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OPTICALLY ACTIVE 3,3'-BITHIENYLS

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A STUDY of restricted rotation in the bithienyl series, which should give valuable information about the geometric and electronic properties of such compounds, has hitherto been very difficult to undertake owing to difficulties involved in the synthesis of such compounds. Some years ago Nord *et al.*[1,2] investigated two sterically hindered 2- and 3-phenylthiophenes, which they synthesized from the corresponding halides via the Ullman reaction, and which they resolved into optical antipodes. They also prepared some 3,3'-bithienyls[3] through the Ullman reaction, but it remains difficult to obtain such compounds by this method.

The reaction of 3-thienyllithium derivatives, obtained through low-temperature halogen-metal interconversion of bromosubstituted thiophenes[4,5] with n-butyllithium, with cupric chloride,[6] provides a new route to 3,3'-bithienyls. Sterically hindered 3,3'-bithienyls are then easily available

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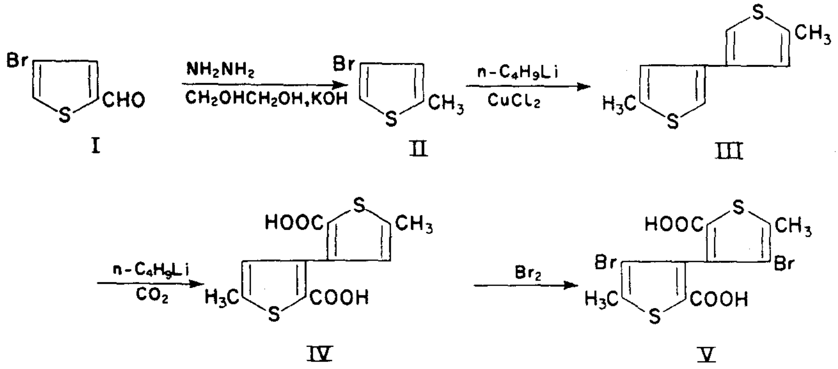
[1] L.J. Owen and F.F. Nord, J.Org.Chem. 16, 1864 (1951).
[2] G.N. Jean, J.Org.Chem. 21, 419 (1956).
[3] G.N. Jean and F.F. Nord, J.Org.Chem. 20, 1363 (1955).
[4] S. Gronowitz, Arkiv Kemi 13, 295 (1958).
[5] S. Gronowitz, P. Moses, A.-B. Hörnfeldt and R. Håkansson, Arkiv Kemi 17, 165 (1961).
[6] S. Gronowitz and H.O. Karlsson, Arkiv Kemi 17, 89 (1960).

through metalation[7], halogen-metal interconversion[8] and other substitution reactions with the 3,3′-bithienyls so obtained.

As a first example, we have prepared 2,2′-dicarboxy-4,4′-dibromo-5,5′-dimethyl-3,3′-bithienyl in the following way: 4-bromo-2-thiophenealdehyd (I) was converted into 4-bromo-2-methylthiophene (II) through the Wolff-Kishner reduction. B.p. 61-62°/11 mm Hg, n_D^{20} = 1.5725 (Found: C, 34.13; H, 2.93. Calc. for C_5H_5BrS: C, 33.91; H, 2.84%). Yield 84%.



Treatment of II with n-butyllithium and $CuCl_2$ at -70° yielded 5,5′-dimethyl-3,3′-bithienyl (III), m.p. 135-136° (Found: C, 62.01; H, 5.23; S, 32.90. Calc. for $C_{10}H_{10}S_2$: C, 61.81; H, 5.19; S, 33.00%). Yield 23%. Refluxing III with excess n-butyllithium for 4 hr followed by carbonation with dry ice yielded 2,2′-dicarboxy-5,5′-dimethyl-3,3′-bithienyl (IV), m.p. 254-257° dec. (Found: C, 50.92; H, 3.74. Calc. for $C_{12}H_{10}O_2S_2$: C, 51.05; H, 3.57). Yield 60%. Upon treatment with excess bromine this gave 2,2′-dicarboxy-4,4′-dibromo-5,5′-dimethyl-3,3′-bithienyl (V) m.p. 312-313° dec. (Found: C, 32.64; H, 1.94; Br, 36.53. Calc. for $C_{12}H_8Br_2O_2S_2$: C, 32.74,

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[7] S. Gronowitz and H.O. Karlsson, to be published.

[8] S. Gronowitz, to be published.

H, 1.83; Br, 36.32%). Yield 80%. III was chosen instead of 3,3'-bithienyl as the metalation of the latter compound with excess n-butyllithium gives a mixture of about equal amounts of 2,2 -dicarboxy-3,3'-bithienyl and 5,5'-dicarboxy-3,3'-bithienyl upon carbonation.[7]

Crystallization of the cinchonine salt of V from aqueous ethanol gave well-defined crystals $[\alpha]_D^{25} = -152°$ (c, 1.10 chloroform). Through decomposition of this salt with hydrochloric acid optically active V was obtained, $[\alpha]_D^{25} = +43°$ (c, 0.51 acetone), $[\alpha]_D^{25} = -57°$, (c, 1.28 chloroform), $[\alpha]_D^{25} = -195°$ (c, 1.14, 0.1-N NaOH). As far as we know this is the first time the resolution of 3,3'-bithienyls has been demonstrated. Further work on the atropisomerism of bithienyls is in progress.

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