

SHORT
COMMUNICATIONS

Specific Features of Dimethyl Malonate Acylation
by 1-Adamantylacetyl Chloride in the Presence of Solid NaOH

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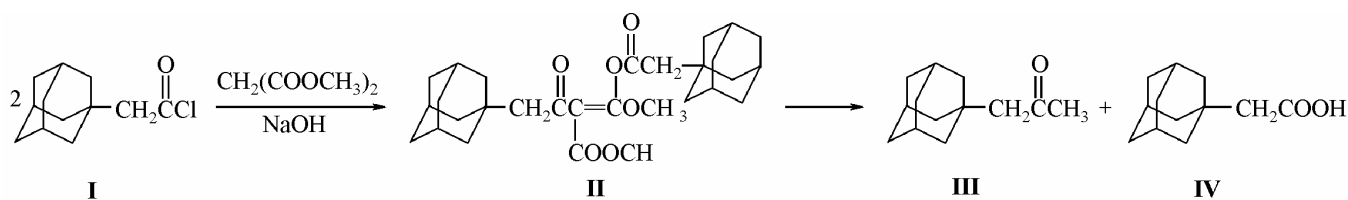
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In extension of study on acylation of dimethyl malonate with 3-R-adamantanecarbonyl chlorides [1–3] we investigated the reaction of 1-adamantylacetyl chloride (**I**) with dimethyl malonate in the presence of NaOH in toluene. A compound was

obtained that proceeding from the data of ¹H NMR, IR, and mass spectroscopy was assigned a structure of product of C- and O-acylation, methyl [2-(1-adamantylacetyl)-3-(1-adamantylmethylcarbonyloxy)-3-methoxy]-2-propenoate (**II**). On its hydrolysis in a mixture acetic

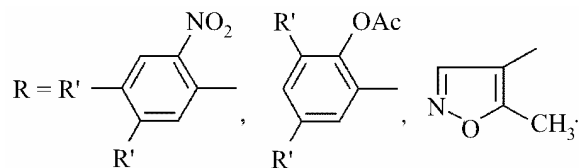
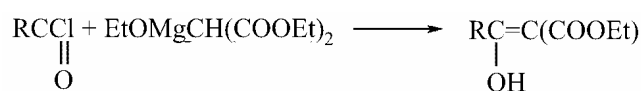


acid–water–sulfuric acid (10 : 3 : 1) were isolated in equimolar ratio (1 : 1) 1-adamantylacetone (**III**) and 1-adamantylacetic acid (**IV**).

We studied relation between the structure of acyl chloride and that of acylated product by performing acylation of dimethyl malonate in toluene in the presence of NaOH with acetyl and benzoyl chlorides. The experimental data obtained disproved our previous assumption [3] on the limitation of applicability of solid NaOH in toluene to acylation of dimethyl malonate with chlorides of acids more active ($\text{p}K_a$) than 3-R-1-adamantylcarboxylic acids. Actually, the reaction occurred with both acetyl and benzoyl chlorides: with benzoyl chloride was isolated a product of C-acylation **V**, and with acetyl chloride a product of C- and O-acylation **VI** was obtained.

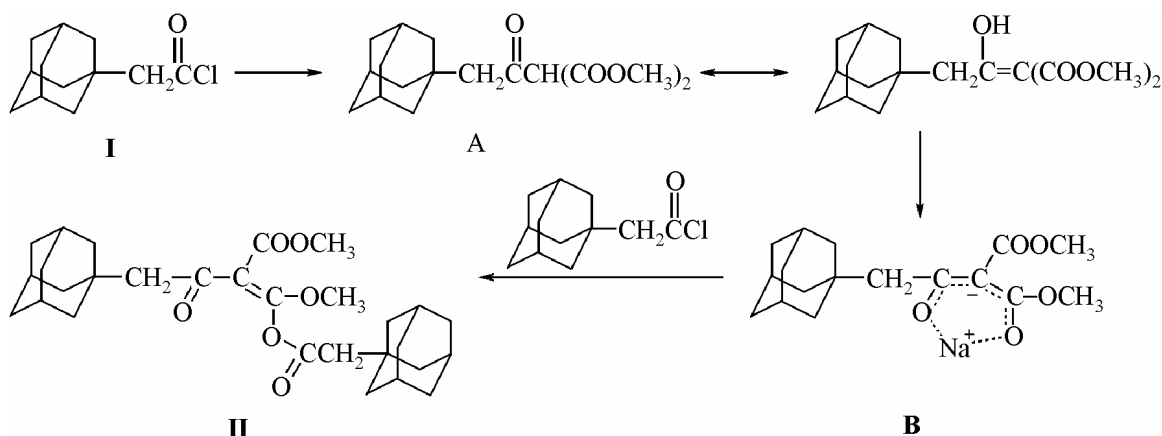
Several examples of unusual products formation in acylation of malonate derivatives were described [4–6].

