REACTION OF ESTER ETHOXYCARBONYLHYDRAZONES WITH ALIPHATIC DIAMINES

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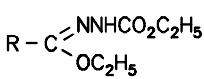
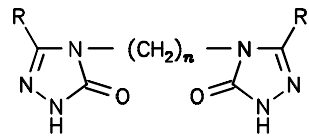
In recent years, the treatment of various ester ethoxycarbonylhydrazones with some amines and hydrazines has been reported[1–13]. The present study describes the reaction of some ester ethoxycarbonylhydrazones *I* with several diamines. Although the reaction of ester ethoxycarbonylhydrazones with some hydrazines led to the formation of substituted 1,2,4-triazoles[3,11], it is known that the 3,4-disubstituted-4,5-dihydro-1*H*-1,2, 4-triazol-5-one ring is generally formed from the treatment of type *I* compounds with hydrazines or amines. Thus, in this study, 1,4-diaminobutane, 1,5-diaminopentane, 1,6-diaminohexane, 1,8-diaminooctane, 1,9-diaminononane and 1,12-diaminododecane reacted with compounds *I* to give the corresponding bis(3-alkyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-alkanes *II – VII* as new compounds. *N*-Methylation reactions of some newly synthesized compounds were performed and *N*-methyl compounds *VIII – XI* were obtained.



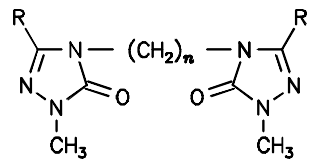
I



II–VII

I–XI	R
a	CH_3
b	CH_2CH_3
c	$CH_2CH_2CH_3$
d	$CH(CH_3)_2$
e	$CH_2C_6H_5$
f	C_6H_5
g	$4\text{-}CH_3C_6H_4$

	n
II, VIII	4
III	5
IV, IX	6
V, X	8
VI	9
VII, XI	12



VIII–XI

TABLE I
Characteristic data for compounds *II* – *VII*

Compound	M.p., °C Yield, %	Formula M.w.	Calculated/Found		
			% C	% H	% N
IIa	292 – 293[a]	$C_{10}H_{16}N_6O_2$	47.61	6.39	33.31
	59	252.3	47.35	6.33	33.02
IIb	277 – 278[a]	$C_{12}H_{20}N_6O_2$	51.42	7.19	29.98
	58	280.3	51.42	7.36	30.28
IIc	211 – 213[b]	$C_{14}H_{24}N_6O_2$	54.53	7.84	27.25
	62	308.4	54.82	8.03	27.42
IId	232 – 233[c]	$C_{14}H_{24}N_6O_2$	54.52	7.84	27.25
	52	308.4	54.68	7.91	26.95
IIe	276 – 278[a]	$C_{22}H_{24}N_6O_2$	65.33	5.98	20.78
	38	404.5	65.63	6.12	21.01
IIf	306 – 308[d]	$C_{20}H_{20}N_6O_2$	63.82	5.36	22.33
	46	376.4	63.73	5.43	22.14
IIg	320 – 322[a]	$C_{22}H_{24}N_6O_2$	65.33	5.98	20.78
	50	404.5	65.50	6.23	20.86
IIIa	211 – 214[e]	$C_{11}H_{18}N_6O_2 \cdot 2H_2O$	43.70	7.33	27.80
	70	302.3	44.00	7.34	27.86
IVa	233 – 234[c]	$C_{12}H_{20}N_6O_2$	51.42	7.19	29.98
	85	280.3	51.23	7.43	30.12
IVb	170 – 171[c]	$C_{14}H_{24}N_6O_2$	54.53	7.84	27.25
	80	308.4	54.40	8.05	27.25
IVc	150 – 151[f]	$C_{16}H_{28}N_6O_2$	57.12	8.39	24.98
	81	336.4	57.25	8.57	25.04
IVd	231 – 233[e]	$C_{16}H_{28}N_6O_2$	57.12	8.39	24.98
	51	336.4	57.23	8.63	25.28
IVe	218 – 219[f]	$C_{24}H_{28}N_6O_2$	66.65	6.53	19.43
	52	432.5	66.44	6.75	19.39
IVf	234 – 235[c]	$C_{22}H_{24}N_6O_2$	65.33	5.98	20.78
	55	404.5	65.26	6.25	20.48
IVg	273 – 275[a]	$C_{24}H_{28}N_6O_2$	66.65	6.53	19.43
	71	432.5	66.83	6.80	19.18

TABLE I
(*Continued*)

