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SHORT COMMUNICATIONS

Reaction of (Chloromethyl)thiirane with Isatins

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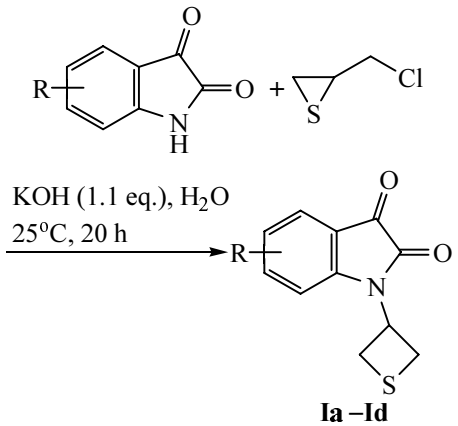
The reaction of (α-haloalkyl)thiiranes with certain anionic nucleophiles in water solutions is known to proceed with a thiirane-thietane rearrangement [1]. However the range of the known N-nucleophiles taking part in this reaction is limited to the anions of the π-excessive nitrogen-containing heterocycles [2] and *N*-arenesulfonamides [3].

We demonstrated that the alkylation by (chloromethyl)thiirane of isatins unsubstituted at the nitrogen in a dilute water alkali led to the formation in a 22–34% yield of the *N*-(thietan-3-yl)isatins.



Ia –Id

R = H (**a**), 5-Br (**b**), 5-MeO (**c**), 5,6-(OCH_2O) (**d**).

By an example of compound **Ia** we established that the increase in the concentration of a base or an alkylating agent did not improve the yield of the target product, whereas the use in the alkylation of the (bromomethyl)thiirane increased the yield but slightly (from 24 to 29%). The reaction carried out in methanol under homogeneous conditions gave rise to an intractable mixture of compounds devoid of N-(thietan-3-yl)isatin (**Ia**).

Under analogous conditions we did not obtain from 5-nitroisatin the product of N-thietanylation: The corresponding isatinic (2-amino-5-nitrophenylglyoxylic) acid was obtained that by heating in a glacial acetic acid quantitatively was converted into the initial 5-nitoisatin.

***N*-(Thietan-3-yl)isatin (Ia).** To a solution of 2 g (13.6 mmol) of isatin in a 50 ml of water containing 1 g (15.2 mmol) of 85% KOH was added 1.63 g (15 mmol) of (chloromethyl)thiirane, and the mixture was stirred for 20 h at room temperature; an orange-red precipitate separated in the course of the reaction. The mixture was treated with CH_2Cl_2 (3×100 ml), the combined organic solutions were washed with saturated NaCl solution and dried with $MgSO_4$. The drying agent was filtered off, the filtrate was concentrated to a volume of 100 ml and subjected to flash-chromatography on silica gel (2.5 cm, eluent CH_2Cl_2 or $CHCl_3$, R_f 0.5–0.6, R_f of impurities ≤ 0.2). The solvent was evaporated to dryness, the residue was ground with a little of a mixture hexane–ether, 1:1, the crystals were filtered off. Yield 24%, crystals from bright red to yellow-orange color, mp 150–151°C. ^{1}H NMR spectrum, δ, ppm: 3.45 t (2H), 4.10 t (2H), 5.75 quintet (1H), 7.21 t (1H), 7.60 d (1H), 7.65–7.76 m (2H). ^{13}C NMR spectrum, δ, ppm: 31.4 (–, 2C), 48.1 (+), 111.8 (+), 118.1 (q), 124.5 (+), 126.3 (+), 139.1 (+), 149.7 (q), 157.5 (q), 183.1 (q). Mass spectrum, *m/z* (I_{rel}, %): 219 $[M]^{+\cdot}$ (43), 173 (67), 145 (100), 117 (32), 90 (61), 73 (63), 72 (69), 63 (24), 50 (26), 45 (68), 39 (32). Found, %: C 60.22; H 4.19; N 6.31. $C_{11}H_9NO_2S$. Calculated, %: C 60.26; H 4.14; N 6.39.

