On the reaction of sterically hindered α,β-unsaturated ketones with hydroxylamine: preparation of 5-hydroxy derivatives of isoxazolidine and 4,5-dihydroisoxazole

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A reaction of hydroxylamine with α,β-unsaturated ketones containing a tertiary carbon atom α to the keto group leads to 5-hydroxyisoxazolidine and 5-hydroxy-Δ^2-isoxazoline derivatives.

Key words: isoxazolidin-5-ols, isoxazolin-5-ols, α,β-enones, hydroxylamine.

α,β-Unsaturated ketones **1** are important synthons for the preparation of various heterocyclic systems.[1,2] In particular, their reactions with hydroxylamine derivatives lead to isoxazoline and isoxazolidine derivatives,[2] which are used in the synthesis of steroids,[3] nucleosides and peptidomimetics,[4] alkaloids (cocaine, biotin, cedridin, *etc.*).[5a] In addition, they possess useful biological properties,[3,5,6] including antibacterial and antifungal,[5b,6a] antiinflammatory,[3b] antiviral,[6b] herbicide and fungicide,[6c—f] neurotropic and antitumor,[6g] they are mediators of various biochemical processes and enzyme inhibitors, as well.[6h—l]

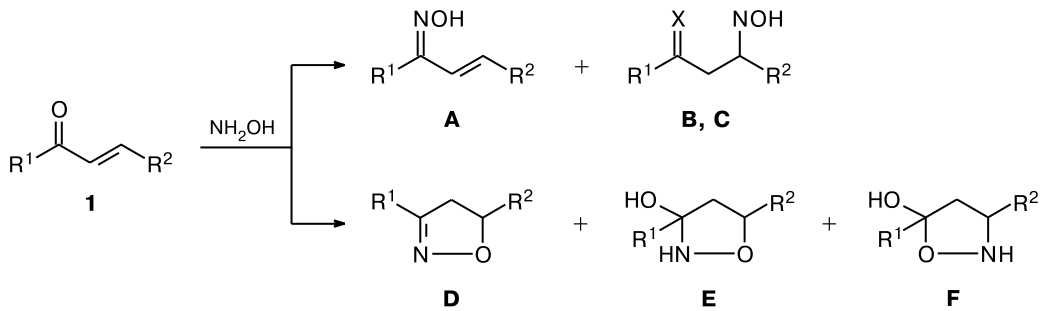
In the reactions indicated, hydroxylamine can function as both the N- and the O-nucleophile.[2a—c] Moreover, products of either 1,2- (oximes **A**) or 1,4-addition (hydroxylamines **B**, **C**) can be obtained depending on the structure of α,β-enone **1**, as well as products of their subsequent transformations **D**—**F** (Scheme 1).[2a,d,7,8]

5-Hydroxyisoxazolidines **F** are formed only in the reactions with mesityl oxide,[8a] fluorine-containing enones **1** ($R^1 = CF_3$),[2d,9] and some α-aminoenones, in which the amino group is bonded to the nitrogen heterocycles.[6d—f,10] The well known [3+2] cycloaddition reactions of nitrones to olefins allow one to synthesize such isoxazolidinols in two steps, using Pd catalysts and pressure (see, for example, reviews[11]).

We studied regioselectivity of reactions of hydroxylamine with α,β-enones containing bulky *tert*-alkyl or hydroxydialkyl groups at the α-position to the keto group in the assumption that they would block approach of a nucleophile to the carbon atom of the keto group, thereby directing the process predominantly toward the 1,4-addition.

In fact, the reaction of enones **2a**,**b**, **3a**—**h**, **4a**,**b**, and **5a**,**b** with hydroxylamine hydrochloride in aqueous methanol in the presence of NaOH (Scheme 2) leads predominantly to hydroxy derivatives of isoxazolidine **6**—**9** and Δ^2-isoxazoline **10**—**12** (according to the ^{1}H NMR spectroscopic data, the content of the products in the reaction mixture was 45—80%). An increase in the amount of hydroxylamine to 2.5—3 equiv. virtually does not affect the

Scheme 1



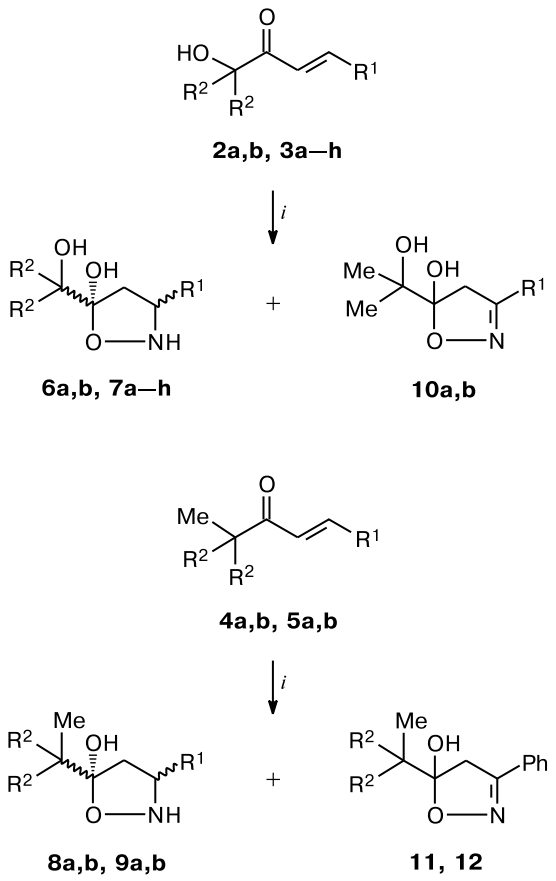
X = O (**B**), NOH (**C**)

Published in Russian in *Izvestiya Akademii Nauk. Seriya Khimicheskaya,* No. 3, pp. 604—612, March, 2012.

1066-5285/12/6103-606

yields of compounds **6—12**. In the presence of other bases (Et_3N, Py, AcOK, K_2CO_3), the products of oximation **A** and conjugate addition **B**, **C** are mainly formed.

Scheme 2



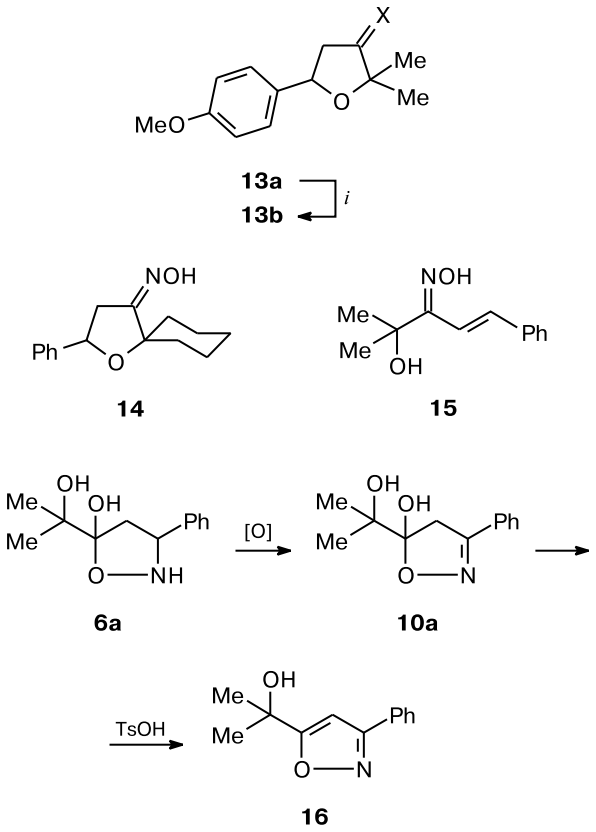
i. $H_2NOH \cdot HCl$, NaOH, MeOH—H_2O (4 : 1), 28—45 °C.

2—10: R^1 = Ph (**a**), 4-$MeOC_6H_4$ (**b**), 3,4-$(MeO)_2C_6H_3$ (**c**), 3,4,5-$(MeO)_3C_6H_2$ (**d**), 4-$Me_2NC_6H_4$ (**e**), furan-2-yl (**f**), Me_2CH (**g**), 4-MeC_6H_4 (**h**);
2, 4, 6, 8, 11: R^2 = Me;
3, 5, 7, 9, 12: $R^2 + R^2 = (CH_2)_5$

Besides the major products, some by-products are formed in all the cases (15—35% of total amount). Some of them were successfully isolated and characterized. Thus, the oximation of α-hydroxyenones, for example **2a**,**b** and **3a**, leads to the isolation of 3-ketotetrahydrofuran oximes **13** and **14**, which are the products of O-heterocyclization characteristic of conjugated hydroxyenones,[12a,b] and oxime of α,β-enone **2a**, *i.e.*, compound **15**.

Moreover, after a prolonged standing (2—4 months) of the mother liquors from the reactions with involvement of enones **2a**, **4a**, and **5a**, we successfully isolated Δ^2-isoxazolines **10a**,**b**, **11**, and **12** in 8—15% yields. The structure of obtained Δ^2-isoxazolines **10—12** was inferred from the ^1H and ^{13}C NMR spectra and confirmed by the dehydration of compound **10a** to the corresponding isoxazole **16** (Scheme 3).

Scheme 3



i. NH_2OH.

13: X = O (**a**), NOH (**b**)

Compounds **10—12**, which earlier have not been considered among the reaction products of α,β-enones with hydroxylamine (see reviews[2,11]), are apparently formed by the oxidation of isoxazolidinols **6**, **8**, and **9** in alcoholic medium upon the action of atmospheric oxygen.

The structure of compounds obtained was inferred from the ^1H and ^{13}C NMR spectroscopic and mass spectrometric data and confirmed by elemental analysis. Comparison of the ^1H (an ABX spectrum typical of rings) and ^{13}C NMR spectra of the compounds synthesized with the spectra of similar compounds reported in the literature,[2a,6f,9] as well as studies of their reactivity (see below), gave us a reason to believe that the cyclic derivatives **6—9** have the structure of 1,2-isoxazolidine containing a heterocycle with the hemiacetal fragment (O—C—O-surrounding).

