Aminoketone, oxazole and thiazole synthesis. Part 15.[1] 2-[4-(4-Halobenzenesulphonyl)-phenyl]-5-aryloxazoles

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Abstract

Acylaminoacylation of aromatic hydrocarbons (benzene, toluene, *meta*-xylene, mesitylene) with 2-[4-benzenesulfonyl-(4-halophenyl)]-5-oxazolones in the presence of anhydrous aluminum chloride leads to 2-aza-1,4-diones **5** which cyclize under the action of phosphorus oxychloride yielding the corresponding 2-[4-(4-halobenzenesulphonyl)-phenyl]-5-aryloxazoles **6**. The *para*-halogens are chloro or bromo atoms. Electronic absorption, vibrational, ^{1}H-NMR and 13C-NMR spectral data are presented. The UV and NMR spectra provide evidence for the non-coplanarity of the oxazole and mesityl rings.

Keywords: Amoinoketone, oxazole, thiazole, acylaminoacylation, synthesis

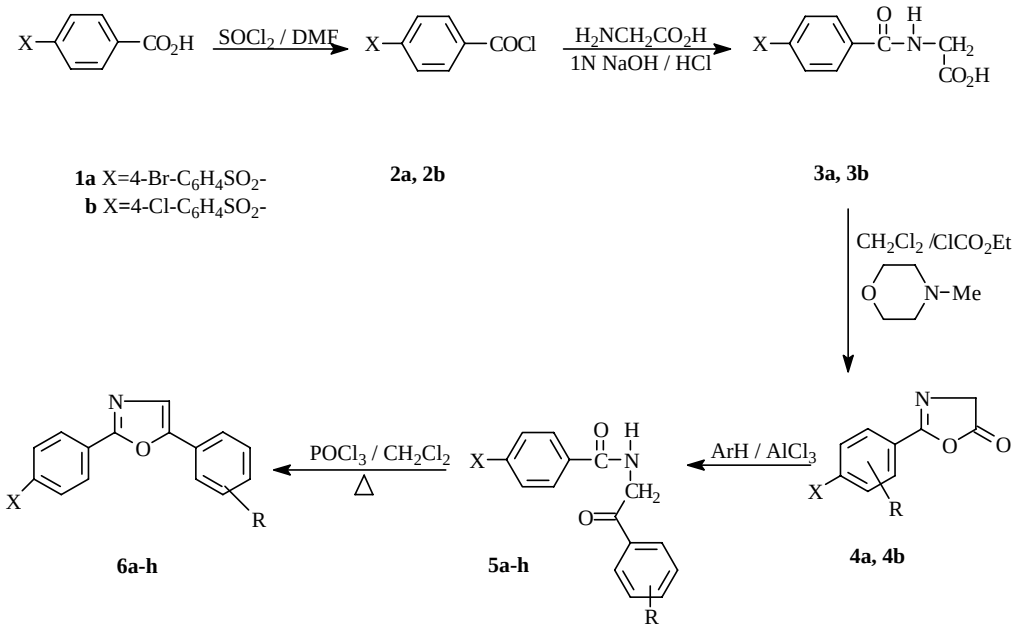
Introduction

In continuation of the previous part in this series,[1] we now report the preparation of new 2,5-diaryloxazoles wherein the 2-aryl group is 4-[4-chloro- or 4-bromo-benzenesulfonyl)-phenyl]. Such 2,5-diaryloxazoles **6a-h** (Scheme 1) which are potential fluorescent sensors, laser dyes, and scintillators for detecting nuclear radiations[3] have been prepared by extending our earlier method[2] by reacting 2-oxazolones (azlactones) **4a-b** with benzene, toluene, *m*-xylene and mesitylene under Friedel-Crafts reaction conditions to afford the corresponding ketones **5a-h**, in

68-88% overall yields. These intermediates were then treated with phosphorus oxychloride in refluxing dichloromethane to afford the corresponding oxazoles **6a-h** in 85-92% overall yields.