Compound	M.p., °C Yield, %	Formula M.w.	Calculated/Found		
			% C	% H	% N
Va	204 – 205[c]	$C_{14}H_{24}N_6O_2$	54.53	7.84	27.25
	80	308.4	54.36	7.98	27.05
Vb	178 – 179[c]	$C_{16}H_{28}N_6O_2$	57.12	8.39	24.98
	84	336.4	57.41	8.58	25.13
Vc	121 – 122[e]	$C_{18}H_{32}N_6O_2$	59.32	8.85	23.06
	81	364.5	59.60	8.86	22.76
Vd	133 – 136[c]	$C_{18}H_{32}N_6O_2 . 3 H_2O$	51.66	9.15	20.08
	65	418.5	51.90	9.41	20.38
Ve	167 – 168[c]	$C_{26}H_{32}N_6O_2$	67.80	7.00	18.25
	51	460.6	67.66	7.17	17.96
Vf	189 – 190[c]	$C_{24}H_{28}N_6O_2$	66.65	6.53	19.43
	54	432.5	66.41	6.77	19.26
Vg	185 – 186[a]	$C_{26}H_{32}N_6O_2$	67.80	7.00	18.25
	58	460.6	67.50	7.10	18.12
VIa	94 – 97[e]	$C_{15}H_{26}N_6O_2 . H_2O$	52.92	8.29	24.69
	76	340.4	53.10	8.23	24.40
VIIa	154 – 155[c]	$C_{18}H_{32}N_6O_2$	59.32	8.85	23.06
	96	364.5	59.60	9.02	22.95
VIIb	139 – 140[g]	$C_{20}H_{36}N_6O_2$	61.20	9.24	21.41
	94	392.5	60.94	9.32	21.65
VIIc	103 – 104[g]	$C_{22}H_{40}N_6O_2$	62.83	9.59	19.98
	96	420.6	62.70	9.50	19.86
VIIe	144 – 145[h]	$C_{30}H_{40}N_6O_2$	69.74	7.80	16.27
	81	516.7	70.03	8.15	16.21
VIIf	158 – 160[g]	$C_{28}H_{36}N_6O_2$	68.83	7.43	17.20
	74	488.6	68.90	7.50	16.94

Crystallized from: [a] DMSO–H_2O (1 : 5); [b] ethanol–ethyl acetate (1 : 2); [c] ethanol–water (1 : 2); [d] ethanol–acetone (1 : 5); [e] water; [f] ethanol; [g] ethyl acetate–benzene (1 : 2); [h] *e*thyl acetate.

EXPERIMENTAL

Melting points were determined in a Büchi oil heated melting point apparatus and are uncorrected. Experimental data for compounds *II – VII* and *VIII – XI* are given in Table I and Table II, respectively. Infrared spectra (given in cm^{-1}) were run as potassium bromide pellets on a Perkin–Elmer 377 spectrophotometer (Table III), ^1H NMR spectra (δ, ppm) were obtained on a Varian 60 A spectrometer in $(CD_3)_2SO$ (Table IV). UV absorption spectra were measured between 210 and 350 nm with a Varian Spectrophotometer using 10 mm quartz cells. All the measurements were carried out with $1 . 10^{-4} – 1 . 10^{-3}$ M ethanolic solutions. UV data are given in Table III. Microanalyses were performed on a Carlo Erba 1106 elemental analyzer. The starting compounds *I* were synthesized by procedures described earlier[1–3]. Compounds *IIIa*, *Vd* and *VIa* were obtained as hydrate forms.

α,ω-Bis(3-alkyl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)alkanes *II – VII*. General Procedure

Aliphatic ester ethoxycarbonylhydrazone (*I*, 0.02 mol) was treated with a solution of the corresponding α,ω-diaminoalkane (0.01 mol) in water (100 ml), and the mixture was refluxed for 5 – 6 h. After cooling, the precipitate formed was recrystallized from an appropriate solvent to give the compound *II – VII*.

TABLE II
Characteristic data for compounds *VIII – XI*

Compound	M.p., °C Yield, %	Formula M.w.	Calculated/Found		
			% C	% H	% N
VIIIa	148 – 149[a]	$C_{12}H_{20}N_6O_2$	51.41	7.19	29.98
	36	280.3	51.70	7.32	30.08
IXa	103 – 104[b]	$C_{14}H_{24}N_6O_2$	54.52	7.84	27.25
	35	308.4	54.23	7.85	27.19
IXg	101 – 103[c]	$C_{26}H_{32}N_6O_2$	67.80	7.00	18.25
	49	460.6	67.50	6.94	18.16
Xa	130 – 132[a]	$C_{16}H_{28}N_6O_2$	57.12	8.39	24.98
	33	336.4	56.87	8.34	24.88
XIa	83 – 84[d]	$C_{20}H_{36}N_6O_2$	61.20	9.24	21.41
	42	392.5	61.28	9.29	21.47

Crystallized from: [a] Benzene–petroleum ether (1 : 2); [b] chloroform–petroleum ether (1 : 4); [c] ethanol–water (1 : 4); [d] petroleum ether.