The ^1H NMR spectra of substituted 5-hydroxyisoxazolidines containing an additional vicinal hydroxyl group

as a substituent (compounds **6a**,**b** and **7a**—**h**) showed the presence of two sets of signals assigned to *cis*-/*trans*-diastereomers with respect to the orientation of substituents at positions 3 and 5 of the isoxazolidine ring (for example, in the case of **6b** the ratio *cis* : *trans* ≈ 2 : 1).

To confirm the structure of isoxazolidinol **6b**, we carried out a detailed analysis using 2D ^{1}H NMR spectroscopy (HSQC, HMBC, and NOESY). The presence in the predominant isomer of the contact of the Me group at δ 1.41 with the protons of the aryl fragment H(3′) or H(5′), as well as nonequivalence of the Me groups (two singlets) caused by the absence of free rotation, speak in favor of its *cis*-structure (Fig. 1). In addition, a large spin-spin coupling constant $J_{HN-H(3)}$ = 11.7 Hz was observed for the *cis*-isomer, while for the *trans*-isomer, the signal for the proton H(3) was found in the lower field than that for the *cis*-isomer, with the spin-spin coupling constant being nonexistent.

A predominance of *cis*-isomer can be explained if a coordinating effect of the hydroxyl group is allowed for (formation of hydrogen bonds between the hydroxyl and the keto groups of hydroxyenones **2** and **3**). A similar picture is observed in the NMR spectra of isoxazolidinols **7a**—**h**, other representatives of this group of compounds.

The ratio of signal intensities for the indicative protons C(3)H of isoxazolidinols varies depending on the reaction conditions, however, a *cis*-isomer is usually the major product. Moreover, the ratio of isomers depends on the nature of the solvent and the aggregate state. Thus, the content of the *trans*-isomer increases as the low polar $CDCl_3$ is exchanged for the polar solvents (Table 1). Recrystallization is accompanied by the loss in the major compound and appearance in the ^{1}H NMR spectra of additional signals, which were absent in the spectra of crude products. Compounds **6**—**9** in chloroform are entirely in the isoxazolidine form, however, in DMSO-d_6, according to the IR and ^{13}C NMR spectroscopic data, these compounds (or, most likely, one of the diastereomers) due to the ring-chain tautomerism[13] are subject to noticeble isomeric transformation into the linear structure of the type **B** (see Scheme 1).

In the ^{1}H NMR spectrum of compound **6b** and in the spectra of other isoxazolidinols **6a**, **7a**—**h**, the signals for the two geminal protons at position 4 of the heterocycle appear as an ABX system in the region δ 2.2—3.2 (J_{AB} = 16.7—17.2 Hz), with their chemical shift for *cis*-isomer being different (Δδ ≥ 0.5 ppm). At the same time, both protons of *trans*-isomer have close (or the same) chemical shifts, with their geminal constants slightly differing.

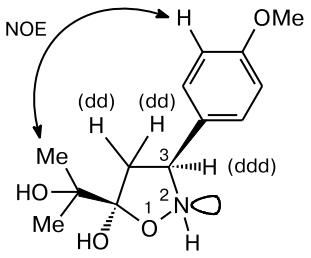


Fig. 1. Configuration of *cis*-isomer of isoxazolidinol **6b**.

Table 1. Influence of solvents on the ratio of diastereomers of isoxazolidinol **6a**[a]

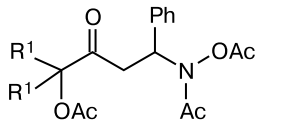
Solvent	$\delta_{H(3)}$ (*J*/Hz)	Ratio *cis* : *trans*
$CDCl_3$	4.47 (t, *J* = 8.1); 4.73 (partial t, *J* = 7.0)	62 : 38
$CDCl_3$—DMSO-d_6 (4 : 1)	4.30 (t, *J* = 8.1); 4.58 (t, *J* = 7.1)	58 : 42
CCl_4—DMSO-d_6 (4 : 1)	4.24 (dd, *J* = 8.9, *J* = 7.7); 4.56 (dd, *J* = 8.9, *J* = 7.8)	58 : 42
DMSO-d_6	4.22 (m); 4.56 (dd, *J* = 8.7, *J* = 7.9)	55 : 45
CD_3OD	4.40 (t, *J* = 8.1); 4.69 (dd, *J* = 8.6, *J* = 7.9)	42 : 58
CD_3COCD_3	—	—[b]

[a] Before recording the ^{1}H NMR spectra (300 MHz), the pre-prepared samples were kept for 8—10 h at 20 °C.
[b] Isoxazolidinol **6a** converted to α,β-enone **2a** (25%) and oxime **15** (75%).

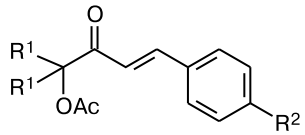
Unlike hydroxy-containing isoxazolidinols considered above, three sets of signals for the proton of the CHN group of unequal intensity are present in the ^{1}H NMR spectra of isoxazolidinols **8a**,**b** and **9a**,**b** having a methyl (not coordinated with the keto group) substituent, with the *trans*-isomer becoming predominant. This was demonstrated for compounds **8a**,**b** using NOESY spectra. From the three signals for the *tert*-butyl group, only the most high-field (shifted by 0.07 and 0.1 ppm for compounds **8a** and **8b**, respectively) broad singlet has contacts with the *o*-aryl protons. Such a change in the chemical shift is typical of substituents placed inside the conical magnetic field of the aryl fragment and is indicative. The absence of the cross-lines from interactions of the protons indicated, apparently, suggests a *trans*-isomerism of the latter. We suppose that the appearance of additional *trans*-isomers is caused by the presence or absence of hydrogen bonding between the hydroxyl and NH groups or by steric reasons. Thus, the minor *trans*-isomer **8b**, judging from the intensities of analogous signals for the protons of the CHN cycle, became the major for **9a**,**b**.

The hemiacetal structure of compounds **6**—**9** was additionally confirmed by the N,O-acylation reactions. For

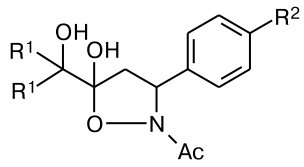
instance, their treatment with Ac_2O leads to the isolation of linear ketoamides **17a**,**b**, as well as acetates of the corresponding hydroxyenones **18a**—**d** as the side products. The action of AcCl in pyridine (0—5 °C) leads to the formation of individual *N*-acetyl derivatives **19a**,**b** (the only isomer) and **20** (a mixture of isomers).



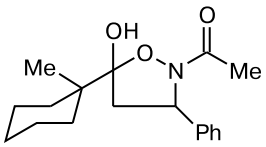
17a,b



18a—d



19a,b



20

R^1 = Me (**a**, **c**), $R^1 + R^1 = (CH_2)_5$ (**b**, **d**)
R^2 = H (**a**, **b**), OMe (**c**, **d**)

Formation of a mixture of diastereomeric acetates **20** can be concluded from the ^{1}H NMR spectroscopic data, namely, from the presence (a down-field shift of the signal for the OH group) or the absence of hydrogen bonding in the case of *syn*- or *anti*-arrangement of the OH and C=O groups.

In conclusion, the reaction of α,β-enones containing a tertiary C atom α′ to the keto group with hydroxylamine leads to 5-hydroxyisoxazolidine derivatives as the major products. It was unexpectedly found that 5-hydroxyisoxazolidines are oxidized to 5-hydroxy-Δ^2-isoxazolines upon the action of atmospheric oxygen.

Experimental

^{1}H and ^{13}C NMR spectra were recorded on Bruker DRX-500 (500.13 MHz) and Bruker AM-300 (300 (^{1}H) and 75.5 (^{13}C) MHz) spectrometers for solutions in $CDCl_3$ and DMSO-d_6, with Me_4Si as an internal standard. Standard procedures from Bruker were used for the studies of 2D spectra. UV spectra were recorded on a Specord M-40 spectrometer (Carl Zeiss Jena) for solutions in EtOH. Mass spectra were recorded on a Kratos MS-30 instrument (70 eV). IR spectra were recorded on a Specord M-80 spectrometer (oily products as neat samples, solid compounds in KBr pellets). Melting points were measured on a Boetius heating stage (Germany) and were not corrected. Reaction progress was monitored by TLC on Silufol plates (UV-254), with visualization in iodine vapors. Silica gel 60 purchased from Merck was used for chromatography, with ethyl acetate—hexane (CH_2Cl_2) as an eluent.

Reactants of the home-country (Khimmed) and foreign (Aldrich, Lancaster) production were used without additional purification.

Compounds **2a**,**b**,[12a] **3a**,**b**,[12b] **4a**,**b**,[14] and earlier undescribed **3c**—**h** and **5a**,**b** were obtained by the reaction of R methyl ketones RCOMe (R = 2-hydroxyprop-2-yl, 1-hydroxycyclohexyl, 1-methylcyclohexyl,[15] and *tert*-butyl) with the methylidene-forming components: aromatic aldehydes R′ArCHO (R′ = H, 4-Me, 4-MeO, 3,4-$(MeO)_2$, 3,4,5-$(MeO)_3$, 4-Me_2N), furfurol and isobutyraldehyde.

α,β-Enones 2—5 (general procedure). A 50% aqueous KOH (6 mL) was added dropwise to a solution of stoichiometric amount of a ketone and an aldehyde (10 mmol each) in EtOH (10—15 mL) over 10—15 min with stirring. The mixture was heated for 12—15 h at 45—50 °C, then diluted with water (10 mL), and neutralized with 2 *M* HCl. The organic layer was extracted with benzene, dried with Na_2SO_4, and concentrated. The residue was distilled from a collar flask *in vacuo*. The crystallizing oils were filtered off to obtain compounds **2a**,**b**, **3a**,**b**,**g**, **4a**, and **5a**,**b**. In the synthesis of compounds **3c**—**f**,**h**, a solid product precipitated from the reaction mixture was filtered off, washed with water, and recrystallized from the corresponding solvent.