Results and Discussion

The key intermediates involved in the synthesis of desired oxazoles **6a-h** are described in Scheme 1. Thus 4-bromo- (**1a)** and 4-chloro–benzenesulfonyl benzoic acids (**1b**) were converted into the corresponding acid chlorides **2a** and **2b** by reacting **1a** and **1b** with thionyl chloride in dimethylformamide.[4-6] The acid chlorides thus obtained were then treated with glycine according to Steiger's procedure,[7] to afford the corresponding hippuric acids **3a-b** which were dehydrated to the respective azlactones **4a-b**. The azlactones were then reacted with benzene, toluene, *m*-xylene and mesitylene under Friedel-Crafts reaction conditions using anhydrous aluminum chloride in the presence of excess reactant as a solvent. After workup, the corresponding ketones **5a-h** were purified and their structures were confirmed by their analytical and spectral data (Table 1). These intermediates **5a-h** were then dehydrated in the presence of phosphorus oxychloride in refluxing dichloromethane to afford the corresponding oxazoles **6a-h** in 85-92% overall yields.



1a X=4-Br-$C_6H_4SO_2$-
b X=4-Cl-$C_6H_4SO_2$-

2a, 2b

3a, 3b

4a, 4b

5a-h

6a-h

5, 6 a X=4-Br-$C_6H_4SO_2$, R=C_6H_5
b X=4-Cl-$C_6H_4SO_2$, R=C_6H_5
c X=4-Br-$C_6H_4SO_2$, R=4-Me-C_6H_4
d X=4-Cl-$C_6H_4SO_2$, R=4-Me-C_6H_4
e X=4-Br-$C_6H_4SO_2$, R=2,4-$(Me)_2C_6H_4$
f X=4-Cl-$C_6H_4SO_2$, R=2,4-$(Me)_2C_6H_4$
g X=4-Br-$C_6H_4SO_2$, R=2,4,6-$(Me)_3C_6H_2$
h X=4-Cl-$C_6H_4SO_2$, R=2,4,6-$(Me)_3C_6H_2$

Scheme-1

Table 1. *N*-[4-(4-Halobenzenesulphonylphenyl)-aroyl]-phenacylamine derivatives, **5**

Comp	Ar	m.p.	Yeild	Formula	Anal. N (%)	ν(NH)	ν(C=O)	ν(SO_2)
		(º)	(%)		Calc./Found	(cm^{-1})	(cm^{-1})	(cm^{-1})
5a	C_6H_5	199	72	$C_{21}H_{16}BrNO_4S$	3.06 / 2.78	3390	1650,1692	1150,1320
5b	C_6H_5	203	68	$C_{21}H_{16}ClNO_4S$	3.38 / 3.25	3388	1649,1693	1152,1321
5c	4-MeC_6H_4	206	88	$C_{22}H_{18}BrNO_4S$	2.97 / 2.85	3368	1636,1698	1154,1323
5d	4-MeC_6H_4	199	88	$C_{22}H_{18}ClNO_4S$	3.27 / 3.12	3367	1635,1698	1153,1323
5e	2,4-$Me_2C_6H_3$	148	84	$C_{23}H_{20}BrNO_4S$	2.88 / 2.85	3412	1657,1676	1157,1323
5f	2,4-$Me_2C_6H_3$	149	85	$C_{23}H_{20}ClNO_4S$	3.17 / 3.15	3377	1635,1706	1154,1323
5g	2,4,6-$Me_3C_6H_2$	166	83	$C_{24}H_{22}BrNO_4S$	2.80 / 2.62	3377	1662,1713	1156,1322
5h	2,4,6-$Me_3C_6H_2$	172	86	$C_{24}H_{22}ClNO_4S$	3.07 / 3.01	3421	1662,1713	1155,1323

The structures were confirmed by their analytical and spectral data (see Table 2 for analytical data).