TABLE III
IR and UV data for compounds *II* – *XI*

Compound	ν(NH)	ν(C=O)	ν(C=N)	ν(substituted benzene)	λ_{max}, nm (ε . 10^{-3})
IIa	3 160, 3 054	1 680	1 565	–	–
IIb	3 155, 3 053	1 675	1 563	–	–
IIc	3 130, 3 053	1 673	1 565	–	229 (0.34)
IId	3 153, 3 055	1 674	1 558	–	229 (0.26)
IIe	3 163, 3 063	1 677	1 568	740, 690	224 (1.23)
IIf	3 138, 3 044	1 680	1 545	738, 687	267 (5.24), 264 (4.83)
IIg	3 150, 3 055	1 679	1 513	802	286 (4.75), 277 (5.10), 274 (4.53)
IIIa[a]	3 139, 3 043	1 670	1 576	–	–
IVa	3 143, 3 023	1 670	1 565	–	226 (0.83)
IVb	3 175, 3 063	1 669	1 565	–	226 (0.76)
IVc	3 168, 3 076	1 666	1 565	–	227 (0.77)
IVd	3 148, 3 036	1 678	1 556	–	231 (0.18)
IVe	3 140, 3 035	1 666	1 557	725, 699	223 (5.15)
IVf	3 150, 3 037	1 670	1 525	729, 687	276 (5.34), 274 (5.55), 263 (6.82)
IVg	3 148, 3 036	1 680	1 565	804	276 (4.41), 274 (4.14)
Va	3 144, 3 022	1 672	1 564	–	226 (0.67)
Vb	3 165, 3 063	1 680	1 560	–	226 (0.79)
Vc	3 150, 3 032	1 660	1 553	–	227 (0.75)
Vd[b]	3 160, 3 060	1 672	1 521	–	–
Ve	3 160, 3 042	1 669	1 556	740, 690	221 (4.58)
Vf	3 142, 3 041	1 672	1 527	715, 684	276 (4.42), 252 (10.21), 223 (6.94)
Vg	3 134, 3 034	1 672	1 565	810	–
VIa[c]	3 152, 3 057	1 671	1 578	–	–
VIIa	3 148, 3 025	1 674	1 558	–	229 (0.27)
VIIb	3 146, 3 033	1 680	1 564	–	230 (0.27)
VIIc	3 153, 3 043	1 686	1 575	–	231 (0.30)
VIIe	3 152, 3 040	1 682	1 556	720, 687	228 (1.22)
VIIf	3 151, 3 039	1 678	1 570	740, 680	–
VIIIa	–	1 683	1 572	–	232 (0.38)
IXa	–	1 685	1 568	–	231 (0.59)
IXg	–	1 683	1 565	823	276 (7.69), 267 (7.83)
Xa	–	1 673	1 564	–	232 (0.32)
XIa	–	1 676	1 564	–	232 (0.42)

[a] ν(OH) 3 352; [b] ν(OH) 3 340; [c] ν(OH) 3 343.