1-(1-Hydroxycyclohexyl)-3-phenylprop-2-en-1-one (3a). The yield was 62%, m.p. 61—62 °C (from hexane) (*cf.* Ref. 12b: liquid compound). UV, λ_{max}/nm (ε): 295 (26300). The ^{1}H NMR and IR spectra are consistent with those described in the work.[12b]

1-(1-Hydroxycyclohexyl)-3-(3,4-dimethoxyphenyl)prop-2-en-1-one (3c). The yield was 44%, m.p. 140—142 °C (from light petroleum—AcOEt). Found (%): C, 70.24; H, 7.47. $C_{17}H_{22}O_4$. Calculated (%): C, 70.32; H, 7.64. UV, λ_{max}/nm (ε): 241 (10200), 341 (20200). IR, ν/cm^{-1}: 3512 (OH), 1676 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.34 (m, 1 H, CH_2); 1.54 (m, 2 H, CH_2); 1.66—1.86 (m, 7 H, CH_2); 3.77 (s, OH); 3.92, 3.96 (both s, 3 H each, MeO); 6.89 (dd, 1 H, Ar, J = 8.0 Hz, J = 1.0 Hz); 6.99, 7.80 (both d, 1 H each, CH=CH, J = 16.0 Hz); 7.11 (d, 1 H, Ar, J = 1.0 Hz); 7.22 (dd, 1 H, Ar, J = 8.0 Hz, J = 1.0 Hz).

1-(1-Hydroxycyclohexyl)-3-(3,4,5-trimethoxyphenyl)prop-2-en-1-one (3d). The yield was 32%, m.p. 122—123 °C (from light petroleum—AcOEt). Found (%): C, 67.32; H, 7.37. $C_{18}H_{24}O_5$. Calculated (%): C, 67.48; H, 7.35. UV, λ_{max}/nm (ε): 240 (14000), 325 (28700). IR, ν/cm^{-1}: 3456 (OH), 1668 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.36 (m, 1 H, CH_2); 1.56 (m, 2 H, CH_2); 1.68—1.86 (m, 7 H, CH_2); 3.72 (s, OH); 3.81 (s, 3 H, OMe); 3.83 (s, 6 H, OMe); 6.82 (s, 2 H, Ar); 7.02, 7.72 (both d, 1 H each, CH=CH, J = 16.0 Hz).

1-(1-Hydroxycyclohexyl)-3-(4-dimethylaminophenyl)prop-2-en-1-one (3e). The yield was 32%, m.p. 134—136 °C (from EtOH—AcOEt). Found (%): C, 74.37; H, 8.49; N, 4.95. $C_{17}H_{23}NO_2$. Calculated (%): C, 74.62; H, 8.48; N, 5.12. UV, λ_{max}/nm (ε): 253 (5500), 400 (10800). IR, ν/cm^{-1}: 3452, 3428 (OH), 1656 (C=O). ^{1}H NMR (300 MHz, DMSO-d_6), δ: 1.24 (m, 1 H, CH_2); 1.48 (m, 4 H, CH_2); 1.48—1.70 (m, 5 H, CH_2); 2.99 (s, 6 H, Me_2N); 5.0 (s, OH); 6.73, 7.54 (both d, 2 H each, Ar, J = 8.0 Hz); 7.26, 7.49 (both d, 1 H each, CH=CH, J = 15.9 Hz).

1-(1-Hydroxycyclohexyl)-3-(furan-2-yl)prop-2-en-1-one (3f). The yield was 43%, m.p. 144—145 °C (from light petroleum). Found (%): C, 70.61; H, 7.23. $C_{13}H_{16}O_3$. Calculated (%): C, 70.89; H, 7.32. UV, λ_{max}/nm (ε): 324 (28000). IR, ν/cm^{-1}: 3464 (OH), 1672 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.23—1.41 (m, 1 H, CH_2); 1.44—1.54 (m, 2 H, CH_2); 1.58—1.88 (m, 7 H, CH_2); 3.82 (s, 1 H, OH); 6.50 (t, 1 H, furyl, J = 2.8 Hz); 6.72 (d, 1 H, furyl, J = 2.8 Hz); 6.98, 7.56 (both d, 1 H each, CH=CH, J = 16.0 Hz); 7.51 (d, 1 H, furyl, J = 3.6 Hz).

1-(1-Hydroxycyclohexyl)-4-methylpent-2-en-1-one (3g). The yield was 27%, a heterogeneous liquid (the product purity ~80%), b.p. 91—96 °C (20 Torr), n_D^{20} 1.4860. UV, λ_{max}/nm (ε): 232 (9400). IR, ν/cm^{-1}: 3440 (OH), 1670 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.08 (d, 6 H, Me, J = 6.8 Hz); 1.18 (m, 1 H, CH_2); 1.44 (m, 2 H, CH_2); 1.56—1.82 (m, 7 H, CH_2); 2.51 (octet, 1 H, C<u>H</u>Me$_2$, J = 6.8 Hz); 3.84 (s, 1 H, OH); 6.45 (d, 1 H, CH=, J = 16.0 Hz); 7.10 (dd, 1 H, =C<u>H</u>CH, J = 16.0 Hz, J = 6.8 Hz).

1-(1-Hydroxycyclohexyl)-3-(4-methylphenyl)prop-2-en-1-one (3h). The yield was 41%, m.p. 98 °C (from AcOEt). Found (%): C, 78.39; H, 8.18. $C_{16}H_{20}O_2$. Calculated (%): C, 78.65; H, 8.25. UV, λ_{max}/nm (ε): 293 (25700). IR, ν/cm^{-1}: 3442 (OH), 1674 (C=O). ^{1}H NMR (300 MHz, DMSO-d_6), δ: 1.18—1.31 (m, 1 H, CH_2); 1.44—1.91 (m, 9 H, CH_2); 2.35 (s, 3 H, Me); 5.08 (s, 1 H, OH); 7.25, 7.61 (both d, 2 H each, Ar, J = 8.0 Hz); 7.47, 7.53 (both d, 1 H each, CH=CH, J = 16.0 Hz).

1-(1-Methylcyclohexyl)-3-phenylprop-2-en-1-one (5a). The yield was 39%, a crystallizing oil, m.p. 36—37 °C (from pentane). Found (%): C, 84.23; H, 8.80. $C_{16}H_{20}O$. Calculated (%): C, 84.16; H, 8.83. UV, λ_{max}/nm (ε): 292 (25800). IR, ν/cm^{-1}: 1672 (C=O). ^{1}H NMR ($CDCl_3$), δ: 1.16 (s, 3 H, Me); 1.30—1.68 (m, 8 H, CH_2); 2.02—2.15 (m, 2 H, CH_2); 7.14, 7.68 (both d, 1 H each, CH=CH, J = 16.0 Hz); 7.38 (m, 3 H, Ph); 7.57 (m, 2 H, Ph).

Ketone 5a semicarbazone. The yield was 40%, m.p. 122—124 °C (from EtOH). Found (%): C, 71.25; H, 8.17; N, 14.41. $C_{17}H_{23}N_3O$. Calculated (%): C, 71.54; H, 8.12; N, 14.73. ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.12 (s, 3 H, Me); 1.08—1.60 (m, 8 H, CH_2); 1.81—1.98 (m, 2 H, CH_2); 6.39, 6.71 (both d, 1 H each, CH=CH, J = 16.0 Hz); 7.31—7.49 (m, 5 H, Ph); 8.02 (br.s, 1 H, NH); other signals do not appear.

3-(4-Methoxyphenyl)-1-(1-methylcyclohexyl)prop-2-en-1-one (5b). The yield was 42%, a crystallizing oil, m.p. 49—50 °C (from hexane). Found (%): C, 79.15; H, 8.64. $C_{17}H_{22}O_2$. Calculated (%): C, 79.03; H, 8.58. UV, λ_{max}/nm (ε): 296 (30900). IR, ν/cm^{-1}: 1676 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.18 (s, 3 H, Me); 1.28—1.63 (m, 8 H, CH_2); 2.02—2.14 (m, 2 H, CH_2); 3.86 (s, 3 H, MeO); 6.91, 7.53 (both d, 2 H each, Ar, J = 8.0 Hz); 7.02, 7.67 (both d, 1 H each, CH=CH, J = 16.0 Hz).

Reactions of α,β-unsaturated ketones 2—5 with hydroxylamine (general procedure). Sodium hydroxide (0.60 g, 15 mmol) was added in one portion to a warm (28—32 °C) solution of the corresponding enone **2**—**5** (10 mmol) and $NH_2OH \cdot HCl$ (0.98 g, 14 mmol) in aq. MeOH (45 mL, H_2O : MeOH = 1 : 4) with stirring. The reaction was accompanied by the elevation of temperature by 5—8 °C. The reaction mixture was kept for 2—4 h at 35—43 °C (disappearance of the starting ketone was monitored by TLC) and worked-up according to one of the following methods (***A***—***D***).

A. A plentiful flaky precipitate formed was filtered off, thoroughly washed with water, aq. MeOH (H_2O : MeOH 2 : 1), mixtures of AcOEt and light petroleum with MeOH (~4 : 1, v/v), dried on the filter and *in vacuo* of a water-jet pump at ~80 °C. Isoxazolidin-5-ols **6** and **7** were obtained without recrystallization as mixtures of diastereomers in the ratio close (±10%) to statistical.

Attempts to isolate individual isomers were unsuccessful. Attempted separation of the mixtures by recrystallization from different solvents (H_2O, MeOH, EtOH, MeCN, EtOAc, Bu^{n}OAc) or isolation of a predominant isomer by column chromatography gave unsatisfactory results: the processes were accompanied by losses in the major compound (~20—30%) and changes in the diastereomeric composition.

Method ***A*** was used for obtaining compounds **6a**,**b** and **7a**—**h**.

B. A reaction mixture was diluted with water (10—15 mL), the solvent was partially evaporated. A slowly forming precipitate was filtered off, compounds **8a**,**b** and **9a**,**b** were isolated after washing with solvents and drying similarly to the manner described in method ***A***.

C. The filtrates left after isolation of the solid precipitates of isoxazolidines **6**—**9** (mainly in the series **a**,**b**) and, according to the ^{1}H NMR spectroscopic data, containing mixtures of minor products **A**—**D** (see Scheme 1) were allowed to stand for 3—4 months at ~20 °C. A solid precipitate formed was filtered off, washed with water and a mixture of light petroleum—AcOEt and dried to obtain nearly individual Δ^2-isoxazolines **10a**, **11**, and **12** or a mixture of Δ^2-isoxazoline **10b** (82—92%) with the corresponding isoxazolidine.

