ISSN 1070-4280, Russian Journal of Organic Chemistry, 2010, Vol. 46, No. 5, pp. 760–761. © Pleiades Publishing, Ltd., 2010.
Original Russian Text © K.A. Ovchinnikov, I.K. Moiseev, 2010, published in Zhurnal Organicheskoi Khimii, 2010, Vol. 46, No. 5, pp. 764–765.

SHORT COMMUNICATIONS

Synthesis of *N*-Nitrosoamines of the Adamantane Series

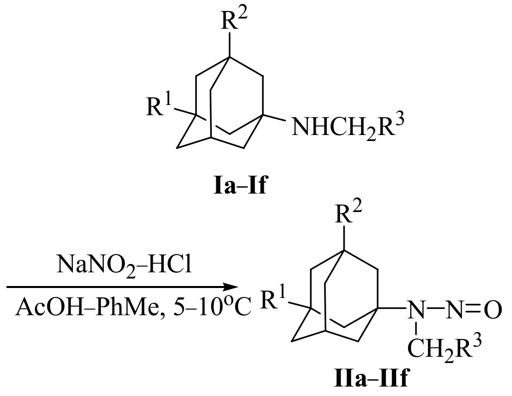
K. A. Ovchinnikov and I. K. Moiseev

Samara State Technical University, Samara, 443100 Russia
e-mail: ikmoiseev@mail.ru

Received December 7, 2009

DOI: 10.1134/S1070428010050283

N-Nitrosoamines hold an important place among the nitrogen compounds. They are widely employed in the synthesis of diazo derivatives, dialkylhydrazines, nitramines, and exhibut a high biological activity. The synthesis and chemical properties of *N*-nitrosoamines of the aliphatic series are compiled in the review [1]. However there are virtually no published information on the synthesis and properties of the adamantyl-containing N-nitrosoamines [2]. We report here on the synthesis and physicochemical properties of the *N*-nitrosoamines of the adamantane series.



R^1 = H (**a–d**), OH (**e**), Me (**f**); R^2 = H (**a–e**), Me (**f**); R^3 = Ph (**a**), 2-thienyl (**b, e, f**), 4–MeOC$_6$H$_4$ (**c**), 4–NO$_2$C$_6$H$_4$ (**d**).

We selected for initial compounds secondary amines **Ia–If** prepared by the reduction of the appropriate azomethines with NaBH$_4$ [3]. The nitroso group was introduced by the nitrosation in acid medium [1, 4–7].

***N*-Nitrosoamines IIa–IIf**. In a minimum volume of the glacial acetic acid was dissolved 0.01 mol of amine hydrochloride, 30 ml of 10% HCl and 60 ml of toluene was added, the mixture was cooled to 5–10°C , and at vigorous stirring was added dropwise within 3 h the sodium nitrite water solution. The reaction mixture was maintained for 2 h at room temperature, the toluene layer was separated, washed with water (2 × 50 ml), and dried with sodium sulfate. The solution was evaporated in a vacuum to obtain yellow crystalline sibstances stable at storage.

***N*-Benzyl-*N*-nitrosoadamantan-1-amine (IIa).** Yield 2.1 g (80%), yellow crystals, mp 80–82°C. IR spectrum, ν, cm^{-1}: 2908, 2854 (Ad), 1384 (NNO), 717 (C–H$_{\text{arom}}$). ^{1}H NMR spectrum, δ, ppm: 1.65–2.23 m (15H, Ad), 4.80 s (2H, CH$_2$), 6.95 d (2H, CH$_{\text{arom}}$, *J* 5.1 Hz), 7.22 d (2H, CH$_{\text{arom}}$, J 5.1 Hz), 7.25 s (1H, CH$_{\text{arom}}$). Mass spectrum, m/z (I_{rel}, %): 270 (5) [M]$^+$, 135 (100) [Ad]$^+$. Found, %: C 75.44; H 8.12; N 10.25. $C_{17}H_{22}N_2O$. Calculated, %: C 75.52; H 8.20; N 10.36. M 270.37.

***N*-Nitroso-N-(2-thienylmethyl)adamantan-1-amine (IIb).** Yield 2.6 g (90%), yellow crystals, mp 98–100°C. IR spectrum, ν, cm^{-1}: 2916, 2850 (Ad), 1647 (C–N), 1396 (NNO), 1562, 702 (C–S). ^{1}H NMR spectrum, δ, ppm: 1.43–1.98 m (15H, Ad), 4.89 s (2H, CH$_2$), 6.85 d (1H, CH$_{\text{thiophene}}$, *J* 3 Hz), 6.97 d (1H, CH$_{\text{thiophene}}$, *J* 3 Hz), 7.31 d (1H, CH$_{\text{thiophene}}$, J 3 Hz). Mass spectrum, *m/z* (I_{rel}, %): 276 (20) [M]$^+$, 149 (100) [AdN]$^+$. Found, %: C 65.09; H 7.17; N 10.12. $C_{15}H_{20}N_2OS$. Calculated, %: C 65.18; H 7.29; N 10.14. M 276.39.

