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LETTERS TO THE EDITOR

Methyl 2-Acetylaminoacrylate in the Reaction with Aliphatic Dienes

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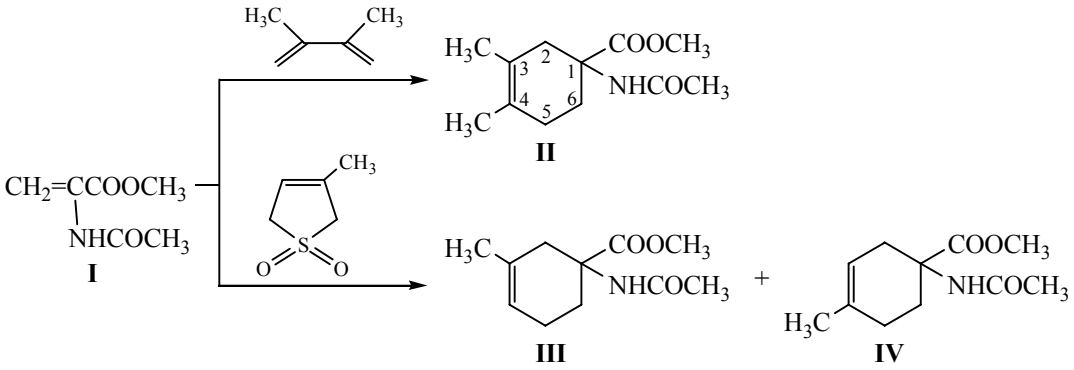
Cycloaddition reactions (Huisgen reaction, Diels–Alder reaction) of diazo compounds and dienes with dehydroamino acids derivatives (dehydroalanine, dehydrophenylalanine) are a convenient method for the synthesis of functionalized ring systems like pyrazolines [1], pyrazoles [2], cyclopropanes [3, 4], norbornenes [5, 6], and 9,10-ethanoanthracenes [7]. The interest in these carbo- and heterocycles representa-tives is due to the possibility of their use as precursors for the synthesis of cyclic α-amino acids, which are promising in terms of their structural and biological properties [8–10].

We first carried out the reaction of methyl 2-acetyl-aminoacrylate **I** with aliphatic dienes, the 2,3-dimethylbutadiene and isoprene. Dehydroalanine **I** was shown to react with 2,3-dimethylbutadiene in toluene under reflux over 5 h to give methyl 3,4-dimethyl-1-acetylaminocyclohexen-1-ylcarboxylate **II** in 62% yield.

To obtain isoprene *in situ* under the reaction conditions, we used 3-methylsulfolene as a synthetic precursor. In this case, more rigid reaction conditions are required due to the desulfonation of the latter. The reaction of dienophile **I** with 3-methylsulfolene was carried out in *p*-xylene under reflux over 24 h. The reaction was completed with the formation of regioisomeric 3(4)-methylcyclohexenes **III** and **IV** in 1:3 ratio.



The target products were isolated using the column chromatography on silica gel.

The structure of the obtained cyclohexenes **II**–**IV** was proved by the IR and ^{1}H NMR spectroscopy, and their composition was confirmed by the elemental analysis.

The IR spectra of compounds **II**–**IV** contain the absorption bands belonging to the carbonyl group

(1670–1680, 1740–1750 cm^{-1}), secondary amine (3440–3450 cm^{-1}), and methyl groups (2800–3000 cm^{-1}).

The ^1H NMR spectra data correspond to the attributed structures and are similar to those of the structurally related cyclohexenes [11].

Thus, in the ^1H NMR spectrum of cyclohexene **III** protons of the methyl groups appear as singlets at 1.25 and 1.62 ppm. The methyl protons in acetamide group ($NHCOCH_3$) resonate as a singlet at 1.98 ppm. The ring methylene protons are nonequivalent and appear in different spectrum regions as multiplets at 1.80 (C^5H_2) and 2.10 ppm (C^6H_2). The most informative are C^2H_2-methylene protons, each of which resonates as a doublet with a geminal constant $^2J_{HH}$ 16 Hz.

The signals of $COOCH_3$ protons appear at 3.71 ppm. The amide proton ($\underline{NH}COCH_3$) resonates as a narrow singlet at 5.70 ppm, which indicates the absence of the intermolecular hydrogen bonds.

A doubling of the methyl (1.75 and 1.85 ppm) and acetamide groups signals (1.90 and 1.98 ppm) and the presence of two different signals of the multiple C=C bond of the six-membered ring (5.8 and 6.2 ppm) indicate that regioisomeric cyclohexenes **III** and **IV** are formed.

The starting compounds, 2-methyl acetylaminoacrylate **I** [12], 2,3-dimethylbuta-1,3-diene [13], and 3-methylsulfolene [14] were prepared according to the known procedures.

