

Synthesis of Some Benzylidenamino Compounds

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Summary. Reactions of 3-substituted-4-amino-4,5-dihydro-1,2,4-triazol-5-ones with salicylaldehyde, *o*-chlorobenzaldehyde and *p*-tolualdehyde were studied, and 14 new benzylidenamino compounds were obtained.

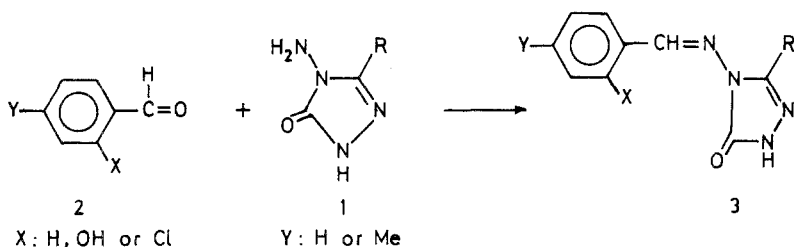
Keywords. 4-Amino-4,5-dihydro-1,2,4-triazol-5-ones; Benzylidenamino compounds; *o*-Chlorobenzaldehyde; Salicylaldehyde; *p*-Tolualdehyde.

Synthesen einiger Benzylidenaminoverbindungen

Zusammenfassung. Die Reaktionen von 3-substituierten 4-Amino-4,5-dihydro-1,2,4-triazol-5-onen mit Salicylaldehyd, *o*-Chlorobenzaldehyd und *p*-Tolualdehyd wurden untersucht und 14 Benzylidenaminoverbindungen dargestellt.

Introduction

In recent years, the reactions of various N-amino-1,2,4-triazoles and N-amino-4,5-dihydro-1,2,4-triazol-5-ones with certain aldehydes and the formation of benzylidenamino compounds have been reported [1–13]. In the present study some 3-alkyl- and 3-aryl-4-amino-4,5-dihydro-1,2,4-triazol-5-ones (**1**) were treated with salicylaldehyde, *o*-chlorobenzaldehyde, and *p*-tolualdehyde (**2**) and the corresponding benzylidenamino derivatives (**3**) were obtained (Scheme 1). Thus, 3-alkyl(aryl)-4-*o*-hydroxybenzylidenamino-, 3-alkyl-4-*o*-chlorobenzylidenamino- and 3-alkyl(aryl)-4-*p*-methylbenzylidenamino-4,5-dihydro-1,2,4-triazol-5-ones (compounds **3a–3f**, **3g–3j**, and **3k–3n**, respectively) were synthesized (Scheme 1). The group *R*, *X* and *Y* are listed in Table 1.



Scheme 1

Table 1. List of compounds **3**

No.	<i>R</i>	<i>X</i>	<i>Y</i>
3a	<i>Me</i>	OH	H
3b	<i>Et</i>	OH	H
3c	<i>Pr</i>	OH	H
3d	Isopentyl	OH	H
3e	CH ₂ <i>Ph</i>	OH	H
3f	<i>Ph</i>	OH	H
3g	<i>Me</i>	Cl	H
3h	<i>Et</i>	Cl	H
3i	<i>Pr</i>	Cl	H
3j	CH ₂ <i>Ph</i>	Cl	H
3k	<i>Me</i>	H	<i>Me</i>
3l	<i>Et</i>	H	<i>Me</i>
3m	<i>Pr</i>	H	<i>Me</i>
3n	<i>Ph</i>	H	<i>Me</i>

Experimental

Melting points were determined with a Büchi oil heated melting point apparatus and are uncorrected. The infrared spectra were recorded as potassium bromide pellets using a Perkin-Elmer 377 spectrophotometer. The ¹H-NMR and ¹³C-NMR spectra were obtained on a Varian 60 A spectrometer or a Bruker AC-200 FT instrument.

The starting compounds **1** were synthesized by routes previously reported [8]. The required aldehydes **2** were obtained from Fluka.

