

SHORT
COMMUNICATIONSUnusual Reaction of Endic Anhydride
with 2-Methyl-2-phenylaminopropanenitrileV. A. Pal'chikov^a, I. N. Tarabara^a, N. Yu. Kol'tsov^b, and L. I. Kas'yan^a^a Dnepropetrovsk National University, per. Nauchnyi 13, Dnepropetrovsk, 49625 Ukraine
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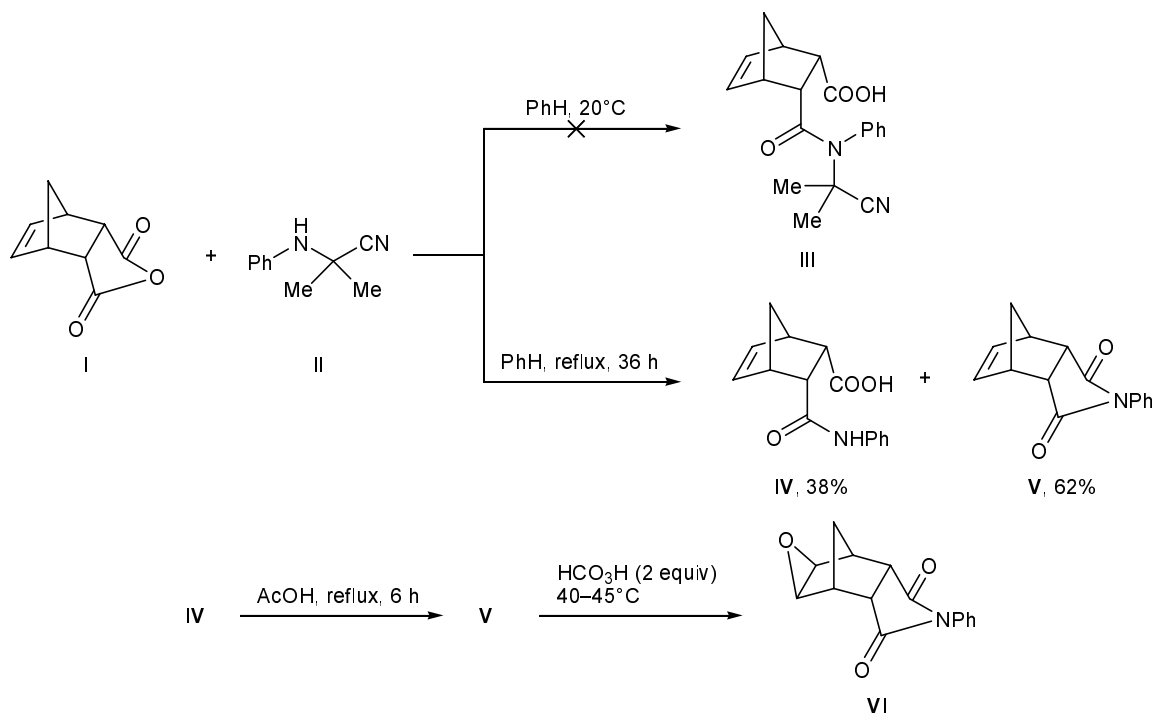
Received August 17, 2005

DOI: 10.1134/S107042800604021X

Many amido acids derived from commercially available bicyclo[2.2.1]hept-5-ene-endo-2,endo-3-dicarboxylic anhydride (**I**, endic anhydride) exhibit strong and versatile biological activity [1, 2]. We have studied the reaction of compound **I** with 2-methyl-2-phenylaminopropanenitrile (**II**) [3]. Under standard conditions for synthesis of amido acids (benzene, 20–25°C) no amido acid **III** was formed over a period of 17 days, and up to 50% of initial amino nitrile **II** was recovered. By heating compounds **I** and **II** in boiling anhydrous benzene (reaction time 36 h) we obtained a mixture of amido acid **IV** and *N*-phenyl imide **V**.

Compound **IV** was prepared previously from anhydride **I** and aniline [4]. Pure imide **V** was formed when mixture **IV/V** was additionally heated in boiling glacial acetic acid. Compound **V** was converted into epoxy derivative **VI** by treatment with 2 equiv of peroxyformic acid. Compounds **V** and **VI** were identical to those reported previously [5] in the TLC data, melting points, and IR and ¹H NMR spectra.

