11. A. E. Lipkin, Zh. Org. Khim., 33, 169 (1963).
12. I. M. Sosonkin, G. N. Strogov, T. K. Ponomareva, A. N. Domarev, A. A. Glushkova, and G. N. Freidlin, Khim. Geterosikl. Soedin., No. 2, 195 (1981).

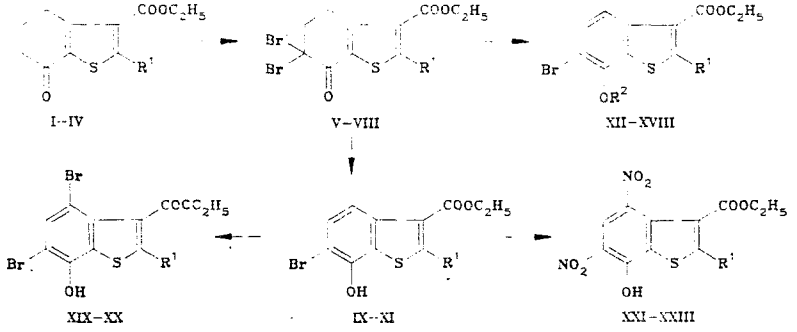
SYNTHESIS OF DERIVATIVES OF 2-ACYLAMINO-7-OXYBENZO[b]THIOPHENE. BROMINATION AND NITRATION

A. N. Grinev, I. A. Kharizomenova, M. V. Kapustina, Yu. N. Sheinker, L. M. Alekseeva, and N. M. Rubtsov

UDC 547.735.07:542.944.1:543.422

Bromination of 2-acylamino-3-ethoxycarbonyl-7-oxo-4,5,6,7-tetrahydrobenzo[b]-thiophenes has been studied. This reaction affords 2-acylamino-6,6-dibromo-3-ethoxycarbonyl-7-oxo-4,5,6,7-tetrahydrobenzo[b]thiophene, which on dehydrobromination gives 6-bromo-7-oxybenzo[b]thiophene derivatives. The 4,6-dibromo- and 4,6-dinitro-7-oxybenzo[b]thiophenes were also obtained.

Bromination of the 7-oxo-4,5,6,7-tetrahydrobenzo[b]thiophenes (I-IV) [1] with 2 moles of bromine gave the 6,6-dibromoderivatives (V-VIII), the structures of which were confirmed by PMR spectra. The PMR spectrum of the 6,6-dibromoderivative V contained a multiplet at 3.19 ppm from the two CH_2 groups at positions 4 and 5. In order to synthesize 6-bromo-7-oxybenzo-[b]thiophenes (IX, X), the dibromosubstituted compounds V and VII were dehydrobrominated using potassium carbonate. The PMR spectrum of the oxybenzo[b]thiophene IX contained doublets at 7.59 and 7.50 ppm corresponding to the two aromatic protons 4-H and 5-H, respectively. The structures of the compounds were also confirmed from IR spectra. In the spectra of compounds IX, the OH group absorbed at 3360 cm^{-1}, and the CO group absorbed at 1700-1650 cm^{-1}. We also prepared methoxy (XII, XIII), benzyloxy- (XIV), p-bromophenacyloxy- (XV, XVI), and acetoxy derivatives (XVII, XVIII) of benzo[b]thiophene. Bromination of compounds IX and X gave the 4,6-dibromoderivatives XIX, XX, which is in agreement with literature data [2]. Nitration of the 6-bromobenzo[b]thiophenes IX and X, and the previously obtained [1] XI, with nitric acid, takes place at the 4 position; replacement of the bromine by a nitro group also occurs. The PMR spectra of compounds XIX and XXI contained singlets at 7.72 and 8.67 ppm, respectively, arising from the aromatic protons at the 5 position. Nitration of compound XI occurred also at the benzene ring, confirmed by the presence of singlets in the PMR spectra of compound XXII at 8.53 and 8.75 ppm from the protons at positions 2 and 5.



