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7-*exo*-BROMO-2-OXABICYCLO[4.1.0]HEPT-7-YL LITHIUM

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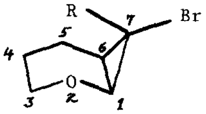
α-Haloorganolithium compounds are receiving increased attention both as proposed transient intermediates in carbenoid reactions and as synthetically useful organometallic reagents (1). We would like to report our initial results on the synthesis and some nucleophilic reactions of the title compound, II, a rather stable α-bromoorganolithium reagent.

The starting material for the preparation of II was I, the dibromocarbene (2) adduct of 2,3-dihydro-4H-pyran. Purification of II was difficult owing to its thermal instability (3). However, satisfactorily pure and colorless samples of I could be obtained by warming the crude oil briefly *in vacuo* and then chromatographing it over alumina. The n.m.r. spectrum of I was very similar to that of the known 7,7-dichloro-2oxabicyclo[4.1.0]heptane (4) and the structure of I was further confirmed by sodium-liquid ammonia reduction to the known 2-oxabicyclo[4.1.0.]heptane (5).

Treatment of an ethereal solution of I at -78° with methyl lithium followed by a water or methanol quench afforded III in 95% yield as determined by v.p.c. (6). Bromide III could be isolated by vacuum distillation in 78% yield (>98% pure). At -20° the v.p.c. yield was 62% (55% isolated). The structure of III was supported by elemental analysis (7), mass spectroscopy (molecular ions at m/e 175 and 177) reduction to 2-oxabicyclo[4.1.0.]heptane and n.m.r. spectroscopy. From the n.m.r. spectrum ($CDCl_3$) of III the following assignments could be made: C-1, quartet (J = 1.3 and 8.0 cps) 1 H at δ3.78; C-3, broad multiplet, 2H, centered at δ3.4; C-7, quartet (J = 1.3 and 5.0 cps) 1 H at δ2.83; C-4,5 and 6, broad absorption, 5 H,



I R = Br

II R = Li

III R = H

IV R = D

V R = $(C_6H_5)_2COH$

VI R = C_6H_5NHCO

VII R = COOH

VIII R = CH_3

between δ2.3 - 1.3. The coupling constants for the C-1 and C-7 protons are consistent with those reported for the analogous protons of 7-exo-chloro-2-oxabicyclo[4.1.0.]heptane (8). When a deuterium oxide quench was used the deuterio compound IV was produced. Its mass spectrum showed molecular ions at mle 176 and 178 and in its n.m.r. spectrum the C-1 proton was now a sharp doublet with J = 8.0 cps (loss of trans coupling) and absorption for the C-7 proton was absent. The above evidence was consistent with the formation of a stable lithium reagent, II, on reaction of I with methyl lithium. The nucleophilic reactivity and utility of II was further tested by the reactions described below.

Treatment of II at -80° with ethereal benzophenone yielded V, mp. 88-90°, in 75% yield. Similar treatment of II with ethereal phenylisocyanate yielded the heat sensitive VI, mp. 112.5-133°d., in 37% yield. Carbonation of II gave an 87% yield of a crystalline acid, presumably VII, which proved too unstable for complete characterization. When a preparation of II at -80° was allowed to warm and stir for one hour at room temperature in the presence of excess methyl iodide VIII (C-7 CH_3 at δ1.77) was produced in about 90% yield as estimated by v.p.c.

The stereochemical assignment for V is supported by its infrared spectrum which showed broad absorption for a hydrogen bonded OH group (νCCl_4 3450 cm^{-1}) which did not change upon dilution. This observation is consistent with the presence of an intramolecular O to O hydrogen bond which would be possible only with the diphenyl carbinol moiety located in an endo position (9). The stereochemical assignments for VI-VIII are tentatively made as shown and are based, by analogy, on the results above and on the results of Walborsky, Impastato and Young who studied the optical stability of 1-methyl-2,2-diphenylcyclopropyllithium (10).

In ether, II appears to be somewhat more stable than other α-bromolithium reagents in the more stabilizing solvent, tetrahydrofuran (1). A more dramatic difference is seen when II is compared with the analogous reagent prepared by the reaction of ethereal 7,7-dibromobicyclo [4.1.0.]heptane with methyllithium (11). This reaction proceeds rapidly with the formation of bromine free products. The high degree of stereoselectivity of formation of II implies a fundamental involvement of the ring oxygen in the formation and stabilization of II. *Intramolecular* coordination between the oxygen and lithium atoms appears to be one likely explanation. Further work, aimed at testing this explanation and the structural requirements for preparing stable α-halolithium reagents, is in progress.

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