D. The mother liquor, obtained after isolation of the corresponding azolidines from the products of the reactions of hydroxyenones **2b**, **3a**, was concentrated, the residue was diluted with light petroleum (25 mL) and refluxed for 5 min. The soluble minor products were decanted without analysis, the mother liquor was extracted with a mixture of AcOEt—C_6H_6 (~1 : 1, 2×10 mL), repeatedly washed with water and brine, and dried. Oxime **15** and the corresponding tetrahydrofuranone oximes **13** and **14** were isolated after purification by column chromatography (SiO_2, eluent a mixture of CH_2Cl_2—AcOEt (from 20 : 1 to 10 : 1)).

The mother liquors obtained in the reactions of hydroxylamine with other enones were not analyzed.

5-Hydroxy-5-(2-hydroxyprop-2-yl)-3-phenylisoxazolidine (6a). Method ***A*** gave a chemically homogeneous (~94%) mixture of *cis*- and *trans*-isomers in the ratio ~2 : 1 (0.96 g, 43%), m.p. 155 °C (from EtOH).* Found (%): C, 64.22; H, 7.79; N, 6.41. $C_{12}H_{17}NO_3$. Calculated (%): C, 64.55; H, 7.68; N, 6.27. IR, ν/cm^{-1}: 3464, 3180—3300, 3104. ^{1}H NMR (500 MHz, $CDCl_3$), δ: 1.29, 1.30, 1.38, 1.45 (all s, 6 H, Me); 1.85—2.25 (br.s, 1 H, OH); 2.31 (dd, 1 H, H(4), J = 13.2 Hz, J = 7.3 Hz); 2.72 (dd, 1 H, H(4), J = 13.2 Hz, J = 9.3 Hz); 4.46 (br.t, 0.63 H, *cis*-H(3), J = 8.1 Hz); 4.73 (br.t, 0.37 H, *trans*-H(3), J = 7.0 Hz); 6.04 (br.s, 1 H, OH); 7.25—7.42 (m, 5 H, Ph). ^{13}C NMR (300 MHz, DMSO-d_6), δ: 24.39, 25.88, 45.15 (C(3)), 64.45, 72.08, 111.04 (C(5)), 112.04 (C(5)), 126.66, 127.39, 127.60, 127.83, 128.18, 128.45; an additional signal was found at 210.7 (C=O). MS, m/z (I_{rel} (%)): 223 [M]$^+$ (~2), 192 (8), 131 (17), 122 (29), 106 (17), 105 (23), 104 (75), 103 (23), 91 (29), 78 (20), 77 (44), 59 (100), 43 (59).

5-Hydroxy-5-(2-hydroxyprop-2-yl)-3-(4-methoxyphenyl)-isoxazolidine (6b). Method ***A*** gave a chemically homogeneous (~94%) mixture of two diastereomers (~2 : 1) (1.36 g, 54%), m.p. 140—141 °C (from AcOEt). Found (%): C, 61.49; H, 7.32; N, 5.47. $C_{13}H_{19}NO_4$. Calculated: C, 61.64; H, 7.56; N, 5.53. IR, ν/cm^{-1}: 3224 br (NH, OH). MS, m/z (I_{rel} (%)): 253 [M]$^+$ (2), 222 (14), 176 (17), 162 (41), 161 (100), 136 (31), 135 (51), 134 (78), 133 (47), 108 (12), 103 (11), 92 (15), 91 (18), 59 (95).

<u>Compound *cis*-**6b**.</u> ^{1}H NMR (500 MHz, $CDCl_3$), δ: 1.41, 1.50 (both s, 3 H each, Me); 2.20 (br.s, 1 H, CMe$_2$O<u>H</u>); 2.24

* The samples obtained by recrystallization from other solvents (AcOEt, Bu^{n}OAc, MeCN, EtOH—H_2O, EtOH—AcOEt) melt in the range 130—138 °C within 1—2 °C.

(dd, 1 H, H(4), J = 13.3 Hz, J = 7.3 Hz); 2.67 (dd, 1 H, H(4), J = 13.3 Hz, J = 9.4 Hz); 3.58 (br.s, 1 H, OH); 3.78 (s, 3 H, OMe); 4.39 (ddd, 1 H, H(3), J = 11.7 Hz, J = 9.4 Hz, J = 7.3 Hz); 6.04 (d, 1 H, NH, J = 11.7 Hz); 6.88 (d, 2 H, H(3′), H(5′), J = 8.7 Hz); 7.37 (d, 2 H, H(2′), H(6′), J = 8.7 Hz). ^{13}C NMR ($CDCl_3$), δ: 24.59, 43.83, 55.30, 64.61, 73.90, 111.59 (C(5)), 114.16, 128.98, 130.45, 159.60.

Compound *trans*-**6b**. ^{1}H NMR (500 MHz, $CDCl_3$), δ: 1.39 (s, 6 H, Me); 220 (br.s, 1 H, $CMe_2O\underline{H}$); 2.29 (dd, 1 H, H(4), J = 13.3 Hz, J = 7.3 Hz); 2.60 (dd, 1 H, H(4), J = 13.3 Hz, J = 9.4 Hz); 3.58 (br.s, 1 H, OH); 3.70 (s, 3 H, OMe); 4.67 (dd, 1 H, H(3), J = 9.4 Hz, J = 7.3 Hz); 6.90 (d, 2 H, Ar, J = 8.7 Hz); 7.28 (d, 2 H, Ar, J = 8.7 Hz). ^{13}C NMR ($CDCl_3$), δ: 24.97, 43.83, 55.30. 61.80, 73.90, 110.96 (C(5)), 113.96, 127.41, 128.23, 159.60.

5-Hydroxy-5-(1-hydroxycyclohexyl)-3-phenylisoxazolidine (7a). Method ***A*** gave a chemically homogeneous (~96%) mixture of *cis*- and *trans*-isomers in the ratio 58 : 42 (1.50 g, 57%), m.p. 147—148 °C (from MeCN). Found (%): C, 68.21; H, 7.78; N, 5.44. $C_{15}H_{21}NO_3$. Calculated (%): C, 68.41; H, 8.04; N, 5.32. IR, ν/cm^{-1}: 3208. ^{1}H NMR (500 MHz, $CDCl_3$), δ: 1.12—1.80 (m, 8 H, CH_2); 1.84—1.96 (m, 2 H, CH_2); 2.27 (dd, 0.58 H, *cis*-H(4), J = 13.2 Hz, J = 7.4 Hz); 2.31 (m, 0.42 H, *cis*-H(4)); 2.66 (br.dd, 0.42 H, *trans*-H(4), J = 11.2 Hz, J = 9.0 Hz); 2.77 (dd, 0.58 H, *cis*-H(4), J = 13.2 Hz, J = 9.4 Hz); 3.52 (br.s, 1 H, OH); 4.42 (br.dd, 0.58 H, *cis*-H(3), J = 8.5 Hz, J = 7.7 Hz); 4.71 (br.t, 0.42 H, *trans*-H(3), J = 6.7 Hz); 7.34 (t, 1 H, Ph, J = 6.7 Hz); 7.38 (t, 2 H, Ph, J = 6.7 Hz); 7.48 (d, 2 H, Ph, J = 6.7 Hz). ^{13}C NMR (DMSO-d_6), δ: 20.62, 20.78, 20.99, 21.04, 25,04, 25.55, 25.62, 30.08, 31.78, 31.84, 32.71, 32.79, 32.91, 45.10, 61.74, 64.47, 72.77, 77.09, 111.36 (O—C—O), 112.45 (O—C—O), 121.23, 126.80, 127.54, 127.91, 128.28, 128.56, 192.02, 142.20, 142.58; an additional signal was found at 214.50 (C=O). MS, m/z (I_{rel} (%)): 263 [M]$^+$ (<1), 231 (6), 213 (2), 146 (20), 132 (37), 131 (45), 122 (19), 119 (15), 106 (24), 105 (21), 104 (87), 103 (25), 99 (48), 91 (16), 81 (100), 79 (18), 77 (42),69 (10), 55 (54).

5-Hydroxy-5-(1-hydroxycyclohexyl)-3-(4-methoxyphenyl)-isoxazolidine (7b). Method ***A*** gave a chemically homogeneous (~96%) mixture of *cis*- and *trans*-isomers in the ratio 65 : 35 (1.89 g, 65%), m.p. 150—151 °C (from EtOH). Found (%): C, 65.62; H, 7.79; N, 4.68; $C_{16}H_{23}NO_4$. Calculated (%): C, 65.51; H, 7.90; N, 4.78. IR, ν/cm^{-1}: 3220, 3120—3180. ^{1}H NMR (500 MHz, $CDCl_3$), δ: 1.16 (m, 1 H, CH_2); 1.35 (m, 1 H, CH_2); 1.52—1.76 (m, 6 H, CH_2); 1.82 (m, 2 H, CH_2); 2.24 (dd, 0.65 H, *cis*-H(4), J = 12.1 Hz, J = 7.2 Hz); 2.28, 2.69 (both br.m, 0.35 H each, *trans*-H(4)); 2.69 (dd, 0.65 H, *cis*-H(4), J = 12.1 Hz, J = 7.8 Hz); 3.52 (br.s, 1 H, OH); 5.82 (br.s, 0.65 H, OH); 4.36 (br.t, 0.65 H, *cis*-H(3), J = 7.4 Hz); 4.80 (br.m, 0.35 H, *trans*-H(3)); 6.89 (d, 2 H, Ar, J = 8.2 Hz); 7.32 (d, 0.70 H, Ar, J = 8.2 Hz); 7.40 (d, 1.3 H, Ar, J = 8.2 Hz). MS, m/z (I_{rel} (%)): 293 [M]$^+$ (2), 261 (14), 162 (34), 161 (35), 152 (14), 151 (19), 149 (15), 136 (23), 135 (59), 134 (100), 133 (18), 99 (88), 91 (17), 81 (85), 79 (19), 77 (24), 65 (16), 55 (49), 41 (44).

