SYNTHESIS OF NEW ARYLIDENE DERIVATIVES OF 3-AMINORHODANINE

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The synthesis of new arylidene derivatives of 3-aminorhodanine has been effected. It has been established that the condensation of 3-aminorhodanine with aldehydes in an alcoholic medium gives 3'-arylidene derivatives. Similar reactions in an ammoniacal medium lead to 5-derivatives of 3-aminorhodanine. 3', 5-Diarylidene derivatives can be obtained by condensing 3'-aminorhodanine with an excess of an aldehyde in glacial acetic acid, except for the salicylidene and 9-anthrylidene derivatives, the synthesis of which can be carried out only in two stages.

As already reported [1], 3-aminorhodanine possesses a dual reactivity which is caused by the existence of two tautomeric forms, namely the hydrazine form and the thiol form. In view of this, the condensation of 3-aminorhodanine with aldehydes can give either 3'-arylidene derivatives or 5-substituted or 3', 5-disubstituted 3-aminorhodanines.

Since, according to the literature [2, 3], p- and o-hydroxybenzylideneaminorhodanines suppress the action of decarboxylase, which is capable of converting 5-hydroxytryptophan into serotonin, we set ourselves the task of carrying out for comparison the condensation of 3-aminorhodanine with p-dimethylaminobenzaldehyde, p-diethylaminobenzaldehyde, salicylaldehyde, veratraldehyde, and cinnamaldehyde, and also with furfural and 9-anthraldehyde. The substances that we obtained by condensing 3-aminorhodanine with aldehydes in an alcoholic medium are 3'-substituted derivatives and are given in Table 1.

The 5-substituted derivatives of 3-aminorhodanine (see Table 2) were obtained by Girard's method [5], i.e., in an ammoniacal medium under conditions in which aminorhodanine is converted completely into its second tautomeric form, the mercaptan form.

The 3', 5-disubstituted derivatives of 3-aminorhodanine (Table 3) were obtained by boiling aminorhodanine with an excess of the aldehydes in glacial acetic acid.

When an excess of salicylaldehyde or 9-anthraldehyde was boiled with 3-aminorhodanine in glacial acetic acid, we obtained no disubstituted products as is usually found with other aldehydes. Substitution took place in one position only, and the substances obtained were identical with the 3-substituted aminorhodanines. Attempts to obtain the disubstituted derivatives of 3-aminorhodanine by more prolonged boiling in glacial acetic acid or even by boiling the 3-substituted aminorhodanines with the same aldehydes in acetic acid were unsuccessful.

We succeeded in obtaining the disalicylidene and dianthrylidene derivatives only in two stages, with the isolation of the 3'-derivative from an alcoholic medium and its condensation in an ammoniacal medium by Girard's method [5].

The introduction of a benzylidene residue into 3'-salicylidene- or 3'-anthrylideneaminorhodanine takes place readily in position 5 not only by means of the Girard condensation, but also by boiling in glacial acetic acid.

In its turn, 3'-benzylideneaminorhodanine can condense with salicylaldehyde or anthraldehyde in acetic acid. It is impossible to introduce the same radicals into the 5 position of 3'-salicylidene- and 3-anthrylideneaminorhodanines in acetic acid.

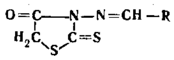
It may be assumed that this is prevented by the appearance of steric hindrance. Consequently, disubstituted derivatives of 3-aminorhodanine with salicylaldehyde and with anthraldehyde must be obtained in two stages.

EXPERIMENTAL

The 3-arylideneaminorhodanines, 5-arylidene-3-aminorhodanines, and 3', 5-diarylideneaminorhodanines were obtained by previously described methods [1].

Table 1

3'-Arylidene Derivatives of Aminorhodanine



R	Mp, °C	Empirical formula	Found, %			Calculated, %			Yield, %
			C	H	N	C	H	N	
o-HOC_6H_4	178*	$C_{10}H_8N_2O_2S_2$	47.64	3.26	11.20	47.59	3.20	11.10	91.2
9-Anthryl	210	$C_{18}H_{12}N_2OS_2$	63.59	3.69	8.34	64.25	3.60	8.32	93.5
p-$(CH_3)_2NC_6H_4$	164	$C_{12}H_{13}N_3OS_2$	—	—	15.10	—	—	15.04	88.0
p-$(C_2H_5)_2NC_6H_4$	178	$C_{14}H_{17}N_3OS_2$	54.57	5.54	13.75	54.69	5.58	13.66	88.0
3,4-$(CH_3O)_2C_6H_3$	142	$C_{12}H_{12}N_2O_3S_2$	47.92	4.10	9.32	48.61	4.08	9.45	86.0
2-Furyl	134**	$C_8H_6N_2O_2S_2$	—	—	11.98	—	—	12.38	53.0
$C_6H_5—CH=CH$	145***	$C_{12}H_{10}N_2OS_2$	—	—	10.88	—	—	10.67	87.5

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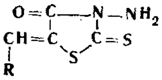
*According to the literature [4], mp 178°–180° C.

