

THE MAIN CONSIDERATIONS REGARDING THE IMPORTANCE AND RANGE OF USES OF ARILAZOPYRIMIDINES

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ABSTRACT

The synthesis of arilazopyrimidines is accomplished most often either by coupling a pyrimidine with a diazonium salt coming from an aromatic amine, or by coupling a diazopyrimidine with an phenol or with an aromatic amine. There are also a lot of indirects methods of synthesis and primary synthesis.

The main purpose of the undertaken research was to obtain the characteristics of some arilazopyrimidines. These compounds shows a different interest under the structural aspect, because the tautomeric phenomenon is very complex.

The compound that were taken into account were done with barbituric acid and some substituted pyrimidines. The IR secrets of the derivatives obtained from the barbituric acid presents a group of bands from the region 3260-3080 cm, due to the valence of vibrations of NH groups in both from the pyrimidines skeleton and the hydrozonic group.

In order to obtain additional arguments about the adoption of azo or hidrazo structure, of these compounds, we undertook a complex study HyperChem5.

Key words: the arilazopyrimidines synthesis, the barbituric acid, IR spectra.

INTRODUCTION

The interest for the arilazopyrimidines is distinguished by the following facts:

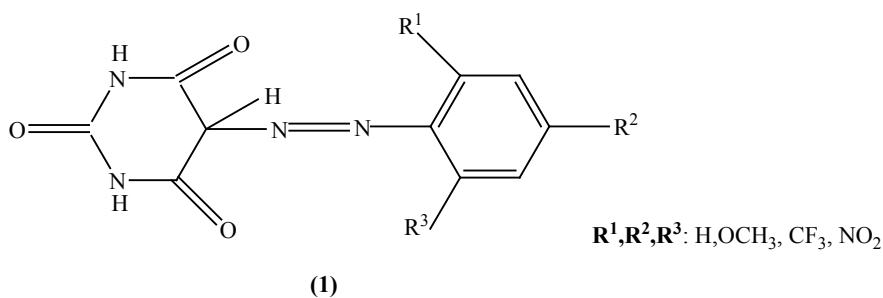
- some arilazopyrimidines are known by some of their pharmacological activity [1,2].
- are many azoderivatives containing a pyrimidine core, used or recommended to be used like others for cellulose fibers in shades of yellow-gold [3].
- from azo compounds obtained by reduction reaction, we can obtain amino-pyrimidines and by cyclizing reactions we can obtain the purines and pteridines [4, 5].

The synthesis of arilazopyrimidines is often done either by coupling a pyrimidine with a diazonium salt derived from an aromatic amine, or by connecting a diazopyrimidine with a phenol or aromatic amine. There are also indirect methods of synthesis, and primary synthesis.

Generally speaking, the arilazo group may be introduced into the structure of a pyrimidine in very mild conditions without affecting even the most labile substituents in the substrate. The reaction usually takes place in the position 5, but substitutions can be made at to another carbon atom of the core pyrimidine and even extracyclic carbon atom, or nitrogen.

The main objective of the researches was to obtain some arilazopyrimidines and their characteristics. These compounds present an particular structural aspect, because the tautomery phenomenon is very complex. On the one hand, in the pyrimidine core substituted with hydroxy groups, amino or mercapto we can observe the tautomery well known of these compounds, and on the other hand the group azo present the tautomery exocyclic azo ↔ hydrazo.

The analysed compounds were obtained from barbituric acid (1) and some substituted pyrimidines (2)



The structural studies done consider the known informations about the diverse substituted pyrimidines [6].

The substances are summarized in Table 1, together with the data that were used to characterize them. As mentioned, they are identical to substances obtained by condensation of aloxan with the arilhidrazineles appropriately substituted.

Work flow

To prepare these compounds we used the general procedure described below:

In a mixture of 10 ml and 10 ml concentrated HCl is dissolved in hot water, stirring, 0.0125 mol aromatic amine. The solution is cooled to 0°C and then gradually added to a solution cooled to 0°C NaNO₂ (0.7 g) in water (8 ml). The diazonium salt formed is filtered and added quickly, stirring, at a solution of barbituric acid (1.54

g) and sodium acetate (0.16 g) in methanol (20 ml) maintaining the mixture at 0°C. We bring the mixture to the room temperature and the yellow crystalline compound formed is filtered, washed on the filter with 3 x 15 ml ethanol. The purification we can done by recrystallization from DMFA using active coal.