I, V, IX, XII, XIV, XV, XVII, XIX, XXI R^1=$NHCOCH_3$; II, VI R^1=$NHCOCH_2CH_3$; III, VII, X, XIII, XVI, XVIII, XX, XXIII R^1=$NHCOC_6H_5$; IV, VIII R^1=$NHCOCH_2Cl$; XI, XXII R^1=H; XII, XIII R^2=CH_3; XIV R^2=$CH_2C_6H_5$; XV, XVI R^2=$CH_2COC_6H_4Br$-(*p*); XVII, XVIII R^2=$COCH_3$

S. Ordzhonikidze All-Union Scientific-Research Institute of Pharmaceutical Chemistry, Moscow 119815. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 4, pp. 460-462, April, 1987. Original article submitted June 27, 1985.

 0009-3122/87/2304-0384$12.50

TABLE 1. Physico-chemical Data for Compounds Prepared

Compound	mp, °C*	Found, %					Empirical formula	Calculated, %					Yield, %
		C	H	Br	N	S		C	H	Br	N	S	
V	145—146	35,5	3,3	36,4	3,1	7,0	$C_{13}H_{13}Br_2NO_4S$	35,6	3,0	36,4	3,2	7,3	77,5
VI	156—157	36,8	3,2	35,3	3,0	7,4	$C_{14}H_{15}Br_2NO_4S$	37,0	3,3	35,3	3,1	7,1	59,6
VII	200—201	43,4	3,3	31,8	2,7	6,3	$C_{18}H_{15}Br_2NO_4S$	43,1	3,0	31,9	2,8	6,4	76,8
VIII	142—143	32,9	3,4	33,4	2,9	7,0	$C_{13}H_{12}Br_2ClNO_4$	33,0	2,6	33,7	3,0	6,8	65,4
IX	261—262	43,4	3,5	22,3	3,8	8,7	$C_{13}H_{12}BrNO_4S$	43,6	3,4	22,3	3,9	8,9	79,1
X	245—246	51,3	3,4	19,0	3,1	7,6	$C_{18}H_{14}BrNO_4S$	51,4	3,4	19,1	3,3	7,6	46,3
XII	182—183	45,2	4,0	21,3	3,7	8,8	$C_{14}H_{14}BrNO_4S$	45,2	3,8	21,5	3,8	8,6	64,4
XIII	184—185	52,7	3,7	18,3	3,0	7,3	$C_{19}H_{16}BrNO_4S$	52,5	3,7	18,4	3,2	7,4	80,4
XIV	150—151	53,4	4,0	18,0	2,9	7,3	$C_{20}H_{17}BrNO_4S$	53,7	3,8	17,9	3,1	7,2	71,0
XV	180—181	45,1	3,0	29,0	2,3	5,9	$C_{21}H_{17}Br_2NO_5S$	45,4	3,0	28,8	2,5	5,8	65,0
XVI	190—191	50,2	3,3	26,0	2,0	5,1	$C_{26}H_{19}Br_2NO_5S$	50,6	3,1	25,9	2,3	5,2	58,0
XVII	215—216	44,8	3,5	20,0	3,4	8,0	$C_{15}H_{14}BrNO_5S$	45,0	3,5	20,0	3,5	8,0	71,0
XVIII	204—205	52,0	3,3	17,3	2,8	7,0	$C_{20}H_{16}BrNO_5S$	51,9	3,5	17,3	3,0	6,9	77,6
XIX	198—199	35,9	2,7	36,4	3,1	7,2	$C_{13}H_{11}Br_2NO_4S$	35,7	2,5	36,6	3,2	7,3	61,5
XX	231—232	43,1	2,6	31,9	2,5	6,4	$C_{18}H_{13}Br_2NO_4S$	43,3	2,6	32,0	2,8	6,4	82,2
XXI	198—199	42,2	3,0		11,3	8,5	$C_{13}H_{11}N_3O_8S$	42,3	3,0		11,4	8,7	48,5
XXII	164—165	41,8	2,6		9,0	10,2	$C_{11}H_8N_2O_7S$	42,3	2,6		9,0	10,3	45,3
XXIII	266—267	50,5	3,1		10,0	7,1	$C_{18}H_{13}N_3O_8S$	50,1	3,0		9,7	7,4	31,6

*Compounds V-X, XII-XX were recrystallized from a 3:1 mixture of alcohol and dioxane, and compounds XXI-XXIII from acetic acid.