General method for the synthesis of **3** type 3-alkyl(aryl)-4-benzylidenamino-4,5-dihydro-1,2,4-triazol-5-one derivatives: 3-Alkyl(aryl)-4-amino-4,5-dihydro-1,2,4-triazol-5-one (**1**) (0.01 mol) was dissolved in 50 ml (or in an appropriate amount) of ethanol (1-pentanol for **3f** and **3n**) and the aldehyde **2** (0.01 mol) was added dropwise with constant shaking. After the addition, the mixture was refluxed for one hour (or 1.5 h) and cooled. The precipitate formed was filtered and dried. Recrystallization of the product from ethanol gave pure compounds **3**.

Results

Data about the reactions and compounds **3** are compiled in Table 2.

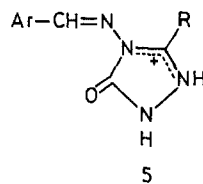
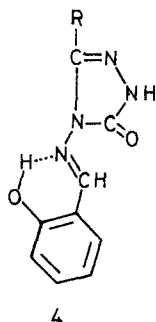


Table 2. Experimental data for compounds **3**

Compd.	Reaction time (hours)	Yield (%)	M.p. (°C) (crystal-lized from)	Molecular ^a formula (<i>M</i>)
3 a	1	97	250 (<i>EtOH</i>)	C ₁₀ H ₁₀ N ₄ O ₂ (218.21)
3 b	1	91	190 (<i>EtOH</i>)	C ₁₁ H ₁₂ N ₄ O ₂ (232.24)
3 c	1	91	179 (<i>EtOH</i>)	C ₁₂ H ₁₄ N ₄ O ₂ (246.26)
3 d	1	92	193 (<i>EtOH</i>)	C ₁₄ H ₁₈ N ₄ O ₂ (274.32)
3 e	1	96	227 (<i>EtOH</i>)	C ₁₆ H ₁₄ N ₄ O ₂ (294.30)
3 f	1	90	230 (<i>EtOH</i>)	C ₁₅ H ₁₂ N ₄ O ₂ (280.28)
3 g	1	96	238 (<i>EtOH</i>)	C ₁₀ H ₉ ClN ₄ O (236.66)
3 h	1	94	208 (<i>EtOH</i>)	C ₁₁ H ₁₁ ClN ₄ O (250.69)
3 i	1	93	197 (<i>EtOH</i>)	C ₁₂ H ₁₃ ClN ₄ O (264.71)
3 j	1	97	195 (<i>EtOH</i>)	C ₁₆ H ₁₃ ClN ₄ O (312.75)
3 k	1.5	95	213 (<i>EtOH</i>)	C ₁₁ H ₁₂ N ₄ O (216.24)
3 l	1.5	95	163 (<i>EtOH</i>)	C ₁₂ H ₁₄ N ₄ O (230.26)
3 m	1.5	90	150 (<i>EtOH</i>)	C ₁₃ H ₁₆ N ₄ O (244.29)
3 n	1.5	96	206 (<i>EtOH</i>)	C ₁₆ H ₁₄ N ₄ O (278.30)

^a All elemental analyses (C, H, N) are in accordance with calculated values

IR, ¹H-NMR and ¹³C-NMR spectral data of compounds **3 a–3 n** are presented in Tables 3, 4 and 5.

Discussion

As seen from the experimental data – except for **3 f** and **3 n** – all compounds **3** were obtained in boiling ethanol. The formation of **3 f** and **3 n** at higher temperatures might be due to the effect of the phenyl group.

Table 3. IR data for compounds **3**

IR (KBr) [cm ⁻¹]								
Compd.	ν_{NH}	ν_{OH}	$\nu_{\text{C=O}}$	$\nu_{\text{C=N}}$	Compd.	ν_{NH}	$\nu_{\text{C=O}}$	$\nu_{\text{C=N}}$
3a	3 180	3 060	1 700	1 590	3h	3 140	1 690	1 580
3b	3 150	3 030	1 697	1 595	3i	3 150	1 680	1 580
3c	3 150	3 025	1 700	1 585	3j	3 160	1 693	1 580
3d	3 157	3 040	1 695	1 580	3k	3 150	1 660	1 595
3e	3 160	3 040	1 695	1 580	3l	3 140	1 688	1 583
3f	3 147	3 040	1 700	1 590	3m	3 150	1 690	1 580
3g	3 155	—	1 687	1 580	3n	3 140	1 693	1 590