5-Hydroxy-5-(1-hydroxycyclohexyl)-3-(3,4-dimethoxyphenyl)-isoxazolidine (7c). Method ***A*** from enone **3c** (5 mmol) gave a chemically homogeneous (~94%) mixture of diastereomers in the ratio ~3 : 2 (0.70 g, 44%), m.p. 169—170 °C (from EtOH). Found (%): C, 63.01; H, 7.84; N, 4.05. $C_{17}H_{25}NO_5$. Calculated (%): C, 63.14; H, 7.79; N, 4.33. IR, ν/cm^{-1}: 3450 sh, 3184 br. ^{1}H NMR (300 MHz, $CDCl_3$—DMSO-d_6 (4 : 1)), δ: 1.0—1.72 (m, 10 H, CH_2); 1.98 (dd, 0.6 H, *cis*-H(4), J = 13.1 Hz, J = 7.2 Hz); 2.18—2.47 (m, 0.8 H, *trans*-H(4)); 2.82 (dd, 0.6 H, *cis*-H(4), J = 13.1 Hz, J = 9.0 Hz); 3.69, 3.74, 3.81 (all s, 6 H, MeO); 4.16 (br.q, 0.6 H, *cis*-H(3), J = 7.8 Hz); 4.49 (br.t, 0.4 H, *trans*-H(3), J = 6.7 Hz); 5.52, 6.02 (both br.s, 1 H each, NH or OH); 6.72—7.04 (m, 3 H, Ar). MS, m/z (I_{rel} (%)): 305 (8), 290 (8), 272 (7), 206 (15), 192 (72), 191 (67), 181 (16), 166 (17), 165 (19), 164 (29), 99 (84), 95 (16), 82 (16), 81 (100), 77 (15), 55 (32). No peak for the molecular ion with m/z 323 was observed in the mass spectrum.

5-Hydroxy-5-(1-hydroxycyclohexyl)-3-(3,4,5-trimethoxyphenyl)isoxazolidine (7d). Method ***A*** from enone **3d** (5 mmol) gave a chemically homogeneous (~94%) mixture of diastereomers in the ratio ~58 : 42 (0.68 g, 39%), m.p. 161—163 °C (from EtOH). Found (%): C, 60.92; H, 7.43; N, 4.07. $C_{18}H_{27}NO_6$. Calculated (%): C, 61.17; H, 7.70; N, 3.96. IR, ν/cm^{-1}: 3248 br, 3190 sh. ^{1}H NMR (300 MHz, $CDCl_3$—DMSO-d_6 (4 : 1)), δ: 1.04 (m, 1 H, CH_2); 1.32—1.78 (m, 9 H, CH_2); 2.04 (dd, 0.58 H, *cis*-H(4), J = 13.2 Hz, J = 7.4 Hz); 2.30—2.48 (m, 0.84 H, *trans*-H(4)); 2.81 (dd, 0.58 H, *cis*-H(4), J = 13.2 Hz, J = 9.1 Hz); 3.67, 3.70, 3.74, 3.77 (all s, 9 H, MeO); 4.28 (t, 0.58 H, *cis*-H(3), J = 7.9 Hz); 4.47 (t, 0.42 *trans*-H, H(3), J = 6.8 Hz); 6.54, 6.65 (both s, 1 H each, Ar). MS, m/z (I_{rel} (%)): 353 [M]$^+$ (1), 317 7), 236 (22), 223 (56); 222 (100), 219 (51), 195 (46), 194 (61), 179 (24), 99 (12), 81 (36), 55 (29).

5-Hydroxy-5-(1-hydroxycyclohexyl)-3-(4-dimethylaminophenyl)isoxazolidine (7e). Method ***A*** from enone **3e** (5 mmol) gave a chemically homogeneous (~94%) mixture of diastereomers in the ratio ~3 : 2 (0.70 g, 26%), m.p. 164—166 °C (from EtOH). Found (%): C, 66.41; H, 8.33; N, 9.27. $C_{17}H_{26}N_2O_3$. Calculated (%): C, 66.64; H, 8.55; N, 9.14. IR, ν/cm^{-1}: 3424, 3304 br, 3232. ^{1}H NMR without assignment of the isomers (300 MHz, $CDCl_3$—DMSO-d_6 (2 : 1)), δ: 1.00—1.72 (m, 10 H, CH_2); 1.92—2.02 (m, 0.6 H, H(4)); 2.21 (m, 0.4 H, H(4)); 2.40—2.60 (m, 1 H, H(4)); 2.98 (br.s, 6 H, NMe_2); 4.02 (br.t, 0.6 H, H(3), J = 7.4 Hz); 4.41 (br.t, 0.4 H, H(3), J = 6.6 Hz); 6.70, 7.52 (both br.s, 2 H each, Ar). MS, m/z (I_{rel} (%)): 306 [M]$^+$ (3), 288 (8), 273 (25), 175 (14), 174 (100), 149 (24), 147 (36), 146 (25), 139 (14), 81 (13), 55 (12).

3-(Furan-2-yl)-5-hydroxy-5-(1-hydroxycyclohexyl)isoxazolidine (7f). Method ***A*** gave a chemically homogeneous (~94%) mixture of *cis*- and *trans*-isomers in the ratio 1 : 1 (0.98 g, 39%), m.p. 144—145 °C (from Bu^{n}OAc). Found (%): C, 61.40; H, 7.50; N, 5.31. $C_{13}H_{19}NO_4$. Calculated (%): C, 61.64; H, 7.56; N, 5.53. IR, ν/cm^{-1}: 3200. ^{1}H NMR (500 MHz, $CDCl_3$), δ: 1.12—1.94 (m, 10 H, CH_2); 2.34 (dd, 0.5 H, *cis*-H(4), J = 13.2 Hz, J = 7.5 Hz); 2.47 (dd, 0.5 H, *trans*-H(4), J = 12.9 Hz, J = 8.4 Hz); 2.57 (dd, 0.5 H, *trans*-H(4), J = 12.9 Hz, J = 5.1 Hz); 2.67 (dd, 0.5 H, *cis*-H(4), J = 13.2 Hz, J = 9.4 Hz); 3.20—3.70 (br.s, 2 H, NH or OH); 4.47 (t, 0.5 H, *cis*-H(3), J = 8.4 Hz); 4.71 (br.t, 0.5 H, *trans*-H(3), J = 6.8 Hz); 6.28, 6.32 (both br.s, 0.5 H each, furyl); 6.37 (br.s, 1 H, furyl); 7.39, 7.41 (both s, 0.5 H each, furyl). MS, m/z (I_{rel} (%)): 253 [M] $^+$ (3), 221 (25), 122 (15), 121 (35), 112 (25), 111 (21), 109 (36), 99 (80), 96 (19), 95 (40), 94 (100), 81 (65), 55 (17).

5-Hydroxy-5-(1-hydroxycyclohexyl)-3-(prop-2-yl)isoxazolidine (7g). Method ***A*** from enone **3g** (5 mmol) gave a chemically homogeneous (~94%) mixture of *cis*- and *trans*-isomers in the ratio ~3 : 2 (0.37 g, 32%), m.p. 158—159 °C (from AcOEt—EtOH). Found (%): N, 5.92. $C_{12}H_{23}NO_3$. Calculated (%): N, 6.11. IR, ν/cm^{-1}: 3288. ^{1}H NMR (500 MHz, DMSO-d_6), δ: 0.91, 0.97, 0.99, 1.02 (all d, 6 H, Me, J = 6.7 Hz); 1.15 (m, 1 H, CH_2); 1.34

(m, 1 H, CH_2); 1.44—1.84 (m, 9 H, CH_2, C<u>H</u>Me_2); 1.86 (dd, 0.6 H, H(4), J = 13.1 Hz, J = 8.0 Hz); 1.98 (m, 0.4 H, H(4)); 2.17 (dd, 0.4 H, H(4), J = 12.4 Hz, J = 7.9 Hz); 2.39 (dd, 0.6 H, H(4), J = 13.1 Hz, J = 8.6 Hz); 3.04 (q, 0.6 H, H(3), J = 8.3 Hz); 3.19 (q, 0.4 H, H(3), J = 7.6 Hz). MS, m/z (I_{rel} (%)): 229 $[M]^+$ (1), 168 (22), 109 (20), 99 (55), 88 (26), 86 (28), 81 (80), 70 (43), 69 (15), 60 (23), 57 (15), 55 (56), 43 (100), 41 (87).

5-Hydroxy-5-(1-hydroxycyclohexyl)-3-(4-methylphenyl)-isoxazolidine (7h). Method ***A*** from enone **3h** (5 mmol) gave a chemically homogeneous (~94%) mixture of diastereomers in the ratio ~4 : 3 (0.42 g, 40%), m.p. 168—170 °C (from AcOEt—EtOH). Found (%): N, 5.21. $C_{16}H_{23}NO_3$. Calculated (%): N, 5.05. IR, ν/cm^{-1}: 3264 br. ^{1}H NMR without assignement of the isomers (300 MHz, $CDCl_3$—DMSO-d_6 (1 : 2)), δ: 1.02 (m, 1 H, CH_2); 1.28—1.78 (m, 9 H, CH_2); 1.98 (br.t, 1 H, H(4), J = 6.0 Hz); 2.24, 2.25 (both s, 3 H, Me); 2.80 (br.t, 1 H, H(4), J = 9.0 Hz); 3.69, 5.38, 5.93, 5.97 (all br.s, 2 H, NH, OH); 4.17, 4.47 (both br.m, in the ratio ~4 : 3, 1 H, H (3)); 7.05, 7.07 (both d, 2 H, Ar, J = 8.4 Hz); 7.18, 7.25 (both d, 2 H, Ar, J = 6.0 Hz).

5-*tert*-Butyl-5-hydroxy-3-phenylisoxazolidine (8a). Method ***A*** gave a mixture of *trans*-, *trans*-, and *cis*-isomers in the ratio ~3 : 1 : 3 (0.90 g, 41 %), m.p. 100—101 °C (from hexane—AcOEt). Found (%): C, 70.47; H, 8.39; N, 6.04. $C_{13}H_{19}NO_2$. Calculated (%): C, 70.55; H, 8.65; N, 6.33. IR, ν/cm^{-1}: 3240 br. ^{1}H NMR (500 MHz, DMSO-d_6), δ: 0.88, 0.95, 1.00 (all s, in the ratio ~3 : 1 : 3, 9 H, Me); 1.96 (dd, 0.43 H, *trans*-H(4), J = 13.1 Hz, J = 8.9 Hz); 2.17 (dd, 0.43 H, *cis*-H(4), J = 12.8 Hz, J = 5.4 Hz); 2.50 (q, 0.43 H, *cis*-H(4), J = 1.8 Hz); 2.81 (dd, 0.43 H, *trans*-H(4), J = 13.1 Hz, J = 8.4 Hz); 2.82 (overlaps, 0.14 H, *trans*-H(4)); 2.94 (dd, 0.14 H, *trans*-H(4), J = 13.0 Hz, J = 9.0 Hz); 4.16 (dd, 0.43 H, *trans*-H(3), J = 8.5 Hz, J = 6.4 Hz); 4.24 (br.t, 0.14 H, *trans*-H(3), J = 6.4 Hz); 4.58 (br.q, 0.43 H, *cis*-H(3), J = 5.5 Hz); 5.09, 5.18, 5.26 (all br.s, in the ratio ~3 : 1 : 3, 1 H, OH); 6.22, 6.84, 7.18 (all br.s, 1 H, NH); 7.16—7.48 (m, 5 H, Ph).

