ISSN 1070-4280, Russian Journal of Organic Chemistry, 2007, Vol. 43, No. 6, pp. 928–929. © Pleiades Publishing, Ltd., 2007.
Original Russian Text © M.V. Vovk, A.V. Bol'but, P.S. Lebed', N.V. Mel'nichenko, 2007, published in Zhurnal Organicheskoi Khimii, 2007, Vol. 43, No. 6, pp. 929–930.

SHORT COMMUNICATIONS

Synthesis of 2-Aryl-2,4,6-tris(trifluoromethyl)-1,2-dihydro-1,3,5-triazines by Reaction of Arylmagnesium Bromides with Trifluoroacetonitrile

M. V. Vovk, A. V. Bol'but, P. S. Lebed', and N. V. Mel'nichenko

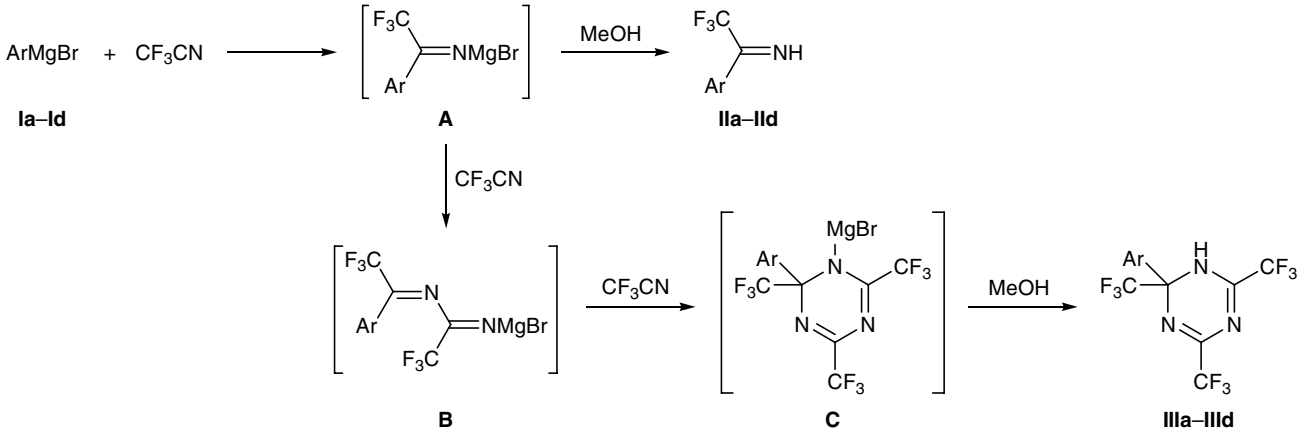
Institute of Organic Chemistry, National Academy of Sciences of Ukraine,
ul. Murmanskaya 5, Kiev, 02660 Ukraine
e-mail: mvovk@i.com.ua

Received November 15, 2006

DOI: 10.1134/S1070428007060231

Reaction of arylmagnesium bromides with trifluoroacetonitrile underlies a preparative procedure for the synthesis of aryl trifluoromethyl ketone imines [1, 2]. According to [1], the yields of the target products attain 50–60% at an arylmagnesium bromide–trifluoroacetamide (precursor of trifluoroacetonitrile) ratio of 1:1.2. The structure of minor products in this reaction remains unexplored; however, we believe it to be important from the viewpoint of development of optimal conditions for the synthesis of the corresponding ketone imines. While attempting to reproduce the procedure described in [1] we have found that, apart from aryl trifluoromethyl ketone imines **IIa**–**IId**, 18–26% of 2-aryl-2,4,6-tris(trifluoromethyl)-1,2-dihydro-1,3,5-triazines **IIIa**–**IIId** is formed in reactions of arylmagnesium bromides **Ia**–**Id** with trifluoroacetonitrile. Using the reaction with *p*-tolylmagnesium bromide (**IIb**) as an example we have shown that the yields of compounds **IIb** and **IIIb** decrease by 6 and 4%, respectively, when an equimolar amount of trifluoroacetamide is used. Presumably, the reason is the reduced conversion of trifluoroacetamide into trifluoroacetonitrile. On the other hand, in the presence of 3 equiv of trifluoroacetamide the yield of triazine **IIIb** increases to 66%. These results led us to presume the following reaction scheme. Initially formed ketone imine salt **A** adds to trifluoroacetonitrile to give diaza diene intermediate **B** which undergoes intermolecular cyclization with another trifluoroacetonitrile molecule. Methanolysis of triazine derivative **C** thus formed yields compounds **IIIa**–**IIId**.