Table 4. ¹H-NMR data of compounds **3** (δ /ppm in *DMSO-d*₆)

Compd.	CH ₃	CH ₂	CH ₂	N=CH	NH	OH	Aromatic H
3a	2.23 (s)	—	—	10.00 (s)	11.80 (s)	10.30 (s)	7.00 (d, 2 H) 7.37 (m, 1 H) 7.80 (d, 1 H)
3b	1.20 (t)	2.70 (q)	—	9.97 (s)	11.77 (s)	10.27 (s)	6.95 (d, 2 H) 7.32 (m, 1 H) 7.75 (d, 1 H)
3c	0.92 (t)	1.60 (sext)	2.57 (t)	9.95 (s)	11.78 (s)	10.25 (s)	6.95 (d, 2 H) 7.31 (m, 1 H) 7.76 (d, 1 H)
3d	0.90 (d) ^a	1.55 (m) ^b	2.60 (t)	9.87 (s)	11.67 (s)	10.17 (s)	6.97 (d, 2 H) 7.34 (m, 1 H) 7.75 (d, 1 H)
3e	—	—	4.07 (s)	9.88 (s)	11.78 (s)	10.18 (s)	7.00 (d, 2 H) 7.40 (m, 6 H) 7.78 (d, 1 H)
3f	—	—	—	9.85 (s)	12.27 (s)	10.25 (s)	7.00 (d, 2 H) 7.35 (m, 1 H) 7.40 — 8.10 (m, 6 H)
3g	2.20 (s)	—	—	10.25 (s)	12.30 (s)	—	7.72 (s, 3 H) 8.28 (s, 1 H)
3h	1.30 (t)	2.60 (q)	—	10.40 (s)	12.34 (s)	—	7.80 (s, 3 H) 8.32 (s, 1 H)
3i	1.05 (t)	1.80 (sext)	2.80 (t)	10.50 (s)	12.30 (s)	—	7.80 (s, 3 H) 8.30 (s, 1 H)
3j	—	—	4.16 (s)	10.40 (s)	12.25 (s)	—	7.50 (m, 5 H) 7.70 (s, 3 H) 8.20 (s, 1 H)

Table 4 (continued)

Compd.	CH ₃	CH ₂	CH ₂	N=CH	NH	OH	Aromatic H
3k	2.33 (t) ^c	—	—	9.70 (s)	11.80 (s)	—	7.30 (d, 2 H) 7.70 (d, 2 H)
3l	1.26 (t) 2.40 (s)	2.73 (q)	—	9.70 (s)	11.80 (s)	—	7.30 (d, 2 H) 7.73 (d, 2 H)
3m	0.97 (t) 2.38 (s)	1.67 (sext)	2.67 (t)	9.70 (s)	11.80	—	7.30 (d, 2 H) 7.73 (d, 2 H)
3n	2.35 (s)	—	—	9.60 (s)	12.60 (s)	—	7.20–8.05 (m, 9 H)

^a 0.90 (d, 6 H, 2 CH₃)^b 1.55 (m, 3 H, CH₂CH)^c 2.33 (t, 6 H, 2 CH₃)

The ¹H-NMR data reveal that the *o*-hydroxybenzylidenamino compounds derived from salicylaldehyde (**3a–3f**) have the phenolimino structure **4**. This chelate formation is in agreement with the data previously reported [14, 15].