5-*tert*-Butyl-5-hydroxy-3-(4-methoxyphenyl)isoxazolidine (8b) was obtained by method ***A*** and from the mother liquor by method ***B***, the overall yield was 1.3 g (52%), a mixture of *trans*-, *trans*-, and *cis*-isomers in the ratio ~6 : 1 : 3, m.p. 102 °C (from hexane—AcOEt). Found (%): C, 66.72; H, 8.15; N, 5.39. $C_{14}H_{21}NO_3$. Calculated (%): C, 66.90; H, 8.42; N, 5.57. IR, ν/cm^{-1}: 3224, 3144 br. ^{1}H NMR (500 MHz, $CDCl_3$), δ: 0.92, 1.02, 1.03 (all s, in the ratio 3 : 1 : 6, 9 H, Bu^t); 2.17 (dd, 0.6 H, *trans*-H(4), J = 13.2 Hz, J = 7.7 Hz); 2.29 (dd, 0.3 H, *cis*-H(4), J = 12.6 Hz, J = 6.1 Hz); 2.38 (br.s, 1 H, OH); 2.56 (dd, 0.3 H, *cis*-H(4), J = 12.6 Hz, J = 8.4 Hz); 2.73 (dd, 0.6 H, *trans*-H(4), J = 13.2 Hz, J = 9.2 Hz); 2.86, 3.02 (both br.d, 0.1 H each, *cis*-H(4), J 8.0 Hz); 3.67, 3.68, 3.70 (all s, 3 H, OMe); 4.38 (t, 0.6 H, *trans*-H(3), J = 8.4 Hz); 4.42 (br.t, 0.1 H, *trans*-H(3), J = 7.2 Hz); 4.64 (br.t, 0.3 H, *cis*-H(3), J = 7.4 Hz); 5.90 (br.s, 1 H, NH); 6.61, 6.87, 7.42 (all d, 3 H, Ar, J 8.4 Hz); 7.28 (t, 1 H, Ar, J 8.4 Hz).

5-Hydroxy-5-(1-methylcyclohexyl)-3-phenylisoxazolidine (9a) was obtained by method ***A***, the yield was 1.1 g (42%), a mixture of three isomers in the ratio ~1 : 2.2 : 1, m.p. 119—120 °C (from AcOEt—EtOH). Found (%): C, 73.50; H, 8.96; N, 5.04. $C_{16}H_{23}NO_2$. Calculated (%): C, 73.53; H, 8.87; N, 5.36. IR, ν/cm^{-1}: 3224, 3216—3190. ^{1}H NMR (500 MHz, DMSO-d_6), δ: 0.85, 1.01, 1.12 (all s, 3 H, Me); 1.02—1.72 (m, 10 H, CH_2); 1.94 (dd, 0.24 H, H(4), J = 13.1 Hz, J = 8.3 Hz); 2.17 (dd, 0.24 H, H(4), J = 12.8 Hz, J = 5.6 Hz); 2.43 (m, 0.24 H, H(4)); 2.83 (dd, 0.52 H, H(4), J = 13.1 Hz, J = 7.6 Hz); 2.83 (overlaps, 0.24 H, H(4)); 2.93 (dd, 0.52 H, H(4), J = 13.1 Hz, J = 6.0 Hz); 4.13 (br.q, 0.24 H, H(3), J 8.0 Hz); 4.27 (t, 0.52 H, H(3), J = 7.1 Hz); 4.51 (m, 0.24 H, H(3)); 5.0, 5.2, 6.1, 6.4 (all br.s, 2 H, NH, OH); 7.19—7.46 (m, 5 H, Ph). ^{13}C NMR (DMSO-d_6), δ: 17.85, 18.16, 21.38, 22.27, 22.49, 23.95, 25.35, 25.87, 25.95, 30.99, 31.15, 31.32, 33.82, 33.90, 40.68, 45.34, 46.0, 47.56, 60.25, 61.97, 64.42, 111.93 (O—C—O), 113.5 (O—C—O), 126.22, 126.83, 127.63, 127.79, 127.88, 128.09, 128.88, 142.48. MS, m/z (I_{rel} (%)): 261 $[M]^+$ (1), 230 (15), 146 (38), 131 (75), 122 (35), 106 (59), 104 (25), 97 (100), 91 (22), 77 (27), 55 (92).

5-Hydroxy-3-(4-methoxyphenyl)-5-(1-methylcyclohexyl)-isoxazolidine (9b) was obtained by method ***A***, the yield was 2.2 g (76%), a mixture of three isomers in the ratio ~2 : 2 : 1, m.p. 120—121 °C (from AcOEt). Found (%): C, 69.92; H, 8.70; N, 4.60. $C_{17}H_{25}NO_3$. Calculated (%): C, 70.07; H, 8.65; N, 4.81. IR, ν/cm^{-1}: 3264, 3192, 3136. ^{1}H NMR (500 MHz, $CDCl_3$), δ: 0.99, 1.02, 1.09 (all s, in the ratio ~2 : 1 : 2, 3 H, Me); 1.10—1.70 (m, 8 H, CH_2); 1.63—1.92 (m, 2 H, CH_2); 2.13 (dd, ~0.4 H, H(4), J = 13.3 Hz, J = 7.8 Hz); 2.28 (dd, ~0.2 H, H(4), J = 12.2 Hz, J = 6.5 Hz); 2.52 (br.s, 0.2 H, H(4)); 2.68, 5.40, 5.90 (all br.s, not assigned, NH, OH); 2.74 (dd, 0.4 H, H(4), J = 13.3 Hz, J = 9.2 Hz); 2.83 (dd, 0.4 H, J = 16.7 Hz, J = 5.3 Hz); 2.96 (dd, 0.4 H, H(4), J = 17.3 Hz, J = 7.8 Hz); 3.78, 3.79, 3.80 (all s, in the ratio ~2 : 1 : 2, 3 H, MeO); 4.30 (br.d, 0.4 H, H(3), J = 7.8 Hz); 4.42 (dd, 0.4 H, H(3), J = 7.6 Hz, J = 5.3 Hz); 4.62 (br.s, 0.2 H, H(3)); 6.85, 6.88, 7.27, 7.38 (all d, 1 H each, Ar, J = 8.6 Hz). ^{13}C NMR (DMSO-d_6), δ: 17.77, 18.10, 21.28. 22.17, 22.40, 23.83, 25.27. 25.79, 25.86, 30.93, 31.24, 33.75. 33.84, 40.60, 45.15, 47.46, 54.92, 55.05, 61.28, 6.83, 111.85 (O—C—O), 113.20, 113.41, 113.84, 114.26, 127.27, 128.75, 130.30, 134.17, 158.16, 158.80, an additional signal was found at 213.06 (C=O). MS, m/z (I_{rel} (%)): 291 $[M]^+$ (0.5), 177 (12), 161 (47), 137 (52), 136 (16), 134 (31), 131 (26), 122 (11), 97 (100), 91 (16), 55 (56).

5-Hydroxy-5-(2-hydroxyprop-2-yl)-3-phenyl-Δ^2-isoxazoline (10a) was obtained by method ***B***, the yield was 230 mg (~7%), m.p. 158—159 °C (from EtOH). Found (%): C, 65.02; H, 6.89; N, 6.04. $C_{12}H_{15}NO_3$. Calculated (%): C, 65.14; H, 6.89; N, 6.33. IR, ν/cm^{-1}: 3250 br, 1668, 1652. ^{1}H NMR (500 MHz, DMSO-d_6), δ: 1.20, 1.26 (both s, 6 H, Me); 3.01, 3.65 (both d, 1 H each, AB system, CH_2, J = 17.6 Hz); 4.56, 4.72 (both br.s, 1 H each, OH); 7.36 (br.t, 3 H, Ph, J = 6.8 Hz); 7.70 (br.s, 2 H, Ph). ^{13}C NMR (DMSO-d_6), δ: 23.87, 25.90, 40.94, 71.75, 112.26 (O—C—O), 126.28, 127.54, 128.53, 129.79, 130.21, 156.21 (C=N).

5-*tert*-Butyl-5-hydroxy-3-(4-methoxyphenyl)-Δ^2-isoxazoline (10b) was obtained by method ***B***, the yield was 230 mg (~8%), contains an admixture (~8%) of isomers of compound **6b**, m.p. 128—130 °C (from AcOEt—hexane). Found (%): N, 5.42. $C_{13}H_{17}NO_4$. Calculated (%): N, 5.57. IR, ν/cm^{-1}: 3240 br, 1656. ^{1}H NMR (300 MHz, $CDCl_3$—DMSO-d_6 (4 : 1)), δ: 1.27, 1.32 (both s, 3 H each, Me); 3.02, 3.56 (both d, AB system, 1 H each, CH_2, J = 17.4 Hz); 3.76 (s, 3 H, MeO); 6.84, 7.53 (both d, 2 H each, Ar, J = 7.8 Hz); other signals do not appear.

