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NMR Study on Substituted Phenyl Furoisoxazolines

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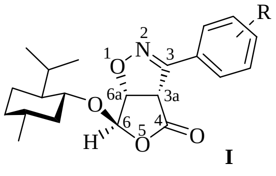
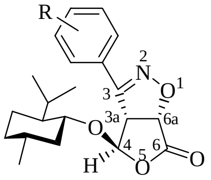
Abstract: The configurations of substituted phenyl furoisoxazolines were determined by study on their ^{1}H-NMR and 1D NOESY. The characteristic chemical shifts of the γ-lactone ring protons in ^{1}H-NMR were also discussed.

Keywords: ^{1}H-NMR, NOE, configuration, phenyl furoisoxazoline.

Recently we reported that phenyl furoisoxazolines **Ia** and **IIa** were synthesized by 1,3-dipolar cycloaddition of 5-(R)-(l-menthyloxy)-2(5H)-furanone with benzonitrile oxide using *in situ* method[1]. It was difficult to decide which one was **Ia** or **IIa** only by the ^{1}H-NMR and ^{13}C-NMR of these two compounds, so their 1D NOESY and HMBC were investigated and the configurations were finally confirmed by the relationships between the new-formed and the known chiral centers[1].



I



II

a: R=H, b: R=*p*-methoxy, c: R=*p*-nitro, d: R=*p*-trifluoromethyl, e: R=2,4-dinitro, f: R=3,4-methylenedioxy, g: R=3,4,5-trimethoxy

Now several new derivatives of these compounds with substituted groups in the phenyl ring were synthesized[2] and some characteristics of chemical shifts of the protons on the γ-lactone ring of **I** and **II** were observed. As shown in **Table 1**, the chemical shifts of C-6a protons in compound **I** are rather downfield than those of C-3a protons in compound **II**, whereas the chemical shifts of C-3a protons in compound **I** are more upfield than those of C-6a protons in compound **II**, these may be caused by the deshielding effect of the electron-withdrawing O on position 1. On the other hand, when the chemical shifts of C-3a protons in both compounds **I** and **II** were compared, the former was rather downfield, this may be due to the deshielding effect of the neighbouring carbonyl group in compound **I**. Because of the same effect, the chemical shifts of C-6a protons in compound **II** are also downfield than those in compound **I**. Therefore, it is obvious from the **Table 1** that there are some regular differences in δ values of the ^{1}H-NMR of **I** and **II**, i.e the differences between the δ values of C-3a and C-6a protons in compound **I** are approximately 0.5~0.6ppm and in compound **II** the values are 1 ppm. The chemical shifts of C-3a protons in compound **I** are higher than 4.6 ppm, in the meantime those of C-3a protons in compound **II** are lower than 4.5 ppm.

Table 1 The chemical shifts of γ-lactone protons of **Ia~c** and **IIa~c**

Compound	I			II		
	C-3a	C-6a	6	C-3a	C-6a	4
a	4.70	5.24	5.83	4.41	5.44	5.71
b	4.67	5.21	5.82	4.37	5.40	5.70
c	4.74	5.33	5.88	4.43	5.53	5.70

^{1}H-NMR spectra were recorded on an INOVA-500 spectrometer for solution in $CDCl_3$ with tetramethylsilane(TMS) as internal standard.

When *p*-trifluoromethyl and two or three substituted groups were introduced into the phenyl ring as reactants, we separated only one derivative in each case. Using the rule discussed above, the configurations of these compounds were assigned to **I** (shown in **Table 2**). In order to check our proposal, these compounds were also submitted to NOE examinations and the results showed its validity.

Table 2 The chemical shifts of γ-lactone protons of **Id~g**

Compound	I		
	C-3a	C-6a	6
d	4.71	5.30	5.86
e	4.70	5.42	5.91
f	4.62	5.21	5.82
g	4.67	5.25	5.82

^{1}H-NMR spectra were recorded under the same condition as **Table 1**.

Thus, the configurations of substituted phenyl furoisoxazolines, the adducts of benzonitrile oxide to 5-(R)-(l-menthyloxy)-2(5H)-furanone, can be determined unambiguously by analysis of their ^{1}H-NMR.

References

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