Reaction of a Zwitterionic Pyridinium Ylide with *N,N*-Dimethylaniline

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1,3-Dimethyl-2,4,6-trioxo-5-pyridinomethyl-1,3-perhydrodiazin-5-ylpyridinium ylide (**3**) reacts with *N,N*-dimethylaniline to give 5-((1,3-dimethyl-2,4,6-trioxo-hexahydropyrimidin-5-yl)methyl)-5-(4-(dimethylamino)benzyl)-1,3-dimethylpyrimidine-2,4,6(1*H*3*H*5*H*)-trione (**6**) in good yield. The crystal structure of **6** is reported.

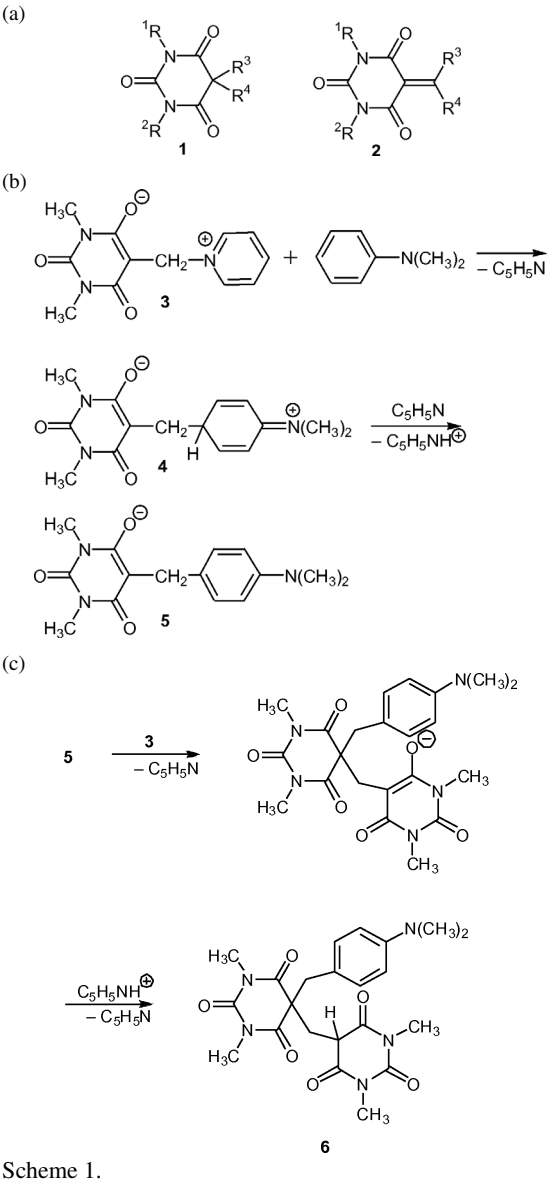
Key words: Heterocycles, Barbituric Acid, Crystal Structure

There has been much interest in barbituric acid derivatives (**1**) in the past years owing to their potential application as drugs [1, 2]. Catalytic hydrogenation of 5-methylenebarbituric acid derivatives (**2**) seems to offer a useful access to **1** [3] in addition to methods mentioned formerly [1, 4]. Recently, we reported on the synthesis of the zwitterionic pyridinium compound **3** and its substitution reactions [5].

Surprisingly, it has now been found that the reaction of **3** with *N,N*-dimethylaniline does not stop with the formation of the zwitterionic compound **4** and its anion **5**. Apparently, the enolate **5** is sufficiently nucleophilic to attack a second molecule of **3** to give the final product **6** in good yield (Scheme 1).

The crystal structure analysis of **6** (Table 1, Fig. 1) reveals the presence of a central barbituric ring connected to both an aniline and an additional barbituric ring by methylene bridges. Interestingly, the "terminal" barbituric ring also adopts a diketo structure which underlines the C-basicity of the enolate fragment. Bond lengths and angles are in the expected range (see Table 2).

In summary, our results confirm the suitability of the easily prepared pyridine adduct **3** as starting compound for the synthesis of barbituric acid derivatives **1**. We will continue our investigations about pyridine substitution in **3** and report on our results in due course.



Scheme 1.

Experimental Section

All experiments were performed in purified solvents under argon. The pyridine adduct **3** was obtained according to a published procedure [5].

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Table 1. Crystal data and structure refinement for $C_{22}H_{27}N_5O_6$ (**6**).

Empirical formula	$C_{22}H_{27}N_5O_6$
Formula weight, g mol^{-1}	457.49
Temperature, K	173(2)
Wavelength; λ, Å	MoK_α; 0.71073
Crystal system	monoclinic
Space group	$P2_1/n$
a, Å	12.1221(9)
b, Å	9.287(1)
c, Å	20.090(2)
β, deg	101.787(6)
V, Å^3	2214.1(3)
Z	4
Density, g cm^{-3}	1.37
μ(MoK_α), mm^{-1}	0.1
F(000), e	968
Θ range for data collection, deg	3.09 – 26.36
hkl ranges	±15, ±11, ±25
Reflections collect. / indep. / R_{int}	30767 / 4515 / 0.098
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	4515 / 0 / 407
$R1$ / w$R2$ [$I \geq 2\,\sigma(I)$]	0.0520 / 0.1048
$R1$ / w$R2$ (all data)	0.0677 / 0.1111
Goodness-of-fit on F^2	1.151
$\Delta\rho$ (max / min), e Å^{-3}	+0.267 / −0.207

Table 2. Selected bond lengths (Å) and angles (deg) for $C_{22}H_{27}N_5O_6$ (**6**).