Table 2. 2-(4-Halobenzenesulphonylphenyl)-5-aryloxazoles, **6**

Comp	Ar	m.p.	Formula	Anal. C (%)	Anal. H (%)	Anal. N (%)
		(ºC)		Calc./Found	Calc./Found	Calc./Found
6a	C_6H_5	185	$C_{21}H_{14}BrNO_3S$	57.28 / 57.14	3.20 / 3.05	3.18 / 3.03
6b	C_6H_5	200	$C_{21}H_{14}ClNO_3S$	63.71 / 63.54	3.56 / 3.41	3.54 / 3.41
6c	4-MeC_6H_4	235	$C_{22}H_{16}BrNO_3S$	58.15 / 57.02	3.55 / 3.50	3.08 / 2.85
6d	4-MeC_6H_4	236	$C_{22}H_{16}ClNO_3S$	64.46 / 64.17	3.93 / 3.81	3.42 / 3.12
6e	2,4-$Me_2C_6H_3$	202	$C_{23}H_{18}BrNO_3S$	59.98 / 58.81	3.87 / 3.72	2.99 / 2.78
6f	2,4-$Me_2C_6H_3$	153	$C_{23}H_{18}ClNO_3S$	65.16 / 64.95	4.28 / 4.25	3.30 / 3.12
6g	2,4,6-$Me_3C_6H_2$	179	$C_{24}H_{20}BrNO_3S$	59.75 / 59.48	4.18 / 4.02	2.90 / 2.66
6h	2,4,6-$Me_3C_6H_2$	164	$C_{24}H_{20}ClNO_3S$	65.82 / 65.80	4.60 / 4.44	3.20 / 3.05

The electronic spectra of **6a-h** were also recorded, and their absorption bands and extinction coefficients are described in Table 3.

Table 3. UV Spectra of oxazoles **6** in methanol

Comp	Ar	Absorption maxima: λ_{max} in nm ($\varepsilon\times10^{-4}$)			
6a	Phenyl	207(2.27)	236(1.56)	253(1.94)	334(2.20)
6b	Phenyl	208(2.11)	230(1.59)	250(1.71)	333(2.25)
6c	*p*-Tolyl	207(1.89)	240(1.34)	253(1.47)	338(2.16)
6d	*p*-Tolyl	207(1.68)	237(1.16)	250(1.24)	338(1.91)
6e	*m*-Xylyl	209(2.34)	243(2.27)	252(2.41)	334(2.80)
6f	*m*-Xylyl	209(2.66)		249(2.35)	333(2.03)
6g	Mesityl	209(2.92)		247(2.06)	310(2.56)
6h	Mesityl	211(2.90)		241(2.09)	313(2.76)

An evident hypsochromic effect for the longest-wavelength band (about 20 nm) can be observed for the two mesityl derivatives **6g** and **6h**. Its origin is the non-coplanarity of the 5-mesityl and oxazole rings due to steric hindrance. One *ortho*-methyl group as in the *meta*-xylyl derivatives **6e** and **6f** causes only a small hypsochromic shift (about 5 nm, if one takes into account also the extra electron-donating effect of methyl groups as evidenced by comparing the phenyl compounds **6a, 6b** with the *p*-tolyl congeners **6c, 6d**); a similar trend was observed for the congeneric systems devoid of halogen atoms.[1]

The ^{1}H-NMR data for azadiketones **5a-h** are presented in Table 4. The ^{1}H-NMR data for oxazoles **6a-h** are presented in Table 5. Data for oxazoles **6a-h** are described in Table 6. Tables 4-6 are placed before the Experimental Part.

From Tables 4 and 5 one can observe that there is a slight deshielding of the protons in the halogen-substituted ring (especially H-17) on increasing the electronegativity of the halogen, i. e. on changing the bromo to the chloro substituent. The sulfonyl group insulates in a fairly efficient manner from the remaining part of the molecule (except for the global electronegativity) the finer electronic effects of the halobenzene group, and this behavior is consistent with what had been observed earlier in ESR spectra of stable free radicals.[9-13]

There is an interesting trend in the chemical shifts of the oxazolic proton H-4. On going from a 5-phenyl to a 5-*para*-tolyl group, one can observe a deshielding of H-4 by 0.35 ppm. On increasing the number of methyl groups attached to the 5-phenyl ring (in the series *para*-tolyl - *meta*-xylyl - mesityl), the oxazolic proton H-4 becomes increasingly shielded; at the same time, the *ortho*-methyl protons in the 5-aryl group also become increasingly shielded. These observations are consistent with the non-coplanarity of the oxazolic and 5-aryl rings due to the presence of *ortho*-methyl substituents.

