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SHORT COMMUNICATIONS

Adamantylation of Azoles by 1,3-Dehydroadamantane: I. *N*-Adamantylation of Imidazoles by 1,3-Dehydroadamantane

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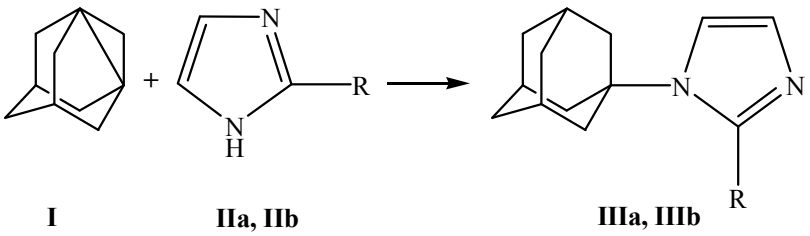
The chemistry of adamantyl-containing heterocyclic compounds was recently under vigorous development [1, 2]. This is due to the possibility of their application as biologically active compounds.

The main procedure for preparation of certain adamantyl-containing azoles, in particular, imidazoles, is the acid-catalyzed adamantylation of the corresponding azoles with various functional derivatives of adamantane [1–6]. However this method provides relatively low yields of the target products (45–75%), and strong acids are used.

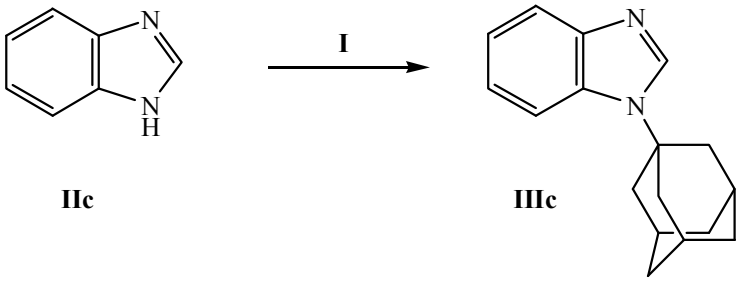
Therefore a promising way to the N-adamantyl-substituted imidazoles consists in the employment as initial reagents of strained [3.3.1]propellanes, e.g., 1,3-dehydroadamantane (**I**), since the imidazoles exhibit the properties of weak acids (pK_a of imidazole 14.2 [7]).

We for the first time carried out the N-adamantylation with reagent **I** of imidazole (**IIa**), 2-methylimidazole (**IIb**), and also of benzimidazole (**IIc**).

The adamantylation of imidazoles **IIa–IIc** by 1,3-dehydroadamantane (**I**) at 80–110°C and molar reagents ratio 1.1:1 within 4–5 h afforded the corresponding



I **IIa, IIb** **IIIa, IIIb**



IIc **IIIc**

N-adamantylimidazoles **IIIa–IIIc** in 78–89% yields.

GC-MS analysis of the reaction mixtures showed that the main direction of the reaction was the N-adamantylation at the mobile proton of the NH bond in the imidazole or benzimidazole ring, therewith as side products formed a little (≥10%) of C-adamantylated into the imidazole or benzimidazole ring derivatives.

This method makes it possible to obtain N-adamantyl-containing imidazole under relatively mild conditions and with a good yield.

The structure of synthesized N-adamantylimidazoles **IIIa–IIIc** was confirmed by ^{1}H NMR and mass spectra, and the composition of products obtained was revealed by GC-MS method.

1-(1-Adamantyl)imidazole (IIIa). To 5 g (0.037 mol) of 1,3-dehydroadamantane (**I**) in 30 ml of anhydrous ethyl ether was added a solution of 2.92 g (0.041 mol) of imidazole (**IIa**) in 20 ml of anhydrous ethyl ether. The mixture was heated to complete evaporation of ether and then for 5 h at 100°C. The reaction mixture was washed with water, then kept at reduced pressure, and the residue was recrystallized from 2-propanol. Yield 6.57 g (0.032 mol, 88%), colorless crystals, mp 109–113°C (mp 106–111°C [6]). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 1.72–1.77 d (6H, CH_2, Ad), 1.98–2.05 d (6H, CH_2, Ad), 2.16–2.22 d (3H, CH, Ad), 6.81–6.87 t (2H, CH, Imd), 7.38–7.42 t (1H, CH, Imd). Mass spectrum, *m/z* (I_{rel}, %): 202 (37) $[M]^+$, 135 (100) $[Ad]^+$, 93 (23) $[Ad - C_3H_6]^+$, 79 (25) $[Ad - C_4H_8]^+$.

Compounds **IIIb** and **IIIc** were obtained similarly.

1-(Adamantyl)-2-methylimidazole (IIIb). Yield 89%, mp 123–125°C (2- propanol) (mp 123–125°C [6]). Mass spectrum, m/z (I_{rel}, %): 216 (100) $[M]^+$, 201 (10) $[M - CH_3]^+$, 159 (50) $[M - C_4H_9]^+$, 135 (88) $[Ad]^+$, 93 (22) $[Ad - C_3H_6]^+$, 79 (30) $[Ad - C_4H_8]^+$.

1-(1-Adamantyl)benzimidazole (IIIc). Yield 78%, mp 183–185°C (2-propanol) (mp 180–184°C [6]). ^{1}H NMR spectrum ($CDCl_3$), δ, ppm: 1.83 m (6H), 2.29 m (3H), 2.34 m (6H, Ad), 7.25 m (2H), 7.70 m (1H), 7.85 m ($1H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 252 (86) $[M]^+$, 201 (10) $[M - CH_3]^+$, 159 (50) $[M - C_4H_9]^+$, 135 (100) $[Ad]^+$, 117 (8) $[M - Ad]^+$, 93 (18) $[Ad - C_3H_6]^+$, 79 (20) $[Ad - C_4H_8]^+$.

^{1}H NMR spectra of compounds obtained were registered on a spectrometer Varian Mercury-300 (300 MHz). GC-MS measurements were performed on an instrument HP GC 5890 II/MSD 5972 in direct admission mode. Energy of ionizing electrons 70 eV. 1,3-Dehydroadamantane (**I**) was obtained by procedure [8].

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