1-Aryl-2,2,2-trifluoroethanimines IIa–IId and 2-aryl-2,4,6-tris(trifluoromethyl)-1,2-dihydro-1,3,5-triazines IIIa–IIId (*general procedure***).** A stream of



Ar = Ph (**a**), 4-MeC_6H_4 (**b**), 4-$MeOC_6H_4$ (**c**), 2-Me-5-FC_6H_3 (**d**).

trifluoroacetonitrile [prepared by heating a mixture of 81.36 g (0.72 mol) of trifluoroacetamide and 213 g (1.5 mol) of phosphoric anhydride to 140–150°C] was passed over a period of 4–5 h under stirring through a solution of arylmagnesium bromide **Ia**–**Id**, prepared from 0.6 mol of the corresponding aryl bromide and 14.4 g (0.6 mol) of metallic magnesium in 600 ml of diethyl ether. The mixture was left to stand for 12 h, and 60 ml of methanol was added over a period of 0.5 h under vigorous stirring. After cooling, the precipitate was filtered off, the filtrate was evaporated, and the residue was subjected to fractional distillation. Yields of compounds **IIa**, **IIb**, and **IIc** 53, 50, and 48%, respectively.

2,2,2-Trifluoro-1-(5-fluoro-2-methylphenyl)-ethanimine (IId) (a mixture of *Z* and *E* isomers). Yield 49%, bp 93–95°C (12 mm). ^{1}H NMR spectrum, δ, ppm: 1.67 s, 2.05 s (3H, CH_3), 6.48–6.72 m (4H, H_{arom}), 9.76 s and 10.84 s (1H, NH). ^{19}F NMR spectrum, δ_F, ppm: –71.51 s and –72.85 s (3F, CF_3), –116.1 s and –116.5 s (1F). Found, %: F 37.21; N 6.99. $C_9H_{10}F_4N$. Calculated, %: F 37.04; N 6.83.

2-Phenyl-2,4,6-tris(trifluoromethyl)-1,2-dihydro-1,3,5-triazine (IIIa). Yield 18%, bp 52°C (0.045 mm). ^{1}H NMR spectrum, δ, ppm: 7.43 m (3H, H_{arom}), 7.67 m (2H, H_{arom}), 8.31 br.s (1H, NH). ^{13}C NMR spectrum, δ_C, ppm: 78.76 q (C^2, $^2J_{CF}$ = 30 Hz), 116.49 q (CF_3, $^1J_{CF}$ = 277 Hz), 122.35 q (CF_3, $^1J_{CF}$ = 284 Hz), 125.41 ($C^{4'}$), 127.74 ($C^{2'}$, $C^{6'}$), 128.68 ($C^{3'}$, $C^{5'}$), 136.91 ($C^{1'}$), 142.31 q (C^4, C^6, $^2J_{CF}$ = 42 Hz). ^{19}F NMR spectrum, δ_F, ppm: –82.32 s (CF_3), –74.41 s ($2CF_3$). Found, %: F 47.24; N 11.79. $C_{12}H_6F_9N_3$. Calculated, %: F 47.08; N 11.57.

2-(4-Methylphenyl)-2,4,6-tris(trifluoromethyl)-1,2-dihydro-1,3,5-triazine (IIIb). Yield 21%, bp 120–123°C (12 mm), mp 42–43°C. ^{1}H NMR spectrum, δ, ppm: 2.38 s (3H, CH_3), 7.24 d (2H, H_{arom}), 7.55 d (2H, H_{arom}), 8.35 br.s (1H, NH). ^{13}C NMR spectrum, δ_C, ppm: 2.13 (CH_3), 78.50 q (C^2, $^2J_{CF}$ = 30 Hz), 116.51 q (4-CF_3, $^1J_{CF}$ = 275 Hz), 122.42 q (6-CF_3, $^1J_{CF}$ = 284 Hz), 126.52 ($C^{2'}$, $C^{6'}$), 129.27 ($C^{3'}$, $C^{5'}$), 133.85 ($C^{1'}$), 140.11 ($C^{4'}$), 142.09 q (C^4, C^6, $^2J_{CF}$ = 40 Hz). ^{19}F NMR spectrum, δ_F, ppm: –82.68 s (CF_3), –74.21 s ($2CF_3$). Found, %: F 45.55; N 11.03. $C_{13}H_8F_9N_3$. Calculated, %: F 45.33; N 11.14.