EXPERIMENTAL

PMR spectra were taken on a Varian XL-200 spectrometer (internal standard — TMS), and IR spectra on a Perkin-Elmer 599.

Physico-chemical data for the compounds are given in Table 1.

2-Propionylamino-3-ethoxycarbonyl-7-oxo-4,5,6,7-tetrahydrobenzo[b]thiophene (II) was obtained in the same way as compounds I, III, and IV [1]. Yield 62.3%, mp 161-162°C (metnanol). IR spectra: 1640, 1700 (CO), 3250 cm^{-1} (NH). Found, %: C 57.1, H 5.6, N 4.8, S 10.7. Calculated, %: C 56.9, H 5.8, N 4.7, S 10.9.

2-Acylamino-6,6-dibromo-3-ethoxycarbonyl-4,5,6,7-tetrahydrobenzo[b]thiophenes (V-VIII). To a solution of 0.05 moles of compounds I-IV in 125 ml of chloroform with mixing was added 5.6 ml (0.11 mole) of bromine in 25 ml of chloroform. The reaction mixture was heated to boiling and allowed to stand at 20°C for 18 h, washed with water, the chloroform removed, and methanol added to the residue. The precipitated material was filtered off.

2-Acylamino-6-bromo-7-oxy-3-ethoxycarbonylbenzo[b]thiophene (IX, X). To a boiling solution of 0.1 mole of compounds V, VII in 200 ml of dioxane was added a solution of 20 g of potassium carbonate in 40 ml of water. The reaction mixture was refluxed with mixing for 30 min, cooled, and the precipitated material filtered off. The precipitate was stirred with 100 ml of acetic acid for 30 min, filtered, and washed with methanol.

2-Acylamino-6-bromo-7-methoxy-3-ethoxycarbonylbenzo[b]thiophenes (XII, XIII), 2-Acetylamino-6-bromo-7-benzyloxy-3-ethoxycarbonylbenzo[b]thiophene (XIV), and 2-Acylamino-6-bromo-7-(4-bromophenacyloxy)-3-ethoxycarbonylbenzo[b]thiophenes (XV, XVI). To a refluxing solution of 0.017 mole of compounds V, VII in 35 ml of dioxane was added a solution of 3.4 g of potassium carbonate in 6.5 ml of water. The reaction mixture was stirred and refluxed for 30 min, cooled and the precipitated material filtered off and suspended in 30 ml of dioxane. To the suspension was added: a) for the synthesis of the 7-methoxy derivatives XII and XIII, 1.14 ml (0.012 mole) of dimethylsulfate and 5 ml of water, the reaction mixture refluxed for 30 min, cooled, and the precipitated compounds XII or XIII filtered off; b) for the synthesis of the benzyloxy derivative XIV — 1.38 ml (0.012 mole) of benzyl chloride and 5 ml of water, the reaction mixture refluxed for 3 h, cooled, and the precipitated compound XIV filtered off; c) for the synthesis of 7-(4-bromophenacyloxy)benzo[b]thiophenes XV, XVI — 2.78 g (0.01 mole) of 4-bromophenacylbromide, 10 ml of methanol, the reaction mixture refluxed for 1 h and 30 min, cooled, and the precipitated compounds XV and XVI filtered and washed with water and alcohol.

2-Acylamino-7-acetoxy-6-bromo-3-ethoxycarbonylbenzo[b]thiophenes (XVII, XVIII). To a refluxing solution of 0.017 mole of compound V or VII in 35 ml of dioxane was added a solution of 3.4 ml of potassium carbonate in 6.5 ml of water. The reaction mixture was refluxed for 30 min. When cool, the precipitated material was filtered off, washed with alcohol and 20 ml

of acetic anhydride added. The reaction mixture was refluxed for 2 h and 30 min, cooled, and poured into water. The precipitated material was filtered off, and washed with alcohol.