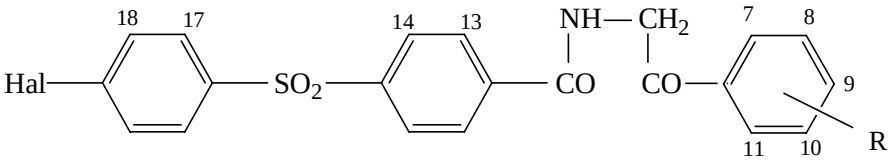


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Table 4. ^{1}H-NMR Spectra of N-[4-(4-Halobenzenesulphonylphenyl)-aroyl]-phenacylamine derivatives **5** in $CDCl_3$

Comp.	H-18	H-17	H-14	H-13	NH	CH_2
5a	7.89, d, 2H (8.8)	7.93, d, 2H (8.8)	8.12, d, 2H (9.1)	8.09, d, 2H (9.1)	9.13, t (5.6)	4.81, d, 2H (5.5)
5b	7.72, d, 2H (8.6)	8.00-8.10, m, 2H	8.12, d, 2H (9.0)	8.09, d, 2H (9.0)	9.16, t (5.5)	4.81, d, 2H (5.5)
5c	7.50, d, 2H (8.7)	7.85, d, 2H (8.7)	8.03, d, 2H (8.8)	7.99, d, 2H (8.8)	7.39, t (4.2)	4.91, d, 2H (4.2)
5d	7.50, d, 2H (8.7)	7.89, d, 2H (8.7)	8.02, d, 2H (8.9)	7.99, d, 2H (8.9)	7.39, t (4.2)	4.91, d, 2H (4.2)
5e	7.67, d, 2H (8.5)	7.82, d, 2H (8.5)	8.00, s, 2H	8.00, s, 2H	7.42, t (4.2)	4.91, d, 2H (4.2)
5f	7.50, d, 2H (8.8)	7.89, d, 2H (8.8)	8.03, d, 2H (9.1)	7.99, d, 2H (9.1)	7.38, t (4.3)	4.84, d, 2H (4.3)
5g	7.67, d, 2H (8.5)	7.82, d. 2H (8.5)	8.00, s, 2H	8.00, s, 2H	7.22, t (4.6)	4.56, d, 2H (4.6)
5h	7.50, d, 2H (8.8)	7.89, d, 2H (8.8)	8.02, d, 2H (9.0)	7.98, d, 2H (9.0)	7.17, t (4.7)	4.55, d, 2H (4.7)

Comp.	H-7	H-8	H-9	H-10	H-11	CH_3-*para*	CH_3-*ortho*
5a	8.04, dd, 2H (7.5, 1.3)	7.56, t, 1H (7.5)	7.68, tt, 1H (7.5, 1.3)	7.56, t, 1H (7.5)	8.04,dd, 2H(7.5,1.3)		
5b	8.00-8.10, m, 2H	7.55, t, 1H (7.7)	7.68, t, 1H (7.7)	7.55, t, 1H (7.7)	8.00-8.10, m, 2H		
5c	7.91, d, 2H (8.4)	7.30, d, 1H (8.4)		7.30, d, 1H (8.4)	7.91, d, 2H (8.4)	2.44, s, 3H	
5d	7.91, d, 2H (8.4)	7.32, d, 1H (8.4)		7.32, d, 1H (8.4)	7.91, d, 2H (8.4)	2.44, s, 3H	
5e		7.27, s, 1H		7.32, d, 1H (8.0)	7.91, d, 1H (8.0)	2.44, s, 3H	2.44, s, 3H
5f		7.15, s, 1H		7.11, d, 1H (8.1)	7.74, d, 1H (8.1)	2.44, s, 3H	2.44, s, 3H
5g		6.88, s, 1H		6.88, s, 1H		2.31, s, 3H	2.22, s, 6H
5h		6.88, s, 1H		6.88, s, 1H		2.30, s, 3H	2.22, s, 6H