2-(4-Methoxyphenyl)-2,4,6-tris(trifluoromethyl)-1,2-dihydro-1,3,5-triazine (IIIc). Yield 26%, bp 80–81°C (0.045 mm), mp 94–95°C. ^{1}H NMR spectrum, δ, ppm: 3.82 s (3H, OCH_3), 6.93 d (2H, H_{arom}), 7.58 d (2H, H_{arom}), 7.99 br.s (1H, NH). ^{13}C NMR spectrum, δ_C, ppm: 55.33 (OCH_3), 77.12 q (C^2, $^2J_{CF}$ = 31 Hz), 114.02 ($C^{3'}$, $C^{5'}$), 116.52 q (CF_3, $^1J_{CF}$ = 277 Hz), 122.42 q (CF_3, $^1J_{CF}$ = 284 Hz), 126.78 ($C^{2'}$, $C^{6'}$), 128.10 ($C^{1'}$), 142.18 q (C^4, C^6, $^2J_{CF}$ = 39 Hz), 160.64 ($C^{4'}$). ^{19}F NMR spectrum, δ_F, ppm: –81.31 s (CF_3), –73.20 s ($2CF_3$). Found, %: F 43.65; N 10.47. $C_{13}H_8F_9N_3O$. Calculated, %: F 43.48; N 10.69.

2-(5-Fluoro-2-methylphenyl)-2,4,6-tris(trifluoromethyl)-1,2-dihydro-1,3,5-triazine (IIId). Yield 23%, bp 133–135°C (12 mm), mp 94–95°C. ^{1}H NMR spectrum ($CDCl_3$), δ, ppm: 2.54 s (3H, CH_3), 6.92–6.98 m (1H, H_{arom}), 7.26 t (1H, H_{arom}), 7.34 d (1H, H_{arom}), 8.03 br.s (1H, NH). ^{13}C NMR spectrum, δ_C, ppm: 21.19 (CH_3), 79.50 q (C^2, $^2J_{CF}$ = 32 Hz), 115.33 d ($C^{4'}$, $^2J_{CF}$ = 26 Hz), 118.49 q (4-CF_3, $^1J_{CF}$ = 212 Hz), 116.61 d ($C^{6'}$, $^2J_{CF}$ = 21 Hz), 122.73 q (6-CF_3, $^1J_{CF}$ = 284 Hz), 133.83 d ($C^{2'}$, $^4J_{CF}$ = 2.5 Hz), 134.60 d ($C^{3'}$, $^3J_{CF}$ = 7.5 Hz), 135.89 d ($C^{1'}$, $^3J_{CF}$ = 3.7 Hz), 142.10 q (C^4, C^6, $^2J_{CF}$ = 39 Hz), 160.51 d ($C^{5'}$, $^1J_{CF}$ = 244 Hz). ^{19}F NMR spectrum, δ_F, ppm: –74.04 s ($2CF_3$), –81.29 s (CF_3), –117.43 s (F). Found, %: F 47.98; N 10.57. $C_{13}H_7F_{10}N_3$. Calculated, %: F 48.07; N 10.63.

The ^{1}H, ^{13}C, and ^{19}F NMR spectra were recorded from solutions in $CDCl_3$ on a Varian-Gemini spectrometer at 299.95, 75.4, and 282.2 MHz, respectively; the chemical shifts were measured relative to tetramethylsilane (^{1}H, ^{13}C) and trichlorofluoromethane (^{19}F) as internal references.

REFERENCES

1. Fetyukhin, V.N., Koretskii, A.S., Gorbatenko, V.I., and Samarai, L.I., *Zh. Org. Khim.*, 1977, vol. 13, p. 271.
2. Koos, M. and Mosher, H.S., *Tetrahedron*, 1993, vol. 49, p. 1541.