

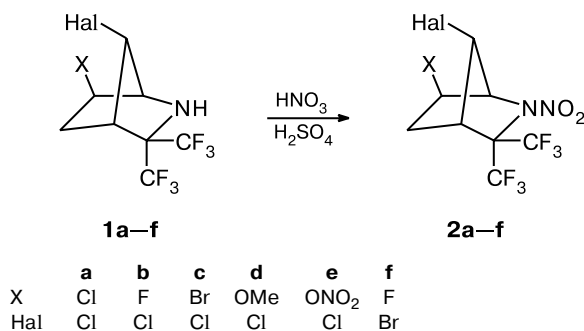
Direct *N*-nitration of bis(trifluoromethyl)-containing 2-azanorbornanesV. M. Nagaev,<sup>\*</sup> G. A. Sokol'skii,<sup>†</sup> S. S. Khokhlov, and A. F. Eleev

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Nitration of 6,7-disubstituted 3,3-bis(trifluoromethyl)-2-azanorbornanes affords the corresponding *N*-nitro derivatives.

**Key words:** fluorine-containing 2-azanorbornanes, nitrating mixture, 6,7-disubstituted *N*-nitro-2-azanorbornanes.

As reported earlier, reactions of 3-halo-7,7-bis(trifluoromethyl)-1-azatricyclo[2.2.1.0<sup>2,6</sup>]heptanes with both hydrogen halides<sup>1</sup> and O-nucleophiles under conditions of proton catalysis<sup>2</sup> afford corresponding 2-azanorbornanes **1**. Apparently, such reactions are due to the very weak basic properties of the resulting bicyclic secondary amines, which form no salts even with excess hydrogen halides in their solutions in ether. In addition, the formation of 2-azanorbornanes does not hinder the catalytic effect of H<sub>2</sub>SO<sub>4</sub> on reactions of azatricyclanes with O-nucleophiles. Analogous nonfluorinated compounds are known to form stable crystalline salts.<sup>3,4</sup> Two CF<sub>3</sub> groups vicinal to the nitrogen atom are responsible for the weak basic properties of bis(trifluoromethyl)-2-azanorbornanes and allow their direct *N*-nitration. For example, compounds **1a–f** undergo nitration in CCl<sub>4</sub> with a mixture of nitric and sulfuric acids to give the corresponding *N*-nitro derivatives **2a–f**.



It should be noted that the weak basicity of secondary amines containing CF<sub>3</sub> groups vicinal to the nitrogen atom and the ensuing ease of *N*-nitration were previously illustrated with bis(2,2,2-trifluoroethyl)amine.<sup>5</sup>

<sup>†</sup> Deceased.

## Experimental

<sup>1</sup>H and <sup>19</sup>F NMR spectra were recorded on a Varian E-890 spectrometer. Compounds **1a–f** were obtained according to a known procedure.<sup>1</sup>

**6,7-Dichloro-2-nitro-3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptane (2a).** A solution of 6,7-dichloro-3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptane (**1a**) (1.0 g, 3.3 mmol) in 10 mL of CCl<sub>4</sub> was added dropwise to a stirred mixture of nitric acid (*d* = 1.36) (1.5 mL) and sulfuric acid (*d* = 1.81) (4.5 mL). The reaction mixture was vigorously stirred for 0.5 h. The organic layer was washed with water (2×30 mL) and 10% sodium carbonate (30 mL) and dried with calcium chloride. The solvent was removed, and the residue was recrystallized from hexane to give compound **2a** (1.2 g, 69%), m.p. 80 °C. Found (%): C, 27.74; H, 1.70; Cl, 20.34; N, 8.07. C<sub>8</sub>H<sub>6</sub>Cl<sub>2</sub>F<sub>6</sub>N<sub>2</sub>O<sub>2</sub>. Calculated (%): C, 27.67; H, 1.73; Cl, 20.46; N, 8.07.

Compounds **2b–f** were synthesized analogously. The <sup>1</sup>H and <sup>19</sup>F NMR spectra of the compounds obtained are given in Table 1.

