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CYCLOADDITION OF 1,3-BENZOTHIAZOLE-2-SULFENYL CHLORIDE TO (1*E*,3*E*)-1,4-DIPHENYL-1,3-BUTADIENE

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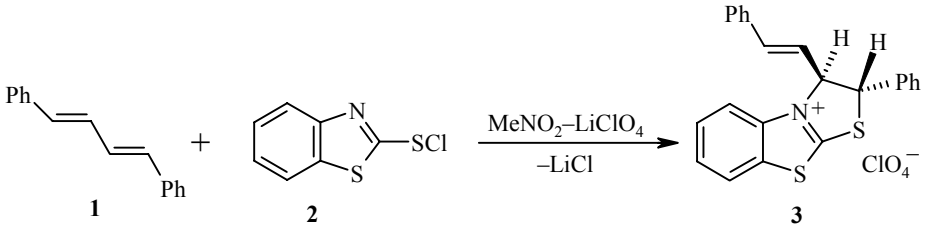
The reaction of conjugated dienes with sulfenylating reagents leads to the formation of products of 1,2- and 1,4-cycloaddition [1, 2]. The products of [1++4]-polar cycloaddition, namely, 2,5-dihydrothiophenium salts have been obtained only in the reactions of methanesulfenyl-2,4,6-trinitrobenzoyl sulfonate with 1,4- and 2,3-diphenyl-1,3-butadienes [3].

We have found that the reaction of (1*E*,3*E*)-1,4-diphenyl-1,3-butadiene (**1**) with 1,3-benzothiazole-2-sulfenyl chloride (**2**) in nitromethane in the presence of lithium perchlorate leads to the [3+2]-cycloaddition of the sulfur-containing electrophile with ring closure upon nucleophilic participation of the hetaryl fragment nitrogen atom and formation of heterocycle **3** in 65% yield.



***trans*-2-Phenyl-3[(*E*)-2-phenylethenyl]-2,3-dihydrobenzo[2,3-*b*]-4-thiazolium Perchlorate (3).** A solution of $LiClO_4$ (1.06 g, 10 mmol) in nitromethane (30 ml) and a solution of sulfenyl chloride **2** (2.02 g, 10 mmol) in nitromethane (15 ml) were added to a solution of diene **1** (2.06 g, 10 mmol) in nitromethane (20 ml) at 20°C. After 40 min, the LiCl precipitate was filtered off and the filtrate was evaporated in vacuum. Recrystallization of the residue from 10:1 chloroform–acetonitrile gave 3.07 g (65%) of **3**; mp 222-224°C. IR spectrum in KBr pellet, ν, cm^{-1}: 1648, 1492, 1456, 1408, 1304, 1264, 1140, 986, 756, 728, 702, 620 (Het, Ph), 1084 (ClO_4). ^{1}H NMR spectrum (500 MHz, DMSO-d_6), δ, ppm, *J* (Hz): 8.35 d, 7.97 d, 7.70 t, 7.64 t (4H, Het); 7.55-7.35 (10H, m, 2Ph); 6.92 (1H, d, ^3J = 15.8, PhHC=); 6.74 (1H, dd, 3*J* = 15.8, 8.3, HC=); 6.45 (1H, dd, ^3J = 5.0, 8.3, CHN^+); 5.79 (1H, d, ^3J = 5.0, CHS). ^{13}C NMR spectrum (125 MHz, DMSO-d_6), δ, ppm: 162.57 (N^+CS), 137.27, 122.00 (HC=), 137.14, 136.01, 134.28, 129.23; 128.99, 128.75, 128.03, 127.08, 126.95, 125.10, 115.35 (CHet, CPh), 72.81 (CHN^+), 62.08 (CHS). Found, %: C 58.78; H 3.93; N 2.77; S 13.37. $C_{23}H_{18}ClNO_4S_2$. Calculated, %: C 58.53; H 3.84; N 2.97; S 13.59.

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