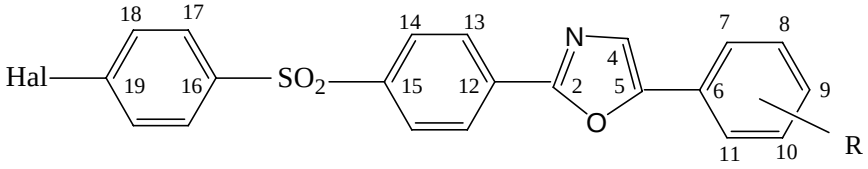

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Table 5. ^{1}H-NMR Spectra of oxazoles **6** in $CDCl_3$

Comp.	H-18	H-17	H-14	H-13	H-4	H-7
6aB	7.67, 2H, d, 8.7	7.84, 2H, d, 8.7	8.24, 2H, d, 8.8	8.04, 2H, d, 8.8	7.51, 1H, s	7.73, 1H, dd, 8.1, 1.6
6bB	7.38-7.52, 2H, m	7.92, 2H, d, 8.8	8.23, 2H, d, 8.8	8.04, 2H, d, 8.8	7.50, 1H, s	7.72, 1H, dd, 8.2, 1.2
6aT	7.71, 2H, d, 8.6	7.84, 2H, d, 8.6	8.28, 2H, d, 8.6	8.15, 2H, d, 8.6	7.82, 1H, s	
6bT	7.56, 2H, d, 8.8	7.92, 2H, d, 8.8	8.32, 2H, d, 8.9	8.18, 2H, d, 8.9	7.88, 1H, s	
6aX	7.63, 2H, d, 8.6	7.83, 2H, d, 8.6	8.22, 2H, d, 8.6	8.02, 2H, d, 8.6	7.34, 1H, s	
6bX	7.50, 2H, d, 8.8	7.91, 2H, d, 8.8	8.22, 2H, d, 8.8	8.03, 2H, d, 8.8	7.35, 1H, s	
6aM	7.66, 2H, d, 8.4	7.83, 2H, d, 8.4	8.30, 2H, d, 8.3	8.02, 2H, d, 8.3	7.17, 1H, s	
6bM	7.49, 2H, d, 8.6	7.90, 2H, d, 8.6	8.19, 2H, d, 8.4	8.02, 2H, d, 8.4	7.17, 1H, s	

Comp.	H-8	H-9	H-10	H-11	CH_3-*para*	*CH_3-ortho*
6aB	7.30-7.50, 3H, m	7.30-7.50, 1H, m	7.30-7.50, 3H, m	7.73, 1H, dd, 8.1, 1.6		
6bB	7.38-7.52, 1H, m	7.38-7.52, 1H, m	7.38-7.52, 1H, m	7.72, 1H, dd, 8.2, 1.2		
6aT	7.35, 2H, d, 8.1		7.35, 2H, d, 8.1	7.66, 2H, d, 8.1	2.44, 3H, s	
6bT	7.37, 2H, d, 8.2		7.37, 2H, d, 8.2	7.67, 2H, d, 8.2	2.45, 3H, s	
6aX	7.12, 1H, s		7.13, 1H, d, 8.3	7.68, 1H, d, 8.3	2.49, 3H, s	2.37, 3H, s
6bX	7.12, 1H, s		7.13, 1H, d, 8.5	7.64, 1H, d, 8.5	2.49, 3H, s	2.37, 3H, s
6aM	6.98, 2H, s		6.98, 2H, s		2.34, 3H, s	2.23, 6H, s
6bM	6.98, 2H, s		6.98, 2H, s		2.34, 3H, s	2.23, 6H, s

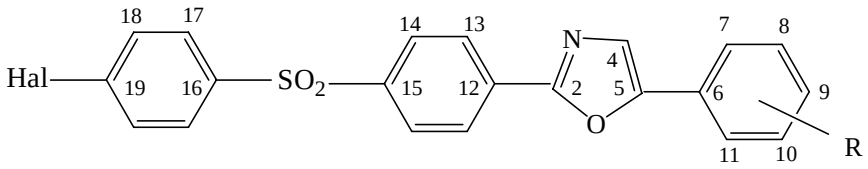

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Table 6. ^{13}C-NMR spectra of oxazoles **6** in DMSO