**7-Chloro-6-fluoro-2-nitro-3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptane (2b).** Yield 69%, m.p. 57 °C (from hexane). Found (%): C, 29.09; H, 2.01; Cl, 10.69; N, 8.22. C<sub>8</sub>H<sub>6</sub>ClF<sub>7</sub>N<sub>2</sub>O<sub>2</sub>. Calculated (%): C, 29.05; H, 1.82; Cl, 10.74; N, 8.47.

**6-Bromo-7-chloro-2-nitro-3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptane (2c).** Yield 62%, m.p. 76 °C (from hexane). Found (%): C, 24.94; H, 1.31; Br, 20.68; Cl, 9.60; N, 7.28. C<sub>8</sub>H<sub>6</sub>BrClF<sub>6</sub>N<sub>2</sub>O<sub>2</sub>. Calculated (%): C, 24.52; H, 1.53; Br, 20.43; Cl, 9.07; N, 7.15.

**7-Chloro-6-methoxy-2-nitro-3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptane (2d).** Yield 74%, m.p. 65 °C (from hexane). Found (%): C, 31.08; H, 2.63; Cl, 10.40; N, 8.43. C<sub>9</sub>H<sub>9</sub>ClF<sub>6</sub>N<sub>2</sub>O<sub>3</sub>. Calculated (%): C, 31.53; H, 2.63; Cl, 10.36; N, 8.18.

**7-Chloro-2-nitro-6-nitroxy-3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptane (2e).** Yield 65%, m.p. 72 °C (from hexane). Found (%): C, 25.54; H, 1.43; Cl, 9.84; N, 11.23. C<sub>8</sub>H<sub>6</sub>ClF<sub>6</sub>N<sub>3</sub>O<sub>5</sub>. Calculated (%): C, 25.79; H, 1.61; Cl, 9.50; N, 11.24.

**Table 1.**  $^1\text{H}$  and  $^{19}\text{F}$  NMR spectra ( $\delta$ , J/Hz) of 6,7-disubstituted 3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptanes

Compound	$^1\text{H}$ NMR					$^{19}\text{F}$ NMR
	H(1) (s)	H(4) (s)	$\text{CH}_2$	H(6)	H(7) (s)	
<b>2a</b>	4.93	3.17	2.80 (d, $J = 7$ )	4.17 (t, $J = 7$ )	4.70	60.0 (q, $J = 11.3$ ); 68.0 (q, $J = 11.3$ )
<b>2b</b>	5.00	3.15	2.65 (m)	4.97 (dm, $J = 50$ )	4.72	60.0 (q, $J = 11.3$ ); 68.0 (q, $J = 11.3$ ); 170.7 (dm, $J = 50$ )
<b>2c</b>	5.07	3.27	3.00 (d, $J = 7$ )	4.27 (t, $J = 7$ )	4.83	59.5 (q, $J = 11.3$ ); 68.0 (q, $J = 11.3$ )
<b>2d</b>	4.77	3.07	2.47 (d, $J = 7$ )	3.73 (t, $J = 7$ )	4.57	60.0 (q, $J = 11.3$ ); 68.0 (q, $J = 11.3$ )
<b>2e</b>	5.00	3.20	2.72 (d, $J = 7$ )	5.23 (t, $J = 7$ )	4.72	60.3 (q, $J = 11.3$ ); 72.0 (q, $J = 11.3$ )
<b>2f</b>	5.03	3.20	2.80 (m)	4.97 (dm, $J = 50$ )	4.70	60.0 (q, $J = 11.3$ ); 68.0 (q, $J = 11.3$ ); 170.3 (dm, $J = 50$ )

**7-Bromo-6-fluoro-2-nitro-3,3-bis(trifluoromethyl)-2-azabicyclo[2.2.1]heptane (2f).** Yield 62%, m.p. 73 °C (from hexane). Found (%): C, 25.63; H, 1.42; Br, 20.81; N, 7.83.  $\text{C}_8\text{H}_6\text{BrF}_7\text{N}_2\text{O}_2$ . Calculated (%): C, 25.62; H, 1.61; Br, 21.31; N, 7.47.

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