron Letters*, 651 (1969).