Table 5. ¹³C-NMR data for compounds **3** (δ/ppm in DMSO-*d*₆)

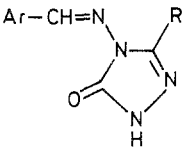
					
Compd.	Triazole C ₃	Triazole C ₅	C=N	R	Ar
3a	144.19	151.09	157.56	11.16	151.29, 132.80, 126.49 119.55, 119.46, 116.43
3b	147.95	151.08	157.56	18.57, 10.01	151.44, 132.78, 126.38 119.61, 119.47, 116.43
3c	146.80	151.03	157.54	26.76, 18.88, 13.47	151.34, 132.80, 126.29, 119.60, 119.48, 116.42
3d	147.12	151.11	157.60	34.49, 27.03 22.88, 22.11	151.37, 132.76, 126.34, 119.62, 119.47, 116.46
3e	146.08	150.90	157.54	135.76, 128.68 (2 C) 128.43 (2 C), 126.68 31.11	151.27, 132.83, 126.36, 119.55, 119.43, 116.41
3f	144.56	151.36	157.69	129.99, 128.44 (2 C) 127.90 (2 C), 126.69	153.63, 133.02, 126.59, 119.52, 119.31, 116.45
3g	144.29	151.19	148.71	11.03	134.22, 132.70, 130.95, 130.03, 127.67, 126.80

Table 5 (continued)

Compd.	Triazole C ₃	Triazole C ₅	C=N	R	Ar
3h	148.00	151.32	148.75	18.41, 9.96	134.20, 132.69, 130.97, 130.04, 127.70, 126.74
3i	146.90	151.29	148.80	26.62, 18.88, 13.46	134.23, 132.73, 130.98, 130.07, 127.76, 126.74
3j	146.00	151.17	148.69	135.67, 128.72 (2 C), 128.42 (2 C), 126.70, 30.97	134.10, 132.80, 130.87, 130.06, 127.73, 126.77
3k	144.20	151.27	153.70	11.07	141.41, 130.82, 129.51 (2 C), 127.60 (2 C), 21.09
3l	147.97	151.43	153.70	18.52, 10.00	141.41, 130.87, 129.52 (2 C), 127.56 (2 C), 21.07
3m	146.83	151.34	153.69	26.70, 18.87, 13.45	141.42, 130.83, 129.53 (2 C), 127.58 (2 C), 21.08
3n	144.48	151.37	156.71	129.99, 128.44 (2 C), 127.83 (2 C), 126.68	141.76, 130.61, 129.61 (2 C), 127.81 (2 C), 21.09

Table 6. ¹H-NMR data in *TFA*

Compd.	δ ppm (in TFA)	Δδ (ppm)	Compd.	δ ppm (in TFA)	Δδ (ppm)
3a	2.50 (s, 3 H, CH ₃)	0.27	3e	4.34 (s, 2 H, CH ₂)	0.27
3b	1.42 (t, 3 H, CH ₃) 2.99 (q, 2 H, CH ₂)	0.22 0.29	3k	2.59 (t, 6 H, 2 CH ₃)	0.26
3c	1.08 (t, 3 H, CH ₃) 1.82 (sext, 2 H, CH ₂) 2.87 (t, 2 H, CH ₂)	0.16 0.22 0.30	3l	1.43 (t, 3 H, CH ₃) 3.00 (q, 2 H, CH ₂)	0.17 0.27
3d	1.05 (d, 6 H, 2 CH ₃) 1.75 (m, 3 H, CH ₂ CH) 2.88 (t, 2 H, CH ₂)	0.15 0.20 0.28	3m	1.12 (t, 3 H, CH ₃) 1.90 (sext, 2 H, CH ₂) 2.96 (t, 2 H, CH ₂)	0.15 0.23 0.29

Apart from the measurements given in Table 4, the ¹H-NMR measurements of some **3** type compounds were performed in trifluoroacetic acid (see Table 5). Protonation shifts, obtained by comparison of spectra in *DMSO-d*₆ and *TFA*, observed for **3** type compounds are consistent with stabilization of the resulting cations **5** in acidic medium by an amidinium type resonance.

Thus, the signals from the groups attached to C-3 were shifted downfield in *TFA*, as seen from Table 6.

In the ¹³C-NMR spectra of the **3a–3n** series, the aryl ring carbons were assigned by comparing the observed chemical shifts to those calculated by means of substituent parameters [16].

Acknowledgements

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