Comp.	C-2	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11
6a	159.09	123.95	152.55	127.32	124.44	29.06	129.06	129.06	124.44
6b	159.15	124.07	152.59	127.41	124.49	129.11	129.11	129.11	124.49
6c	158.56	124.95	154.76	127.13	124.95	130.21	138.69	130.21	124.95
6d	158.56	125.07	155.21	126.31	125.07	130.31	137.87	130.31	125.07
6e	158.51	126.12	152.27	123.91	135.01	132.13	139.11	127.08	126.99
6f	158.48	126.09	152.26	123.88	134.99	132.12	139.09	127.06	126.97

Table 6. Continued

6g	159.34	127.96	150.63	129.88	138.28	128.71	139.82	128.71	138.28
6h	159.36	127.89	150.69	123.27	138.25	128.71	139.79	128.71	138.25

Comp.	C-12	C-13	C-14	C-15	C-16	C-17	C-18	C-19	C-*ortho*	C-*para*
6a	129.37	128.27	126.97	142.16	140.25	129.23	132.74	128.79		
6b	131.79	128.31	127.01	142.24	140.27	129.24	129.81	139.78		
6c	129.91	128.85	128.16	144.64	141.79	129.36	133.14	129.91		21.53
6d	128.52	128.92	128.43	145.16	142.31	129.37	130.23	141.54		21.52
6e	131.88	128.26	126.88	141.99	140.31	129.28	132.72	128.75	21.21	21.74
6f	131.83	128.23	126.87	142.03	140.16	129.01	129.72	139.73	21.18	21.73
6g	132.04	128.25	126.79	142.01	140.32	129.19	132.69	132.04	20.64	21.15
6h	131.98	128.23	126.81	142.19	140.11	129.13	129.66	139.79	20.56	21.09

Experimental Section

General Procedures. NMR data were obtained with a Varian Gemini-300 instrument at 300 MHz for ^{1}H-NMR spectra and at 75 MHz for ^{13}C-NMR spectra. IR spectra were recorded with an FT-IR instrument, and UV spectra with a Perkin-Elmer Lambda-2 spectrophotometer.

General procedures for the synthesis of 4-(4-halobenzenesulfonyl)-benzoyl chlorides 2a and 2b

The acid chlorides **2a** and **2b** were prepared from their respective benzoic acids **1a** and **1b** using Vilsmeier procedure (thionyl chloride and dimethylformamide in benzene).[4] The bromo compound **2a** was obtained in about 90 % yield, had mp 154º C, IR bands at 1781 and 1937(C=O), 1331 and 1159 cm^{-1} (SO_2). Similarly the chloro product **2b** was obtained in about 90 % yield, had mp 138º C and IR bands at 1781 and 1738 (C=O), 1332 and 1163 cm^{-1} (SO_2).

Reaction of glycine with acid chlorides 2a and 2b. Formation of 4-(4-halobenzenesulfonyl)-hippuric acids 3a and 3b. Glycine (20mmol) in 20ml of 1N sodium hydroxide was cooled at 0-5º C and the cold solution was added dropwise to a solution of 20 mmol of acid chlorides **2a** or **2b** in 30ml of chloroform. The reaction mixture was continued under stirring for an additional one hour. The aqueous layer was separated and acidified with 2N hydrochloric acid. The products **3a** and **3b** were collected by filtration and recrystallized from 80% ethanol as colorless needles. The bromo compound **3a** was obtained in 82% yield and was analyzed for $C_{15}H_{12}BrNO_2S$. Required: C, 45.24, H, 3.04, N, 3.52%. Found: C, 45.06, H, 3.01, N, 3.22 % IR (cm^{-1}) 1704 (O-C=O) 1644, (amide), 1541 and 3341 (NH), 1322 and 1154 (SO_2), 2400 (br for CO_2H). ^{1}H-NMR chemical shifts (δ in ppm, *J* in Hz, DMSO-d_6): 8.20, 1H, t, *J* = 5.6 (NH); 8.05, 2H, d, *J* = 8.5 (H-14,14'); 7.97, 2H, d, *J* = 8.5 (H-13,13'); 7.99, 2H, d, *J* = 7.81 (H-17,17'); 7.69, 2H, d (H-18,18'); 4.12, 2H, d, *J* = 5.6, CH_2N (H-18). ^{13}C-NMR chemical shifts (δ in ppm,