Analysis of published data on $\text{p}K_a$ and capability to enolize of the C-acylated malonates [7–10] and of the



data we obtained suggested a conclusion on enol path of formation of C- and O-acylated products: in the first stage arose a product of the common C-acylation **A** that underwent enolization providing a sodium salt **B** thus getting more active than sodium methyl malonate and suffering an attack by brought into the reaction acyl chloride. The attack of the second acyl chloride molecule occurs at the more available oxygen atom resulting in a product of C- and O-acylation (**II**).

The absence of the C-,O-acylated products in reaction of 3-R-1-adamantanecarbonyl and benzoyl chlorides is due to the steric hindrances to formation of enolized C-acylated product.



1-Adamantylacetyl chloride (**I**) was prepared by procedure from [11], n_D^{20} 1.5185.

Methyl [2-(1-adamantylacetyl)-3-(1-adamantylmethylcarboxyloxy)-3-methoxy]-2-propenoate (II). A mixture of 21.5 ml (0.188 mol) of dimethyl malonate, 9.4 g (0.235 mol) of NaOH, and 100 ml of toluene was stirred at 25°C for 40 min. Then to the reaction mixture was added dropwise a solution of 20 g (94 mmol) of acyl chloride **I** in 100 ml of toluene. The reaction mixture was stirred at room temperature for 1 h and then it was poured into 400 ml of 10% aqueous sulfuric acid. The toluene layer was separated, washed in succession with water, water solution of sodium carbonate, and again with water. Toluene was distilled off, and the residue was crystallized from hexane. Yield 18.5 g (81%), mp 134–135°C. IR spectrum, ν , cm^{-1} : 1780 (COO), 1750 (CO), 1660 (C=C). ^1H NMR spectrum, δ , ppm: 1.55–1.65 m (24H, 12CH₂ in Δ^d), 1.95 s (6H, 6CH in Δ^d), 2.2 s (2H, CH₂), 2.45 s (2H, CH₂), 3.68 s (3H, OCH₃), 3.73 s (3H, COOCH₃). Mass spectrum, m/z (I_{rel} , %): 484 (9.5) [I]⁺, 352 (2.5), 335 (6.4), 324 (8.7), 277 (8.1), 244 (8.2), 177 (43.5), 148 (39.3), 136 (43.5), 135 (100), 119 (51.1), 107 (33.1), 105 (31.9), 93 (47.8), 79 (52.3), 67 (41.3), 59 (45.7), 55 (47.8), 43 (90.5).

Dimethyl benzoylmalonate (V) was prepared from 5 g (35.7 mmol) of benzoyl chloride, 8.2 ml (71.4 mmol) of dimethyl malonate, and 3.57 g (89.25 mmol) of NaOH along the procedure described for compound **II**. On distilling off the toluene the residue was distilled in a vacuum, bp 168–171°C (2 mm Hg), n_D^{20} 1.5270. IR spectrum, ν , cm^{-1} : 2860 (CH₃), 1730 (COO), 1650 (CO), 1600 (C=C). ^1H NMR spectrum, δ , ppm: 3.73 s (6H, 2COOCH₃), 6.1 s (1H, CH), 7.59 t, 7.7 t, 7.97 d (2H, 1H, 2H, C₆H₅).

Methyl (2-acetyl-3-methoxy)-2-propenoate (VI) was prepared from 5 g (63.7 mmol) of acetyl chloride,

14.5 ml (127.4 mmol) of dimethyl malonate, and 6.37 g (159.25 mmol) of NaOH along the procedure described for compound **II**. On distilling off the toluene the residue was distilled in a vacuum, bp 130–131°C (7 mm Hg), n_D^{20} 1.4565. IR spectrum, ν , cm^{-1} : 2900 (CH₃), 1740 br (COO and CO), 1650 (C=C). ^1H NMR spectrum, δ , ppm: 2.17 s (3H, COCH₃), 2.22 s (3H, OCOCH₃), 3.68 s (3H, OCH₃), 3.73 s (3H, COOCH₃).

IR spectra were recorded on spectrometer IKS-22. ^1H NMR spectra were registered on spectrometers Bruker $\Delta\text{C}-200$ and Bruker $\Delta\text{I}-300$ at operating frequencies 200 and 300 MHz respectively, solvent DMSO-*d*₆, internal reference HMDS. Mass spectrum was measured on Finnigan MAN JNCOS50 instrument, ionizing electrons energy 70 eV.

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