Russian Chemical Bulletin, International Edition, Vol. 54, No. 4, pp. 1041—1042, April, 2005 1041

Brief Communications

Transformation of 2-alkylcyclohexane-1,3-diones into δ-oxo acid esters in an acidic medium*

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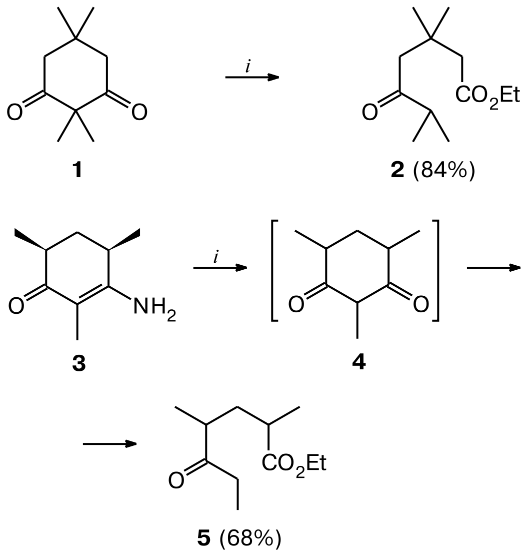
Refluxing of a solution of 2,2,5,5-tetramethylcyclohexane-1,3-dione in a dilute H_2SO_4—ethanol mixture smoothly gave ethyl 3,3,6-trimethyl-5-oxoheptanoate. Under the same conditions, hydrolysis of enamino ketone was followed by analogous ring opening of intermediate 2,4,6-trimethylcyclohexane-1,3-dione.

Key words: cyclohexane-1,3-diones, ring opening, δ-oxo acid esters.

Cyclic 1,3-diketones are known to undergo ring opening under the action of alkalis to give δ-oxo acids (*e.g.*, see Refs 1, 2). However, the possibility of an analogous ring opening in the presence of a protic acid has been reported only in a few papers;[3—5] in some cases, this reaction has been only postulated when considering a probable mechanism of a more complex process.[4,5] We found that such a transformation can be effected by treating a substrate with dilute H_2SO_4 in ethanol. For instance, refluxing of a solution of 2,2,5,5-tetramethylcyclohexane-1,3-dione[2] (**1**) in 50% H_2SO_4—EtOH (1 : 10) gave oxo ester **2** in good yield (Scheme 1).

An analogous transformation accompanied the hydrolysis of racemic 3-amino-2,4(*R**),6(*S**)-trimethylcyclohex-2-en-1-one (**3**) under the above conditions. Apparently, the reaction proceeds through intermediate 2,4,6-trimethylcyclohexane-1,3-dione (**4**) to give a mixture of diastereomeric oxo esters **5** (~1 : 1, ^{1}H NMR data).

Scheme 1



i. 50% H_2SO_4—aqueous EtOH, refluxing.

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* Dedicated to Corresponding Member of the Russian Academy of Sciences E. P. Serebryakov on the occasion of his 70th birthday.

Published in Russian in *Izvestiya Akademii Nauk. Seriya Khimicheskaya,* No. 4, pp. 1016—1017, April, 2005.

It should be noted that 5,5-dimethylcyclohexane-1,3-dione (dimedone) containing no alkyl substituent at the C(2) atom remains virtually unchanged under these conditions.

Experimental

IR spectra were recorded on a Specord M-80 instrument. ^{1}H NMR spectra were recorded on a Bruker AC-300 spectrometer in $CDCl_3$; chemical shifts are referenced to residual signals of the solvent (δ 7.27). The mass spectrum (EI, 70 eV) was recorded on a Finnigan MAT ITD-700 instrument. The R_f value is given for a Silufol plate with a fixed SiO_2 layer.

Ethyl 3,3,6-trimethyl-5-oxoheptanoate (2). A solution of diketone **1** (1.68 g, 10.0 mmol) in a mixture of EtOH (30 mL) and 50% H_2SO_4 (6 mL) was refluxed for 23 h and then concentrated *in vacuo*. The residue was treated with $MeOBu^t$ and water. The organic layer was separated, washed with water and brine, dried with Na_2SO_4, and concentrated *in vacuo*. The residue (1.9 g) was distilled to give oxo ester **2** (1.80 g, 84%), b.p. 56—58 °C (1.5 Torr). ^{1}H NMR (300.13 MHz), δ: 1.03 (d, 6 H, MeC(6), $H_3C(7)$, J = 6.1 Hz); 1.07 (s, 6 H, 2 MeC(3)); 1.23 (t, 3 H, $\underline{Me}CH_2O$, J = 6.7 Hz); 2.45 (s, 2 H, $H_2C(2)$); 2.55 (sept, 1 H, HC(6), J = 6.1 Hz); 2.58 (s, 2 H, $H_2C(4)$); 4.09 (q, 2 H, CH_2O, J = 6.7 Hz) (*cf.* Ref. 2 for Me ester).

Ethyl 2,4-dimethyl-5-oxoheptanoate (5) (1 : 1 mixture of diastereomers). Analogously, a solution of enamino ketone **3** (1.69 g, 11.0 mmol) was refluxed for 30 h. The product (1.85 g) was chromatographed on SiO_2 (50 g) with light petroleum—$MeOBu^t$ (4 : 1) as an eluent to give a mixture of diastereomers **5** (1.50 g, 68%) as a colorless oil, b.p. 50—54 °C (2 Torr), R_f 0.59 (hexane—$MeOBu^t$, 7 : 3). Found (%): C, 65.87; H, 10.39. $C_{11}H_{20}O$. Calculated (%): C, 65.97; H, 10.06. MS, *m/z*: 200 $[M]^+$. IR ($CHCl_3$), ν/cm^{-1}: 664, 720, 792, 1016, 1116, 1180, 1296, 1352, 1396, 1460, 1580, 1608, 2860, 2932, 2968, 3004, 3432, 3536. ^{1}H NMR, δ: 0.97—1.08 (m, 6 H, MeC(2), MeC(4)); 1.11 (br.t, 3 H, HC(7), J = 6.7 Hz); 1.23 (br.t, 3 H, $\underline{Me}CH_2O$, J = 7.0 Hz); 1.30 (ddd, 1 H, HC(3), J = 13.8 Hz, J = 7.6 Hz, J = 5.9 Hz)*; 1.57 (ddd, 1 H, HC(3), J = 14.1 Hz, J = 9.0 Hz, J = 4.8 Hz)*; 1.77 (ddd, 1 H, HC(3), J = 14.1 Hz, J = 8.9 Hz, J = 5.3 Hz)*; 2.03 (ddd, 1 H, HC(3), J = 13.9 Hz, J = 8.9 Hz, J = 6.0 Hz)*; 2.25 (m, 4 H, HC(2), HC(4), $H_2C(6)$); 4.09 (br.q, 2 H, H_2CO, J = 7.0 Hz).

This work was financially supported by the Foundation of the President of the Russian Federation (Program for Support of Leading Scientific Schools of the Russian Federation, Grant NSh-1802.2003.03).

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* Nonoverlapped signals for the protons of the stereoisomers with the relative integral intensity ~1/2.

Received October 27, 2004;
in revised form December 14, 2004