5-*tert*-Butyl-5-hydroxy-3-phenyl-Δ^2-isoxazoline (11) was obtained by method ***C***, the yield was 243 mg (~11%), m.p. ~140 °C (from AcOEt). Found (%): C, 70.94; H, 7.61; N, 6.08. $C_{13}H_{17}NO_2$. Calculated (%): C, 71.20; H, 7.82; N, 6.30. IR, ν/cm^{-1}: 3277 br, 1680. ^{1}H NMR (300 MHz, CCl_4—DMSO-d_6 (4 : 1)), δ: 1.04 (s, 9 H, Me); 3.02, 3.42 (both d, 1 H each, CH_2,

J = 17.6 Hz); 6.36 (br.s, 1 H, OH); 7.42 (m, 3 H, Ph); 7.68 (m, 2 H, Ph). MS, *m/z* (I_{rel} (%)): 219 $[M]^+$ (13), 162 (84), 146 (28), 144 (45), 120 (78), 118 (48), 117 (49), 104 (53), 103 (100), 95 (73), 93 (80), 91 (58), 85 (64), 78 (56), 77 $[Ph]^+$ (96), 76 (65), 75 (26), 67 (37), 65 (24), 63 (25), 57 $[Bu^t]^+$ (57), 55 (28), 51 (38).

5-Hydroxy-5-(1-methylcyclohexyl)-3-phenyl-Δ^2-isoxazoline (12) was obtained by method ***C***, the yield was 340 mg (~14%), m.p. 139—140 °C (from AcOEt). Found (%): C, 73.89; H, 8.28; N, 5.21. $C_{16}H_{21}NO_2$. Calculated (%): C, 74.10; H, 8.16; N, 5.40. IR, ν/cm^{-1}: 3224, 1684, 1652. ^{1}H NMR (500 MHz, DMSO-d_6), δ: 0.99 (s, 3 H, Me); 1.34 (m, 1 H, CH_2); 1.64 (m, 9 H, CH_2); 2.96, 3.53 (both d, AB system, 1 H each, CH_2, *J* = 18.2 Hz); 6.51 (s, 1 H, OH); 7.45 (m, 3 H, Ph); 7.67 (m, 2 H, Ph). ^{13}C NMR (DMSO-d_6), δ: 17.55, 21.32, 24.64, 25.84, 29.31, 30.68, 41.0, 113.31 (O—C—O), 121.41, 126.29, 128.71, 129.73, 130.17, 155.95 (C=N). MS, *m/z* (I_{rel} (%)): 259 $[M]^+$ (6), 162 (37), 146 (35), 144 (21), 120 (57), 117 (92), 105 (17), 104 (37), 103 (48), 98 (55), 93 (40), 91 (50), 81 (54), 77 (100), 55 (37).

5-(4-Methoxyphenyl)-2,2-dimethyltetrahydrofuran-3-one oxime (13b). A solution of ketone **13a** (1.97 g, 8.3 mmol) (obtained by cyclization of hydroxyenone **2b** (20 mmol) upon treatment with H_3PO_4 (*d* = 1.7 g cm^{-3}) under conditions given in work[12a] at 100 °C in 22% yield), $NH_2OH \cdot HCl$ (1.81 g, 26 mmol), and NaOAc (3.5 g, 26 mmol) in a mixture of H_2O (10 mL) and EtOH (10 mL) was refluxed for 5 h and cooled. After usual work-up, a colorless liquid was isolated (2.1 g). Crystallization from aq. EtOH gave oxime **13b** (1.5 g, 63%), m.p. 136 °C (from EtOH). Found (%): C, 66.18; H, 7.14; N, 5.78. $C_{13}H_{17}NO_3$. Calculated (%): C, 66.36; H, 7.28; N, 5.95. IR, ν/cm^{-1}: 3260 br, 1652. ^{1}H NMR (500 MHz, DMSO-d_6), δ: 1.32, 1.38 (both s, 3 H each, Me); 2.45 (dd, 1 H, H(4), *J* = 17.6 Hz, *J* = 9.6 Hz); 3.12 (dd, 1 H, H(4), *J* = 17.6 Hz, *J* = 6.2 Hz); 3.75 (s, 3 H, OMe); 4.99 (dd, 1 H, H(5), *J* = 9.6 Hz, *J* = 6.2 Hz); 6.91, 7.22 (both d, 2 H each, Ar, *J* = 8.6 Hz); 10.14, 10.32 (both s, in the ratio 1 : 24, NOH). MS, *m/z* (I_{rel} (%)): 235 (22), 137 (76), 43 (100).

Method ***D*** and column chromatography on SiO_2 (CH_2Cl_2—AcOEt) gave oxime **13b** (95 mg, ~4%), whose spectral characteristics are in accord with those of an authentic sample.

2-Phenyl-1-oxaspiro[4,5]decen-4-one oxime (14). Method ***D*** and column chromatography on SiO_2 (eluent CH_2Cl_2—AcOEt) gave a mixture of *syn*- and *anti*-isomers in the ratio 10 : 1 (without assignement) (110 mg, ~4%), m.p. 126—128 °C (from AcOEt). Found (%): C, 73.37; H, 7.62; N, 5.70. $C_{15}H_{19}NO_2$. Calculated (%): C, 73.44; H, 7.81; N, 5.71. IR, ν/cm^{-1}: 3344, 1672. ^{1}H NMR (500 MHz, $CDCl_3$—DMSO-d_6 (4 : 1)), δ: 1.21 (m, 1 H, CH_2); 1.37—1.90 (m, 9 H, CH_2); 2.47 (m, 1 H, H(4)); 3.17 (dd, 1 H, H(4), *J* = 17.2 Hz, *J* = 9.2 Hz); 4.94 (dd, 1 H, H(5), *J* = 9.2 Hz, *J* = 5.6 Hz); 7.12—7.37 (m, 5 H, Ph), 9.43, 10.09 (both br.s, in the ratio 1 : 10, NOH).

1-(2-Hydroxyprop-2-yl)-3-phenylprop-2-en-1-one oxime (15) was obtained by method ***D***, the yield was ~5%, m.p. 122—123 °C (from AcOEt) (*cf.* Ref. 16: m.p. 136 °C). Found (%): N, 6.54. $C_{12}H_{15}NO_2$. Calculated (%): N, 6.82. IR, ν/cm^{-1}: 3240, 1620. ^{1}H NMR (300 MHz, DMSO-d_6), δ: 1.39 (s, 6 H, Me); 4.84 (br.s, 1 H, OH); 7.06, 7.74 (both d, 1 H each, CH=CH, *J* = 16.0 Hz); 7.21—7.39 (m, 3 H, Ph); 7.49 (d, 2 H, Ph, *J* = 8.0 Hz); 10.88 (s, 1 H, N—OH).

5-(2-Hydroxyprop-2-yl)-3-phenylisoxazole (16). A mixture of isoxazoline **10a** (1.1 g, 5 mmol), TsOH (10 mg), and anhydrous sodium sulfate (0.5 g) in benzene (8 mL) was refluxed for 1 h with stirring. After cooling to ~20 °C, it was diluted with diethyl ether, washed with aq. $NaHCO_3$ and brine. The residue was twice subjected to chromatography on SiO_2 (eluent light petroleum—AcOEt (2—8%)) to obtain isoxazole **16** (120 mg, ~12%) as an oil. In the work,[17] compound **16** was obtained by [3+2] cycloaddition of benzaldoxime to 2-methylbut-3-yn-2-ol, no physicochemical data were reported. IR, ν/cm^{-1}: 3240, 1852. ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.39 (s, 6 H, Me); 1.54 (s, 1 H, OH); 5.92 (s, 1 H, CH=); 7.42 (m, 3 H, Ph); 7.68 (d, 2 H, Ph, *J* = 8.1 Hz).

N,O-Acylation of isoxazolidinols and hydroxy-α,β-enones. *E*. A mixture of isoxazolidinol **6** or **7** (3 mmol), anhydrous CH_2Cl_2 (20 mL), acetic anhydride (1.2 mL), triethylamine (5 mL), and 4-dimethylaminopyridine (DMAP) (10 mg) was allowed to stand for 2 days at 20—25 °C, suspended in aq. $NaHCO_3$ cooled to 0 °C, and extracted with a mixture of benzene—ethyl acetate. The organic layer was washed with saturated aq. $NaHCO_3$ and brine, dried with Na_2SO_4, and subjected to chromatography on SiO_2 (eluent CH_2Cl_2—AcOEt (2—10%)) to obtain N,O-acylated compounds **17a**,**b**.

F*.** A solution of hydroxyenone **2** or **3** (3 mmol), anhydrous CH_2Cl_2 (20 mL), acetic anhydride (0.22 mL), triethylamine (1 mL), and a catalytic amount of DMAP was kept for 10—12 h at 20—25 °C, worked-up similarly to method ***E, and passed through a short layer of SiO_2 to obtain acetates **18a**—**c**.

***G*.** A solution of AcCl (0.4 g, 4 mmol) in diethyl ether (0.5 mL) was added dropwise to a solution of isoxazolidinols **6**—**9** (3 mmol) and anhydrous pyridine (0.4 g, 4 mmol) in diethyl ether (20 mL) at 0—5 °C. A turbid precipitate formed was filtered off and the mixture was allowed to stand for 12—15 h at 20—25 °C, poured into aq. $NaHCO_3$ cooled to 0 °C, and extracted with a mixture of benzene—ethyl acetate. After drying with Na_2SO_4, the residue was passed through a short layer of SiO_2 to obtain *N*-acetamides **19a,b** and **20**.

2-Acetoxy-2-methyl-5-(*N*-acetyl-*N*-acetoxy)amino-5-phenylpentan-3-one (17a) was obtained by method ***E*** through the acylation of compound **6a**, the yield of an oily product was (0.46 g, 44%). Found (%): N, 3.69. $C_{18}H_{23}NO_6$. Calculated (%): N, 4.01. IR, ν/cm^{-1}: 3460 br, 1800, 1728, 1684 (NC=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.42, 1.48 (both s, 3 H each, Me); 2.06 (s, 6 H, MeC=O); 2.09 (s, 3 H, MeC=O); 3.19, 3.37 (both dd, ABX system, CH_2, J_{AB} = 12.8 Hz, J_{AX} = 8.1 Hz, J_{BX} = 7.4 Hz); 5.87 (br.t, 1 H, NCH, *J* = 7.8 Hz); 7.34—7.48 (m, 5 H, Ph).