Methyl 3,4-dimethyl-1-acetylaminocyclohexen-3-ylcarboxylate (III). Yield 68% (eluent chloroform), mp 100–102°C. IR spectrum ($CHCl_3$), ν, cm^{-1}: 1680 (C=O), 1745 ($COOCH_3$), 3445 (NH), 2020-3020 (CH_3). ^1H NMR spectrum ($CDC1_3$), δ, ppm: 1.25 s and 1.62 s (6H, $2CH_3$), 1.85 m (2H, C^5H_2), 2.10 m (2H, C^6H_2), 2.30 d and 2.50 d (2H, C^2H_2), 2.0 s (3H, $NHCO\underline{CH_3}$), 3.71 s (3H, $COOCH_3$), 5.70 s (1H, $\underline{NH}$Ac). Found, %: C 64.02, 64.05; H 8.42, 8.46; N 6.15, 6.18. $C_{12}H_{19}NO_3$. Calculated, %: C 64.00; H 8.44; N 6.22.

Methyl 3(4)-methyl-1-acetylaminocyclohexen-3-ylcarboxylate (III, IV). Yield 54% (eluent methanol), **III**:**IV** = 1:3, R_f, 0.36, 0.52. IR spectrum ($CHCl_3$), ν, cm^{-1}: 1675 (C=O), 1740 ($COOCH_3$), 3430 (NH), 2000–2800 (CH_3). ^1H NMR spectrum ($CDC1_3$), δ, ppm: 1.35 s and 1.42 s (6H, $2CH_3$), 1.65–1.85 m (4H, C^5H_2, C^6H_2), 2.20–2.55 m (2H, C^2H_2), 1.95 s (3H, $NHCO\underline{CH_3}$), 3.71 s (3H, $COOCH_3$), 5.80 s (1H, $\underline{NH}$Ac). Found, %: C 62.72, 62.77; H 8.10, 8.13; N 6.55, 6.58. $C_{11}H_{17}NO_3$. Calculated, %: C 62.56; H 8.06; N 6.64.

The IR spectra ($CDCl_3$, *c* 0.1–0.001 M) were recorded on an Infra-Lyum FT-02 spectrometer. The ^1H NMR spectra were recorded on a Bruker AC-200 spectrometer (200 MHz, $CDCl_3$) using TMS as a reference. The isolation of the obtained compounds was performed by column chromatography on silica gel (Chemapol 100\200). The purity of compounds and the reaction progress were monitored by TLC [Silufol-254, eluent hexane–acetone mixture (3:2), detecting with iodine). The isomers ratio was determined by the ^1H NMR spectroscopy on the chromatographed compounds.

REFERENCES

1. Cativiela, C., Villegas, D., and Melendes, E., *Tetrahedron*, 1986, vol. 42, no. 2, p. 583.
2. Anisimova, N.A., Berkova, G.A., Deiko, L.I., and Pozdnyakov, V.P., *Zh. Obshch. Khim.*, 1999, vol. 69, no. 9, p. 1529.
3. Anisimova, N.A., Berkova, G.A., and Deiko, L.I., *Zh. Obshch. Khim.*, 1998, vol. 68, no. 7, p. 1165.
4. Bregoves, J. and Jakovcic, T., *Monatsh. Chem*., 1972, vol. 103, no. 1, p. 288.
5. Horikawa, H., Nishitani, T., Iwasaki, T., Mushika, Y., and Inoue, I., *Tetrahedron Lett*., 1980, vol. 21, no. 42, p. 4101.
6. Horikawa, H. and Nishitani, T., *Tetrahedron Lett*., 1980, vol. 21, no. 4, p. 439.
7. Bingwei, V. and Doweyko, Y., *Tetrahedron Lett*., 2005, vol. 46, no. 52, p. 2857.
8. Yanovskaya, L.A., Dombrovskii, V.A., and Khusid, A.Kh., *Tsyklopropany s funktsional'nymi gruppami* (Cyclopropanes containing functional groups), Moscow: Nauka, 1987.
9. Cativiela, C. and Villegas, D., *Tetrahedron Asym*., vol. 11, no. 4, p. 645.
10. Caputo, F., Clerini, F., Gelmi, M. and Nowa, D., *Tetrahedron*, 2006, vol. 62, p. 1288.
11. Avenoza, A., Cativiela, C., Fernandez-Recio, M., and Peregrina, M., *J. Chem. Soc., Perkin Trans. 1*, 1999, p. 3375.
12. Kil'dishev, O.V., *Izv. Akad. Nauk SSSR*, 1955, vol. 52, p. 260.
13. *Sintezy organicheskikh preparatov* (Organic Syntheses), Moscow: Inostrannaya Literatura, 1952, no. 3, p. 187.
14. Wilkinson, J., *Sintezy organicheskikh preparatov* (Organic Syntheses), Moscow: Inostrannaya Literatura, 1958, no. 8, p. 64.