***N*-(4-Methoxybenzyl)-*N*-nitrosoadamantan-1-amine (IIc).** Yield 2.8 g (85%), yellow crystals, mp 206–208°C. IR spectrum, ν, cm^{-1}: 2920, 2854 (Ad), 1384 (NNO), 817 (C–H$_{\text{arom}}$). ^{1}H NMR spectrum, δ, ppm: 1.45–1.90 m (15H, Ad), 3.74 s (3H, OCH$_3$), 4.72 s (2H, CH$_2$), 6.95 d (2H, CH_{arom}, *J* 7 Hz), 7.43 d (2H, CH_{arom}, *J* 7 Hz). Mass spectrum, *m/z* (I_{rel}, %): 300 (10) $[M]^+$, 135 (100) $[Ad]^+$. Found, %: C 71.85; H 7.98; N 9.24. $C_{18}H_{24}N_2O_2$. Calculated, %: C 71.97; H 8.05; N 9.33. M 300.39.

***N*-(4-Nitrobenzyl)-N-nitrosoadamantan-1-amine (IId).** Yield 1.7 g (55%), yellow crystals, mp 140–142°C. IR spectrum, ν, cm^{-1}: 2912, 2885 (Ad), 1512 (NO_2), 1442 (NNO), 729 (C–H_{arom}). ^1H NMR spectrum, δ, ppm: 1.6–1.9 m (15H, Ad), 4.73 s (2H, CH_2), 8.00 d (2H, CH_{arom}, *J* 7.5 Hz), 8.29 d (2H, CH_{arom}, *J* 7.5 Hz). Mass spectrum, *m/z* (I_{rel}, %): 315 (5) $[M]^+$, 135 (100) $[Ad]^+$. Found, %: C 64.65; H 6.51; N 13.24. $C_{17}H_{21}N_3O_3$. Calculated, %: C 64.74; H 6.71; N 13.32. M 315.36.

3-[Nitroso(2-thienylmethyl)amino]adamantan-1-ol (IIe). Yield 1.7 g (55%), yellow crystals, mp 160°C (decomp.). IR spectrum, ν, cm^{-1}: 3413 (OH), 2923, 2850 (Ad), 1635 (C–N), 1384 (NNO), 833 (C–S). ^1H NMR spectrum, δ, ppm: 1.40–1.91 m (14H, Ad), 4.37 s (1H, OH), 4.74 s (2H, CH_2), 6.87 d (1H, $CH_{thiophene}$, *J* 3 Hz), 6.96 d (1H, $CH_{thiophene}$, *J* 3 Hz), 7.32 d (1H, $CH_{thiophene}$, *J* 3 Hz). Mass spectrum, *m/z* (I_{rel}, %): 292 (15) $[M]^+$, 135 (100) $[Ad]^+$. Found, %: C 61.42; H 6.74; N 9.42. $C_{15}H_{20}N_2O_2S$. Calculated, %: C 61.62; H 6.89; N 9.58. M 292.39.

3,5-Dimethyl-*N*-nitroso-*N*-(2-thienylmethyl)-adamantan-1-amine (IIf). Yield 0.84 g (25%), yellow crystals, mp 20–22°C. IR spectrum, ν, cm^{-1}: 2939, 2904, 2846 (Ad), 1631 (C–N), 1438 (NNO), 702 (C–S). ^1H NMR spectrum, δ, ppm: 0.81 s (6H, CH_3), 1.41–1.95 m (13H, Ad), 4.72 s (2H, CH_2), 7.05 d (1H, $CH_{thiophene}$, *J* 3 Hz), 7.34 d (1H, $CH_{thiophene}$, *J* 3 Hz), 7.58 d (1H, $CH_{thiophene}$, *J* 3 Hz). Mass spectrum, *m/z* (I_{rel}, %): 304 (5) $[M]^+$, 163 (30) $[Me_2Ad]^+$, 135 (100) $[Ad]^+$. Found, %: C 66.80; H 7.80; N 9.15. $C_{17}H_{24}N_2OS$. Calculated, %: C 67.07; H 7.95; N 9.20. M 304.45.

IR spectra of compounds synthesized were recorded on a spectrophotometer Shimadzu FTIR-8400S from pellets with KBr. ^1H NMR spectra were registered on spectrometers Bruker AM300 and Varian Mercury 300 (300 MHz), internal reference TMS, solvent DMSO-d_6. Mass spectra were measured on an instrument Finnigan Trace DCQ, ionizing electrons energy 70 eV. Elemental analysis was performed on an analyzer Termo Finnigan Flash 1112 NCH. The purity of compounds was checked by TLC on Silufol plates (eluent chloroform–petroleum ether, 1:1, development in iodine vapor).

REFERENCES

1. Fridman, A.L., Mukhametshin, F.M., and Novikov, S.S., *Usp. Khim.*, 1971, vol. 40, p. 64.
2. Thomas, T.L., *J. Med. Chem.*, 1970, vol. 13, p. 196.
3. Sar, C., Hideg, E., Vass, I., and Hideg, K., *Bio. Med. Chem. Lett.*, 1998, vol. 8, p. 379.
4. Newman, M.S. and Edwards, W.M., *J. Am. Chem. Soc.*, 1954, vol. 76, p. 1840.
5. Spiteller, M., *Monatsh. Chem.*, 1959, vol. 90, p. 721.
6. Ried, W. and Stahlhofen, W., *Chem. Ber.*, 1957, vol. 90, p. 815.
7. Singer, G.M., Andrews, A.W., and Guo, S., *J. Med. Chem.*, 1986, vol. 29, p. 40.