1-(1-Acetoxycyclohexyl)-3-(*N*-acetyl-*N*-acetoxy)amino-3-phenylpropan-1-one (17b) was obtained by method ***E*** through the acylation of compound **7a**, a light crystallizing oil, the yield was 0.22 g (38%), m.p. 169—170 °C. Found (%): C, 64.47; H, 6.79; N, 3.30. $C_{21}H_{27}NO_6$. Calculated (%): C, 64.76; H, 6.99; N, 3.60. IR, ν/cm^{-1}: 1796, 1764, 1736 (C=O, ester), 1704 (C=O), 1676 (C=O, amide). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.06—1.72 (m, 10 H, CH_2); 2.08, 2.12 (both s, in the ratio ~2 : 1, 9 H, MeC=O); 3.12, 3.31 (both dd, ABX system, 1 H each, CH_2, J_{AB} = 12.6 Hz, J_{AX} = 8.0 Hz, J_{BX} = 7.2 Hz); 5.84 (br.t, 1 H, NCH, *J* = 6.4 Hz); 7.22—7.38 (m, 5 H, Ph). ^{13}C NMR ($CDCl_3$), δ: 18.07, 20.95, 23.40, 24.75, 30.55, 30.76, 37.83, 57.85, 83.31, 85.12, 118.77, 127.64, 128.04, 128.36, 128.71, 130.34, 137.38, 143.93, 167.72, 170.20, 205.33 (C=O). MS, *m/z* (I_{rel} (%)): 389 $[M]^+$ (6), 331 (13), 330 (12), 288 (31), 270 (47), 256 (63), 249 (51), 229 (32), 214 (43), 212 (47), 174 (38), 164 (148), 163 (66), 161 (41), 146 (42), 141 (68), 131 (100), 124 (37), 122 (49), 109 (83), 104 (97), 103 (66), 99 (93), 91 (37), 81 (93), 67 (53), 57 (64), 51 (68).

2-Acetoxy-2-methyl-5-phenylpent-4-en-3-one (18a) was obtained by method ***F*** through the acetylation of alcohol **2a**, the yield was 81%, m.p. 82—83 °C (*cf.* Ref. 18: m.p. 83—84 °C). IR, ν/cm^{-1}: 1728 (OC=O), 1688 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.57 (s, 6 H, Me); 2.12 (s, 3 H, MeC=O); 6.96, 7.78 (both d, 1 H each, CH=CH, J = 16.0 Hz); 7.38 (m, 3 H, Ph); 7.56 (m, 2 H, Ph).

Compound **18a** was also synthesized according to method ***E*** by acetylation of isoxazolidine **6a**, the yield was 12%. The ^{1}H NMR spectra of the samples obtained by methods ***E*** and ***F*** are identical.

1-(1-Acetoxycyclohexyl)-3-phenylprop-2-en-1-one (18b) was obtained by method ***E*** through the acylation of isoxazolidine **7a**, the yield was 16%, m.p. 68—70 °C (from hexane—AcOEt). UV, λ_{max}/nm (ε): 240 (24700). IR, ν/cm^{-1}: 1724 (OC=O), 1696 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.31 (m, 1 H, CH_2); 1.49—1.84 (m, 9 H, CH_2); 2.12 (s, 3 H, Me); 6.96, 7.76 (both d, 1 H each, CH=CH, J = 16.0 Hz); 7.36 (m, 3 H, Ph); 7.55 (m, 2 H, Ph).

2-Acetoxy-5-(4-methoxyphenyl)-2-methylpent-4-en-3-one (18c) was obtained by method ***E*** through the acetylation of isoxazolidine **6b**, the yield was 17%, m.p. 75—76 °C (from hexane). UV, λ_{max}/nm (ε): 325 (36500). IR, ν/cm^{-1}: 1730 (OC=O), 1686 (C=O). ^{1}H NMR (300 MHz, $CDCl_3$), δ: 1.52 (s, 6 H, Me); 2.09 (s, 3 H, MeC=O); 3.83 (s, 3 H, OMe); 6.84, 7.73 (both d, 1 H each, CH=CH, J = 16.0 Hz); 6.89, 7.49 (both d, 2 H each, Ar, J = 8.0 Hz).

Compound **18c** was also synthesized according to method ***F*** by acetylation of alcohol **3a**, the yield was 82%. The spectral characteristics of the samples obtained by methods ***E*** and ***F*** are identical.

1-(1-Acetoxycyclohexyl)-3-(4-methoxyphenyl)prop-2-en-1-one (18d) was obtained by method ***G*** through the acetylation of isoxazolidine **7b**, the yield was 43%, m.p. 85—86 °C (from hexane—AcOEt). UV, λ_{max}/nm (ε): 325 (24500). IR, ν/cm^{-1}: 1736 (OC=O), 1680 (C=O). ^{1}H NMR (300 MHz, DMSO-d_6), δ: 1.32 (m, 1 H, CH_2); 1.42—1.78 (m, 7 H, CH_2); 1.96—2.10 (m, 2 H, CH_2); 2.12 (s, 3 H, MeC=O); 3.82 (s, 3 H, MeO); 6.92, 7.54 (both d, 1 H each, CH=CH, J = 16.0 Hz); 7.56 (m, 2 H, Ar); 7.62 (d, 2 H, Ar, J = 8.0 Hz).

Hydroxyenone **3b** was also isolated as a side product in 20% yield.

N*-Acetyl-5-hydroxy-5-(2-hydroxyprop-2-yl)-3-phenylisoxazolidine (19a)** was obtained by method ***G from isoxazolidine **6a**, the yield was 0.33 g (41%), m.p. 142—144 °C (from AcOEt—light petroleum). Found (%): C, 63.08; H, 7.12; N, 4.99. $C_{14}H_{19}NO_4$. Calculated (%): C, 63.38; H, 7.22; N, 5.28. IR, ν/cm^{-1}: 3436, 3376, 1648 (NC=O). ^{1}H NMR (300 MHz, $CDCl_3$—DMSO-d_6 (4 : 1)), δ: 1.21, 1.29 (both s, 3 H each, Me); 2.11 (s, 3 H, MeC=O); 2.41—2.64 (m, 2 H, H(4)); 4.32, 6.07 (both br.s, 1 H each, OH); 5.41 (t, 1 H, H(3), J = 7.6 Hz); 7.10—7.40 (m, 5 H, Ph). ^{13}C NMR ($CDCl_3$), δ: 20.97, 24.36, 25.0, 44.02, 59.74, 72.98, 110.16, 125.76, 126.0, 127.38, 128.72, 141.45, 174.52 (N—C=O). MS, m/z (I_{rel} (%)): 265 [M]$^+$ (17), 248 (14), 223 (22), 207 (16), 206 (31), 191 (76), 193 (30), 179 (31), 164 (18), 163 (43), 162 (32), 147 (32), 145 (39), 133 (32), 132 (41), 131 (72), 106 (57), 104 (100), 103 (58), 91 (32), 77 (38), 69 (43), 59 (91), 51 (67), 42 (53).

N*-Acetyl-5-hydroxy-5-(1-hydroxycyclohexyl)-3-phenylisoxazolidine (19b)** was obtained by method ***G from isoxazolidine **7a**, the yield was 0.36 g (39%), m.p. 123—124 °C (from AcOEt—hexane). Found (%): C, 66.71; H, 7.40; N, 4.42. $C_{17}H_{23}NO_4$. Calculated (%): C, 66.86; H, 7.59; N, 4.59. IR, ν/cm^{-1}: 3460 br, 1662 (NC=O). ^{1}H NMR (500 MHz, $CDCl_3$), δ: 0.91—1.89 (m, 10 H, CH_2); 2.16 (s, 3 H, MeC=O); 2.44 (dd, 1 H, H(4), J = 12.1 Hz, J = 6.9 Hz); 2.70 (dd, 1 H, H(4), J = 12.1 Hz, J = 9.3 Hz); 3.40, 5.24 (both br.s, 1 H each, OH); 5.61 (br.t, 1 H, H(3), J = 7.8 Hz); 7.29—7.35 (m, 5 H, Ph). ^{13}C NMR ($CDCl_3$), δ: 20.86, 20.98, 21.13. 25.15, 25.39, 31.01, 31.58, 43.77, 59.60, 73.92, 110.28 (O—C—O), 125.79, 127.33, 128.70, 141.61, 174.55 (NC=O). MS, m/z (I_{rel} (%)): 305 [M]$^+$ (50), 231 (55), 214 (29), 213 (57), 206 (48), 179 (83), 173 (52), 164 (77), 163 (84), 140 (42), 133 (57), 132 (86), 131 (85), 122 (43), 129 (47), 109 (43), 105 (87), 104 (95), 103 (81), 91 (49), 81 (74), 77 (92), 69 (47), 55 (100).

N*-Acetyl-5-hydroxy-5-(1-methylcyclohexyl)-3-phenylisoxazolidine (20)** was obtained by method ***G through the acylation of isoxazolidine **9a**, the yield was 0.51 g (46%), a mixture of two isomers (~2 : 1), m.p. 138—139 °C (from ethyl acetate—hexane). Found (%): C, 71.01; H, 8.22; N, 4.29. $C_{18}H_{25}NO_3$. Calculated (%): C, 71.25; H, 8.31; N, 4.62. IR, ν/cm^{-1}: 3224, 1648 (NC=O). ^{1}H NMR (500 MHz, DMSO-d_6), δ: 0.99, 1.01 (both s, 3 H, Me); 1.02—1.59 (m, 8 H, CH_2); 1.80—1.91 (both m, 2 H, CH_2); 1.95, 2.06 (both br.s, in the ratio ~2 : 1, 3 H, MeCO); 2.23 (dd, 0.33 H, H(4), J = 12.7 Hz, J = 7.5 Hz); 2.57 (dd, 0.33 H, H(4), J = 12.7 Hz, J = 6.2 Hz); 3.09, 3.22 (both m, 0.67 H each, H(4)); 5.38 (t, 0.33 H, H(3), J = 7.8 Hz); 5.88 (br.s, 0.67 H, H(3)); 6.21 (s, 0.33 H, OH); 7.22—7.38 (m, 5 H, Ph); 9.58 (br.s, 0.67 H, OH). ^{13}C NMR (DMSO-d_6), δ: 17.86, 20.65, 21.00, 21.11, 22.21, 22.40. 22.30, 24.02. 25.29. 25.63, 30.82, 30.89, 33.86, 43.58, 47.45, 53.79, 59.03, 111.02 (O—C—O), 122.02, 125.73, 126.87, 127.11, 127.48, 128.06, 140.14, 142.68, an additional signal was found at 211.50 (C=O).

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Received April 19, 2011;
in revised form January 10, 2012