Presumably, the observed reaction involves intermediate formation of amido acid **III** which then undergoes thermal decomposition to give compound **IV**. This follows from the stability of initial nitrile **II** in



boiling benzene in the absence of anhydride **I** and from the data of GLC analysis of the reaction mixture, which revealed the presence of methacrylonitrile as by-product in the thermolysis of amido acid **III**.

endo-3-(N-Phenylcarbamoyl)bicyclo[2.2.1]hept-5-ene-endo-2-carboxylic acid (IV). Aniline, 0.02 mol, was added under stirring to a mixture of 3.28 g (0.02 mol) of endic anhydride (**I**) and 20 ml of benzene. The mixture was stirred at room temperature until the reaction was complete (TLC), and the precipitate was filtered off and recrystallized from benzene. Yield 5.09 g (99%), mp 136–137°C, R_f 0.63 (A), 0.85 (B). IR spectrum, ν , cm^{-1} : 3410, 3050, 1700, 1610, 1545, 1450, 1315, 1270, 1195, 735. ^1H NMR spectrum, δ , ppm: 11.64 br. s (1H, COOH), 9.83 s (1H, NH), 7.52 (2H, H_{arom}), 7.24 (2H, H_{arom}), 6.98 (1H, H_{arom}), 6.21 d.d (1H, 6-H), 6.03 d.d (1H, 5-H, $^3J_{5,6} = 5.3$, $^3J_{4,5} = 2.7$, $^3J_{6,1} = 2.7$ Hz), 3.37 d.d (1H, 2-H), 3.21 d.d (1H, 3-H, $^3J_{2,3} = 10.4$, $^3J_{1,2} = 3.3$, $^3J_{3,4} = 3.0$ Hz), 3.07 m (1H, 1-H), 3.01 m (1H, 4-H), 1.33 d (1H, *syn*-7-H), 1.27 d (1H, *anti*-7-H, $^2J = 8.1$ Hz). Found, %: C 70.10; H 5.76; N 5.41. $\text{C}_{15}\text{H}_{15}\text{NO}_3$. Calculated, %: C 70.04; H 5.84; N 5.45.

Reaction of endic anhydride (I) with 2-methyl-2-phenylaminopropanenitrile (II). Compound **II**, 1.60 g (0.01 mol), was added to 1.64 g (0.01 mol) of endic anhydride (**I**) in 15 ml of anhydrous benzene, and the mixture was heated for 36 h under reflux (TLC). The mixture was cooled, and the precipitate of compound **IV** was filtered off, dried, and recrystallized in benzene. Yield of **IV** 0.64 g (38%). The filtrate was evaporated under reduced pressure, the solid residue was ground with 10–12 ml of diethyl ether, and the crystals of *N*-phenylbicyclo[2.2.1]hept-5-ene-endo-2,endo-3-dicarboximide (**V**) were filtered off, dried, and recrystallized from 2-propanol. Yield of **V** 1.05 g (62%), mp 141–143°C; published data: mp 141–142°C [2], 142.5°C [4]; R_f 0.73 (A), 0.80 (B).

IR spectrum, ν , cm^{-1} : 3015, 1785, 1720, 1390, 1195, 700. ^1H NMR spectrum, δ , ppm: 7.47–7.10 (5H, H_{arom}), 6.22 m (2H, 5-H, 6-H), 3.48 m (2H, 1-H, 4-H), 3.34 m (2H, 2-H, 3-H), 1.60 m (2H, 7-H).

Compound **VI** was synthesized by the procedure described in [5].

The IR spectra (4000–400 cm^{-1}) were recorded on a UR-20 spectrometer from samples prepared as KBr pellets. The ^1H NMR spectra were measured on a Varian VXR instrument at 300 MHz from solutions in DMSO- d_6 using TMS as internal reference. GLC analysis was performed on a Chrom 5 chromatograph equipped with a flame ionization detector (1500-mm \times 3-mm column, stationary phase 5% of SE-30 on Chromaton N-Super; oven temperature 75°C, injector temperature 160°C; carrier gas argon, inlet pressure 0.5 atm). The progress of reactions and the purity of products were monitored by TLC on Silufol UV-254 plates using diethyl ether (A) or 2-propanol (B) as eluent; development with iodine vapor. The elemental compositions were obtained on a Carlo Erba analyzer.

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