TABLE IV
^{1}H NMR data for compounds *II* – *XI*

Compound	Other (CH_2)	2 CH_3	2 CH_2[a]	2 NCH_2	Aromatic H	2 NH
IIa	1.62 m	2.11 s	–	3.76 s	–	11.33 s
IIb	1.63 m	1.85 t	2.54 q	3.70 s	–	11.35 s
IIc	1.60 m[b]	1.02 t	2.50 t	3.60 s	–	11.40 s
IId[c]	1.60 m	–	–	3.48 m	–	11.40 s
IIe[d]	1.15 t	–	–	3.26 s	7.23 s, 10 H	11.50 s
IIf	1.28 s	–	–	3.60 s	7.50 s, 10 H	11.84 s
IIg[e]	1.34 m	–	–	3.60 m	7.38 s, 8 H	11.80 s
IIIa	–[f]	2.16 s	–	2.40 – 2.81 m	–	11.20 s
IVa	1.43 m	2.10 s	–	3.50 s	–	11.50 s
IVb	0.94 – 1.80 m[g]	–	2.52 q	3.60 s	–	11.44 s
IVc	1.16 – 1.76 m[h]	0.94 t	2.46 t	3.48 s	–	11.46 s
IVd[i]	0.58 – 1.92 m[j]	–	–	3.52 m	–	11.26 s
IVe[k]	0.66 – 1.12 m	–	–	3.44 s	7.28 s, 10 H	11.56 s
IVf	0.64 – 1.68 m	–	–	3.60 m	7.56 s, 10 H	11.84 s
IVg[l]	0.68 – 1.60 m	–	–	3.60 m	7.32 s, 8 H	11.60 s
Va	1.26 m	2.14 s	–	3.52 t	–	11.66 s
Vb	0.54 – 1.86 m[m]	–	2.54 q	3.44 t	–	11.26 s
Vc	0.72 – 1.96 m[n]	–	2.42 q	3.32 t	–	11.32 s
Vd[o]	0.73 – 1.88 m[p]	–	–	3.46 t	–	11.35 s
Ve[q]	1.06 m	–	–	3.35 t	7.32 s, 10 H	11.54 s
Vf	0.58 – 1.82 m	–	–	3.70 t	7.60 s, 10 H	11.92 s
Vg[r]	0.74 – 1.66 m	–	–	3.64 t	7.38 s, 8 H	11.80 s
VIa	–[s]	2.10 s	–	3.46 t	–	11.19 s
VIIa	0.80 – 1.74 m	2.14 s	–	3.46 t	–	11.32 s
VIIb	1.00 – 1.88 m[t]	–	2.50 q	3.54 t	–	11.22 s
VIIc	0.66 – 1.99 m[u]	–	2.48 t	3.50 t	–	11.30 s
VIIe[v]	0.78 – 1.59 m	–	–	3.36 t	7.26 s, 10 H	11.52 s
VIIf	1.06 m	–	–	3.68 t	7.32 s, 10 H	11.54 s
VIIIa	–[w]	2.40 s	3.08 s	3.40 – 4.14 m	–	–
IXa	–[x]	2.14 s	3.16 s	3.38 – 3.68 m	–	–
IXg[y]	–[z]	–	3.34 s	3.60 t	7.21 q, 8 H	–
Xa	–[aa]	2.12 s	3.20 s	3.46 t	–	–
XIa	–[bb]	2.14 s	3.34 s	3.40 t	–	–

[a] 2 NCH_3 for compounds *VIIIa*, *IXa*, *IXg*, *Xa* and *XIa*; [b] m, 8 H, 4 CH_2; [c] 1.08 d, 12 H, 4 CH_3 and 2.49 m, 2 H, 2 CH; [d] 3.58 s, 4 H, 2 CH_2; [e] 1.66 s, 6 H, 2 CH_3; [f] 0.90 – 1.82 m, 6 H, 3 CH_2; [g] m, 14 H, 4 CH_2 and 2 CH_3; [h] m, 12 H, 6 CH_2; [i] 2.44 m, 2 H, 2 CH; [j] m, 20 H, 4 CH_2 and 4 CH_3; [k] 3.92 s, 4 H, 2 CH_2; [l] 2.34 s, 6 H, 2 CH_3; [m] m, 18 H, 6 CH_2 and 2 CH_3; [n] m, 22 H, 8 CH_2 and 2 CH_3; [o] 2.34 – 2.84 m, 2 H, 2 CH; [p] m, 24 H, 6 CH_2 and 4 CH_3; [q] 3.94 s, 4 H, 2 CH_2; [r] 2.38 s, 6 H, 2 CH_3; [s] 1.02 – 1.74 m, 14 H, 7 CH_2; [t] m, 26 H, 10 CH_2 and 2 CH_3; [u] m, 30 H, 12 CH_2 and 2 CH_3; [v] 3.90 s, 4 H, 2 CH_2; [w] 1.80 t, 4 H, 2 CH_2; [x] 0.94 – 1.93 m, 8 H, 4 CH_2; [y] 2.38 s, 6 H, 2 CH_3; [z] 0.73 – 1.60 m, 8 H, 4 CH_2; [aa] 0.80 – 1.74 m, 12 H, 6 CH_2; [bb] 1.23 s, 20 H, 10 CH_2.

α,ω-Bis(3-aryl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)alkanes *II – VII*. General Procedure

Aromatic ester ethoxycarbonylhydrazone (*I*, 0.02 mol) was treated with the corresponding α,ω-diaminoalkane (0.01 mol), and the mixture was heated at 170 – 180 °C for 1 h. The precipitate formed on cooling was recrystallized from an appropriate solvent to afford compounds *II – VII*.

α,ω-Bis(1-methyl-3-alkyl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)alkanes *VIII – XI*. General Procedure

α,ω-Bis(3-alkyl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)alkane (*II – VII*, 0.05 mol) was dissolved in 2 M NaOH solution (16 ml) and dimethyl sulfate (1.04 ml, 0.011 mol) was added dropwise with constant shaking. After stirring of the mixture at room temperature for 2 h, the resulting solution was evaporated at 40 – 45 °C under reduced pressure and dried in vacuo. Several recrystallizations of the residue from an appropriate solvent gave compound *VIII – XI*.

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