5-Bromo-*N*-(thietan-3-yl)isatin (Ib). Yield 22%, orange needle crystals (from CH_2Cl_2–hexane), mp 184–185°C. ^{1}H NMR spectrum, δ, ppm: 3.47 t (2H), 4.03 t (2H), 5.74 quintet (1H), 7.54 d (1H), 7.76–7.86 m (2H).

^{13}C NMR spectrum, δ, ppm: 31.1 (–, 2C), 48.2 (+), 113.5 (+), 117.6 (q), 119.3 (q), 129.1 (+), 141.2 (+), 148.3 (q), 156.7 (q), 181.9 (q). Mass spectrum, *m/z* (I_{rel}, %): 299 $[M]^{+\cdot}$ (13), 297 $[M]^{+\cdot}$ (12), 253 (20), 251 (23), 225 (30), 223 (33), 170 (11), 168 (12), 116 (31), 89 (23), 73 (100), 72 (81), 63 (23), 45 (69). Found, %: C 44.34; H 2.71; N 4.65. $C_{11}H_8BrNO_2S$. Calculated, %: C 44.31; H 2.70; N 4.70.

5-Methoxy-*N*-(thietan-3-yl)isatin (Ic). Yield 34%, dark red crystals (from $CHCl_3$–hexane) or bright red plates (from ethanol–water), mp 136–137°C. ^{1}H NMR spectrum, δ, ppm: 3.45 t (2H), 3.85 s (3H, MeO), 4.06 t (2H), 5.73 quintet (1H), 7.19–7.30 m (2H), 7.54 d (1H). ^{13}C NMR spectrum, δ, ppm: 31.4 (–, 2C), 48.1 (+), 56.4 (+), 110.4 (+), 112.9 (+), 118.7 (q), 125.4 (+), 143.4 (q), 157.1 (q), 157.5 (q), 183.4 (q). Mass spectrum, *m/z* (I_{rel}, %): 249 $[M]^{+\cdot}$ (48), 221 (10), 203 (32), 175 (54), 160 (37), 149 (10), 132 (13), 120 (30), 106 (21), 73 (100), 63 (26), 45 (59). Found, %: C 57.76; H 4.43; N 5.40. $C_{12}H_{11}NO_3S$. Calculated, %: C 57.82; H 4.45; N 5.62.

5,6-Methylenedioxy-*N*-(thietan-3-yl)isatin (Id). Yield 24%, bright red plates (from CH_2Cl_2–ethyl ether), t.decomp. >125°C. ^{1}H NMR spectrum, δ, ppm: 3.46 t (2H), 3.99 t (2H), 5.67 quintet (1H), 6.14 s (2H, OCH_2O), 7.08 s (1H), 7.20 s (1H). ^{13}C NMR spectrum, δ, ppm: 31.5 (–, 2C), 48.0 (+), 94.7 (+), 103.3 (–), 105.6 (+), 111.2 (q), 149.0 (q), 157.2 (q), 158.4 (q), 180.4 (q). Mass spectrum, *m/z* (I_{rel}, %): 263 $[M]^{+\cdot}$ (73), 235 (18), 217 (30), 190 (86), 134 (18), 120 (15), 103 (12), 73 (100), 45 (46). Found, %: C 54.60; H 3.70; N 4.98. $C_{12}H_9NO_4S$. Calculated, %: C 54.75; H 3.45; N 5.32.

^{1}H and ^{13}C NMR spectra were registered on a spectrometer Bruker DPX-300 at operating frequencies 300.13 (^{1}H) and 75.03 MHz (^{13}C), solvent $CDCl_3$; as internal references served the residual signal at δ 7.26 ppm ($CHCl_3$) for ^{1}H and a signal δ 77.0 ppm ($CDCl_3$) for ^{13}C. The interpretation of spectra DEPT-135 is as follows: "+" means positive phase (methyl or methine carbon); "–", negative phase (methylene carbon); "q", missing DEPT-signal (quaternary carbon). Mass spectra were measured on a Finnigan MAT Incos 50 instrument, electron impact ionization, ionizing electrons energy 70 eV. Elemental analysis was carried out on a CHN-analyzer Hewlett-Packard 185 B.

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