DMSO-d_6): 138.23 (C-12); 128.11 (C-13,13'); 127.07 (C-14,14'); 142.80 (C-15,15'); 139.50 (C-16); 128.70 (C-17,17'); 132.21 (C-18, 18'); 128.56 (C-19); 165.20 (COOH); 170.91 (CO); 41.16 (CH_2).

Similarly the chloro compound **3b** mp 138º C was obtained in 77% yield and was analyzed for $C_{15}H_{12}ClNO_5S$. Required: C, 50.92, H, 3.42, N, 3.96%. Found: C, 50.77, H, 3.24, N, 3.70% IR (cm^{-1}) 1729 (O-C=O) 1644 (amide), 1541 and 3351 (NH), 1324 and 1155 (SO_2), 2400 (br for CO_2H). ^{1}H-NMR chemical shifts (δ in ppm, *J* in Hz, DMSO-d_6): 8.22 (1H, t, ***J*** **=** 5.6 , NH); 7.96 (2H, d, *J* = 8.5, H-14,14'); 7.91 (2H, d, *J* = 8.5, H-13,13'); 7.87 (2H, d, *J* = 8.60, H-17,17'); 7.36 (2H, d, H-18,18'); 4.37 (2H, d, *J* = 5.6, CH_2N or H-18). ^{13}C-NMR chemical shifts (δ in ppm, DMSO-d_6): 137.70 (C-12); 130.20 (C-13,13'); 128.14 (C-14,14'); 144.12 (C-15,15'); 141.60 (C-16); 128.26 (C-17,17'); 129.17 (C-18, 18'); 136.98 (C-19); 168.99 (COOH); 174.75 (CO); 41.97 (CH_2).

Cyclizations to azlactones: 2-[4-(4-halobenzenesulfonyl)-phenyl]-5-oxazolones 4a and 4b. The hippuric acids **3a** and **3b** were treated with equimolar quantity of ethyl chloroformate in the presence of N-methylmorpholine in methylene chloride at room temperature[7] to afford the corresponding azalactones **4a** and **4b** as colorless needles. The bromo compound **4a,** mp 187º C, was obtained in 91% yield (benzene:hexane) and was analyzed for $C_{15}H_{10}BrNO_4S$. Required: N, 3.47% Found N, 3.47% IR (cm^{-1}) 1833 (C=O), 1648 (C=N), 1325 and 1156 (SO_2). ^{1}H-NMR chemical shifts (δ in ppm, *J* in Hz, DMSO): 8.15 (2H, d, *J* = 8.3, H-14,14'); 8.05 (2H, d, *J* = 8.7, H-13,13'); 7.97 (2H, dt, *J* = 7.93, H-17, 17'); 2H (d, J = 8.9, H-17,17'); 7.86 (2H, d, J = 8.9, H-18,18'); 4.60 (2H, s, CH_2). ^{13}C-NMR chemical shifts (δ in ppm, DMSO-d_6): 130.68 (C-12); 128.67 (C-13,13'); 128.23 (C-14,14'); 142.80 (C-15,15'); 139.49 (C-16); 129.63 (C-17,17'); 133.06 (C-18, 18'); 128.49 (C-19); 160.44 (C-2); 176.21 (CO); 55.23 (CH_2).

Similarly the chloro compound **4b** had mp 181º C and was obtained in 90% yield (benzene:hexane) and was analyzed for $C_{15}H_{10}ClNO_4S$ Required: N, 4.17% Found: N, 4.01% IR(cm^{-1}) 1814 (C=O), 1660 (C=N), 1324 and 1154 (SO_2). ^{1}H-NMR chemical shifts (δ in ppm, *J* in Hz, DMSO): 8.16 (2H, d, *J* = 8.2, H-14,14'); 8.13 (2H, d, *J* = 8.3, H-13,13'); 8.02 (2H, d, J = 8.6, H-17,17'); 7.73 (2H, d, J = 8.6, H-18,18'); 4.60 (2H, s, CH_2). ^{13}C-NMR chemical shifts (δ in ppm, DMSO-d_6): 130.65 (C-12); 128.62 (C-13,13'); 128.17 (C-14,14'); 143.83 (C-15,15'); 139.42 (C-16); 129.43 (C-17,17'); 129.97 (C-18, 18'); 139.09 (C-19); 165.16 (C-2); 170.82 (CO); 55.16 (CH_2).