C(1)–C(6)	1.503(3)	C(14)–N(15)	1.382(2)
C(1)–C(2)	1.505(3)	N(15)–C(16)	1.381(3)
C(1)–C(12)	1.556(3)	C(16)–O(21)	1.208(2)
C(2)–O(7)	1.209(2)	C(16)–N(17)	1.393(3)
C(2)–N(3)	1.379(2)	N(17)–C(18)	1.371(2)
N(3)–C(4)	1.390(2)	C(18)–O(23)	1.215(2)
C(4)–O(9)	1.205(2)	C(24)–C(25)	1.507(3)
C(4)–N(5)	1.394(2)	C(25)–C(26)	1.390(3)
N(5)–C(6)	1.372(2)	C(25)–C(30)	1.391(3)
C(6)–O(11)	1.216(2)	C(26)–C(27)	1.383(3)
C(12)–C(13)	1.537(2)	C(27)–C(28)	1.404(3)
C(13)–C(18)	1.512(3)	C(28)–N(31)	1.377(3)
C(13)–C(14)	1.514(3)	C(28)–C(29)	1.402(3)
C(13)–C(24)	1.589(3)	C(29)–C(30)	1.384(3)
C(14)–O(19)	1.210(2)		
C(13)–C(12)–C(1)	116.4(2)	C(6)–C(1)–C(2)	115.1(2)
C(12)–C(13)–C(24)	106.8(2)	C(6)–C(1)–C(12)	111.6(2)
C(25)–C(24)–C(13)	115.1(2)	C(2)–C(1)–C(12)	106.1(2)
C(33)–N(31)–C(32)	117.6(2)		

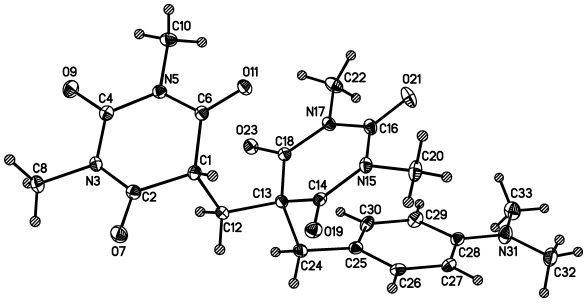

Fig. 1. Molecular structure of $C_{22}H_{27}N_5O_6$ (**6**) in the crystal.

*$C_{22}H_{27}N_5O_6$ (**6**)*

To a solution of **3** (2.2 g, 8.9 mmol) in dichloromethane (20 mL) *N,N*-dimethylaniline (0.62 g, 4.9 mmol) was added. The mixture was stirred at r. t. for 24 h. The solvent was removed *in vacuo* to give 0.79 g (70 %) **6** after recrystallization from dichloromethane/diethyl ether. – ^{1}H NMR ($CDCl_3$): δ = 2.75 (s, 2 H, 4_{Ph}-CH_2), 2.83 (s, 6 H, NMe_2), 2.95 (s, 2 H, 5′-CH_2), 3.01 (s, 6 H, 1′,3′-CH_3), 3.15 (s, 6 H, 1,3-CH_3), 3.65 (s, 1 H, 5′-H), 6.48 – 6.69 (m, 4 H, C_6H_4). – ^{13}C NMR ($CDCl_3$): δ = 28.2 (1,3-CH_3), 28.5 (1′,3′-CH_3), 33.7 (4_{Ar}-CH_2), 40.3 (NMe_2), 44.6 ($C^{5'}$), 49.5 C^5), 56.1 (5′-CH_2), 111.8 ($C^{2,6}{}_{Ar}$), 119.9 ($C^4{}_{Ar}$), 129.7 ($C^{3,5}{}_{Ar}$), 150.3 ($C^1{}_{Ph}$), 150.6 (C^2), 151.2 ($C^{2'}$), 168.3 ($C^{4',6'}$), 170.9 ($C^{4,6}$). – MS (FAB): *m/z* (%) = 457 (11) $[M–H]^+$, 288 (15) $[M–BCH_3]^+$. – Elemental analysis for $C_{22}H_{27}N_5O_6$ (457.48): calcd. C 57.76, H 5.95, N 15.31; found C 57.41, H 6.19, N 15.12.

CCDC 743774 contains the supplementary crystallographic data for this paper. These data can be obtained free of charge from The Cambridge Crystallographic Data Centre *via* www.ccdc.cam.ac.uk/data_request/cif.

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