2-Acylamino-4,6-dibromo-7-hydroxy-3-ethoxycarbonylbenzo[b]thiophenes (XIX, XX). To a refluxing suspension of 0.028 mole of compounds IX or X and a catalytic amount of benzoyl peroxide in 250 ml of chloroform was slowly added a solution of 1.7 ml (0.033 mole) of bromine in 25 ml of chloroform, and the reaction mixture refluxed for 3 h and then allowed to stand at 20°C for 18 h. After washing with water, the chloroform was removed, alcohol added to the residue and the precipitated material filtered off.

2-Acylamino-4,6-dinitro-7-hydroxy-3-ethoxycarbonylbenzo[b]thiophenes (XXI-XXIII). To a suspension of 0.03 mole of compounds IX-XI in 90 ml of acetic acid was added 7 ml of nitric acid (d = 1.42 g/ml). The reaction mixture was refluxed for 5 min, cooled, and the precipitated material filtered off and washed with alcohol.

LITERATURE CITED

1. I. A. Kharizomenova, M. V. Kapustina, A. N. Grinev, Yu. N. Sheinker, L. M. Alekseeva, and E. F. Kuleshova, Khim. Geterosikl. Soedin., No. 2, 1626 (1984).
2. K. Gewald and G. Neumann, Chem. Ber., 101, 1933 (1968).

SULFINYL AND SULFONYL DERIVATIVES OF ARYL SUBSTITUTED cis-1-THIADECALINS

S. K. Klimenko, N. N. Sorokin, T. I. Tyrina, and T. V. Stolbova

UDC 547.818:542.422.25

Individual 2α-aryl- and 2α,4α-diaryl-cis-thiadecalin-1β-oxides and 1,1-dioxides have been synthesized. The effect of sulfinyl and sulfonyl groups has been observed on the chemical shifts of carbon atoms in these conformationally homogeneous, stereochemically similar systems.

In a continuation of studies of cis-1-thiadecalins I-VII [1, 2] a number of new and previously known 2α-aryl- and 2α,4α-diaryl-cis-1-thiadecalin 1-oxides VIII-XIV and 1,1-dioxides XV-XXI were synthesized. Their ^{13}C NMR spectra were studied in order to reveal the effect of sulfinyl and sulfonyl groups on the unusual conformationally homogeneous derivatives of cis-1-thiadecalin.

Only the ^{13}C NMR spectra of the diastereomeric cis-1-thiadecalin-1-oxides [3], and cis-1-thiadecalin-1-N-4-chlorophenylimide and its homologs [4] have been described previously. At the same time, derivatives of trans-1-thiadecalin and its homologs, viz., sulfoxides [5], sulfones [5], and sulfimides [4], have been studied relatively fully.

The oxidant was 30% hydrogen peroxide. Individual thiadecalins I-VII [2] were oxidized in glacial acetic acid. Sulfoxides VIII-XIV were synthesized by oxidation with an equimolar amount of oxidant at 20°C; sulfones XV-XXI, with a fivefold excess of oxidant at 20-50°C. Yields were 53-73 and 70-93%, respectively (Table 1).

In the oxidation of cyclic sulfides we can expect the formation of diastereomeric sulfoxides with equatorially or axially disposed S—O groups. If the equatorial S—O in sulfoxides VIII-XIV is located in the gauche position with respect to two C—H bonds and two C—C bonds, then the axial S—O in diastereomers VIIIa-XIVa should be in gauche position to the four C—C bonds, and moreover should be substantially destablized due to the 1,3-interactions in the heterocycle.

N. G. Chernyshevskii Saratov State University, Saratov 410600.

Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 4, pp. 463-467, April, 1987. Original article received July 15, 1985; revision submitted January 15, 1986.

0009-3122/87/2304-0386$12.50