**According to the literature [4], mp 128.5°–132° C.

***According to the literature [6], mp 144°–145.5° C.

Table 2

5-Arylidene Derivatives of 3-Aminorhodanine



R	Mp, • C	Empirical formula	Found, %			Calculated, %			Yield, %
			C	H	N	C	H	N	
o-HOC_6H_4	214	$C_{10}H_8N_2O_2S_2$	47.55	3.69	11.04	47.59	3.20	11.10	20.0
9-Anthryl	180	$C_{18}H_{12}N_2OS_2$	64.52	4.50	8.79	64.26	3.60	8.32	65.3
p-$(CH_3)_2NC_6H_4$	216*	$C_{12}H_{13}N_3OS_2$	—	—	14.90	—	—	15.04	35.9
p-$(C_2H_5)_2NC_6H_4$	160	$C_{14}H_{17}N_3OS_2$**	—	—	13.60	—	—	13.66	26.0
3,4-$(CH_3O)_2C_6H_3$	136	$C_{12}H_{12}N_2O_3S_2$	49.01	4.08	8.97	48.62	4.08	9.44	81.8
2-Furyl	187***	$C_8H_6N_2O_2S_2$	—	—	12.05	—	—	12.38	72.7
C_6H_5—CH=CH	223	$C_{12}H_{10}N_2OS_2$	54.86	4.35	10.94	54.94	3.84	10.67	57.6

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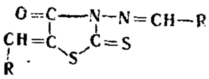
*According to the literature [4], mp 220°–223° C.

**Found, %: S 20.76. Calculated, %: S 20.87.

***According to the literature [4], mp 186.5°–187.5° C

Table 3

3',5-Diarylidene Derivatives of Aminorhodanine



R	Mp, • C	Empirical formula	Found, %			Calculated, %			Yield, %
			C	H	N	C	H	N	
o-HOC_6H_4	198	$C_{17}H_{12}N_2O_3S_2$	57.03	3.32	7.26	57.27	3.39	7.86	57.3
9-Anthryl	242	$C_{33}H_{20}N_2OS_2$*	—	—	5.57	—	—	5.34	10.0
p-$(CH_3)_2NC_6H_4$	266**	$C_{21}H_{22}N_4OS_2$	—	—	13.49	—	—	13.64	88.0
p-$(C_2H_5)_2NC_6H_4$	200	$C_{25}H_{30}N_4OS_2$	65.00	6.92	12.36	64.34	6.48	12.01	84.5
3,4-$(CH_3O)_2C_6H_3$	209	$C_{21}H_{20}N_2O_5S_2$	57.11	4.64	5.96	56.74	4.54	6.30	58.6
2-Furyl	173	$C_{13}H_8N_2O_3S_2$	50.88	3.07	9.20	51.31	2.65	9.21	46.2
C_6H_5—CH=CH	196	$C_{21}H_{16}N_2OS_2$	66.76	4.30	6.95	66.99	4.28	7.44	75.0

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*Found, %: S 12.07. Calculated, %: S 12.22.

**According to the literature [4,6], mp 266°–268° C.

Synthesis of 3', 5-disalicylidene- and 3', 5-dianthrylideneaminorhodanines. With stirring, 1–2 ml of concentrated ammonia solution, 0.4 g of ammonium chloride dissolved in 1 ml of water, and 5 mM of the appropriate aldehyde were added rapidly to a hot suspension of 5 mM of a 3'-substituted aminorhodanine in 15 ml of methanol. In the case of salicylaldehyde, the precipitate formed after 5–6 min, and then on complete cooling the whole mass crystallized. In the case of anthraldehyde, the reaction mixture was stirred at 65° C for 2 hr. After being filtered off, the disalicylideneaminorhodanine was recrystallized from ethanol and the dianthrylideneaminorhodanine was purified with boiling benzene.

Synthesis of 5-benzylidene-3'-salicylidene- and 5-benzylidene-3'-anthrylideneaminorhodanines. In a flask fitted with a reflux condenser, 5 mM of 3'-salicylidene- or 3'-anthrylideneaminorhodanine was boiled with a 20% excess of benzaldehyde in 20 ml of glacial acetic acid for 4 hr. The crystals that deposited on cooling were filtered off and washed with hot methanol and ether.

5-Benzylidene-3'-salicylideneaminorhodanine with mp 140°–142° C was obtained in 57.0% yield. Found, %: N 8.22. Calculated for $C_{17}H_{12}N_2O_2S_2$, %: N 8.24.

An identical substance with mp 136°–138° C was obtained by condensing 3-salicylideneaminorhodanine with benzaldehyde by Girard's method [5]. Yield 54.2%. Found, %: C 60.10; H 3.97; N 8.57. Calculated for $C_{17}H_{12}N_2O_2S_2$, %: C 59.98; H 3.55; N 8.24.

3'-Anthrylidene-5-benzylideneaminorhodanine with mp 212°–214° C was obtained with a yield of 39%. Found, %: N 6.72; S 15.24. Calculated for $C_{25}H_{16}N_2OS_2$, %: N 6.60; S 15.11. The same product prepared by Girard's method had mp 213°–214° C (yield 90.0%).

Synthesis of 3'-benzylidene-5-salicylideneaminorhodanine and 5-anthrylidene-3'-benzylideneaminorhodanine. A mixture of 0.55 g (2.5 mM) of 3-benzylideneaminorhodanine and 0.3 g (2.5 mM) of salicylaldehyde in 10 ml of glacial acetic acid was boiled for 4 hr. After cooling, the yellow precipitate was filtered off, mp 149°–150° C (from ethanol). Yield 24.6%. Found, %: N 8.63; S 19.09. Calculated for $C_{17}H_{12}N_2O_2S_2$, %: N 8.24; S 18.84.

Similarly, the reaction of 3'-benzylideneaminorhodanine with anthrylidene gave a substance with mp 194° C (from glacial CH_3COOH) with a yield of 56.6%. Found, %: C 70.11; H 3.85; S 15.35. Calculated for $C_{25}H_{16}N_2OS_2$, %: C 70.73; H 3.85; S 15.11.

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