General method for preparation of 2-aza-1-[4-(4-halobenzenesulfonyl)-phenyl]-4-phenyl-1,4-butanediones 5a-h

The azlactones **4a** and **4b** each 5mmol in 25ml of appropriate hydrocarbon (benzene, toluene, m-xylene or mesitylene) in excess was treated portionwise with 2.0g (15mmol) of anhydrous aluminum chloride at room temperature. After the addition, the reaction mixture was continued under stirring for 20hrs. The reaction mixture was then poured over crushed ice with hydrochloric acid and the organic component was extracted with methylene chloride, washed (H_2O) and dried. The solvent was removed to yield the crude azadiketones **5a-h,** which were

crystallized from ethanol as colorless needles. Yields and analytical data for **5a-h** are described in Table 1 and ^{1}H-NMR data in Table 4.

General method for synthesis of oxazoles 6a-h

The 2-aza-1,4-butanediones **5a-h** (10mmol) were refluxed with phosphorus oxychloride (20ml) for 4 hrs and the reaction mixture was then treated with ice water and extracted with methylene chloride, washed (H_2O), followed by aqueous sodium hydrogen carbonate, dried (Na_2SO_4) and the solvent was removed to afford the crude oxazoles **6a-h** in 85-92% overall yields.

Analytical data of **6a-h** after crystallization from toluene are reported in Table 2. Table 3 contains UV data, and NMR data are presented in Tables 5 and 6.

References

1. Schiketanz, I.; Istrati, D.; Draghici, C.; Balaban, A. T. *Rev. Roum. Chim.* (in press).
2. Ott, D. G.; Hayes, F. N.; Hansbury, E.; Kerr, V. N. *J. Am. Chem. Soc.* **1957**, *79*, 5448.
3. (a) Balaban, A. T.; Bally, I.; Frangopol, P. T.; Bacescu, M.; Cioranescu, E.; Birladeanu, L. *Tetrahedron* **1963**, *19*, 169. (b) Frangopol, P. T.; Balaban, A. T.; Birladeanu, L.; Cioranescu, E. *ibid.* **1961**, *16*, 59.
4. Fieser L. F.; Fieser, M. *Reagents for Organic Synthesis*, Wiley: New York, 1997; Vol. 1, p 286.
5. Schiketanz, I.; Istrati, D.; Deleanu, C.; Draghici, C.; Balaban, A. T. *Coll. Czech. Chem. Commun.* **1997**, *62*, 769.
6. Schiketanz, I.; Istrati, D.; Draghici, C.; Balaban, A. T. *Rev. Roum. Chim.* **1999**, *44*, 137.
7. Steiger, R. E. *J. Org. Chem.* **1944**, *9*, 396.
8. Chen, L. M. F.; Slebioda, M.; Benoiton, L. *J. Peptide Protein Res.* **1988**, *31*, 339.
9. Balaban, A.T.; Negoita, N. *Rev. Roum. Chim.* **1972**, *17*, 1227.
10. Balaban, A.T.; Negoita, N.; Baican, R. *Chem. Phys. Letters* **1974**, *24*, 30.
11. Balaban, A.T.; Caproiu, M. T.; Negoita, N.; Baican, R. *Tetrahedron* **1977**, *33*, 2249.
12. J. Herdan, J.; Balaban, A. T.; Negoita, N.; Grecu, N. *Rev. Roum. Chim.* **1983**, *28*, 129.
13. Balaban, A.T.; Negoita, N.; Shein, S.M.; Khmelinskaya, A.D. *Rev. Roum. Chim.* **1987**, *32*, 501.