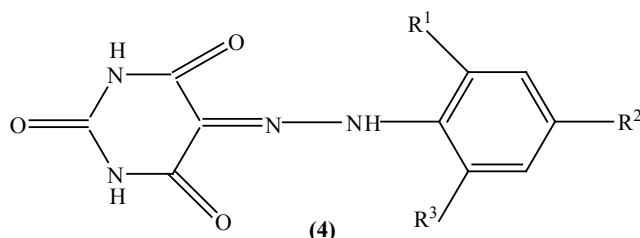
Equipment

IR spectra were performed [7] on a Specord 75-IR camera. ¹H-NMR spectra were performed [7] on a Varian 330 MHz machine, and the mass [7] on a Varian MAT unit.

Experimental results and discussion

The Table 1 presents the results of elementary analysis of carbon, hydrogen and nitrogen, solvents used for recrystallization and melting points of compounds obtained.

Table 1. The results of elementary analysis of nitrogen, efficiency and melting points



No crt	R ¹	R ²	R ³	Molecular weight	Analysis dementiacalculated/d etermined			Color	Recrystal lization solvent	Efficienc y %	P.t. °C
					C%	H%	N%				
1.	H	H	H	C ₁₀ H ₈ N ₄ O ₃ 232,20	51,70 51,43	3,50 3,41	24,10 24,00	Yellow	DMFA	78	306
2.	OCH ₃	H	H	C ₁₁ H ₁₀ N ₄ O ₄ 262,23	50,34 50,10	3,86 3,72	21,37 21,20	Yellow	DMFA	65	272
3.	H		H	C ₁₁ H ₇ N ₄ O ₃ F ₃ 300,20	43,97 43,70	2,35 2,28	18,66 18,41	Light yellow	Acid acetic	55	285-290
4.	NO ₂	H	H	C ₁₀ H ₇ N ₅ O ₅ 277,20	43,30 43,18	2,50 2,25	25,30 25,10	Bright yellow	DMFA	60	290-296
5.	NO ₂	H	NO ₂	C ₁₀ H ₆ N ₆ O ₇ 322,19	37,30 37,00	1,90 1,81	26,10 25,90	Bright yellow	DMFA	83	305-310

The elementary analysis confirmed the molecular formula and the experimental data are within the limit of permissible error. The synthesis yields are relatively high and melting points are around 270-310 ° C.

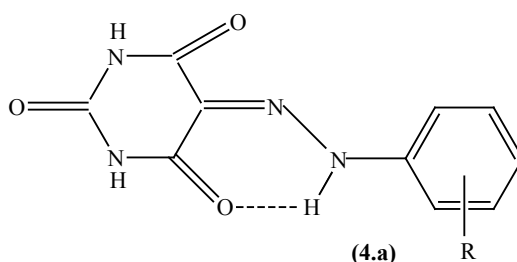
The Table 2 summarizes the main spectral data for the obtained products.

Table 2. The main spectral data of the products (4)

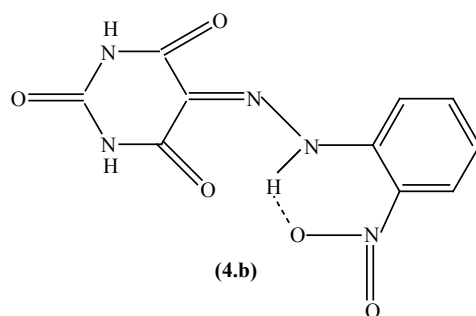
No. crt	R ¹	R ²	R ³	Absorptions in IR			¹ H-RMN δ _{NH} (ppm)	M ⁺ u.m.
				ν _{NH}	ν _{CO}	ν _{C=N}		
1	H	H	H	3260 (i) 3170 (s) 3100 (i) 3068 (s)	1780 (s) 1750 (i) 1710 (i)	1620 (i)	14.16 11.45 11.22	306
2	OCH ₃	H	H	3250 (i) 3180 (m) 3100 (i)	1785 (s) 1730 (i) 1720 (i)	1650 (i) 1608 (m)	14.80 11.50 11.30	272
3	H	CF ₃	H	3200 (i) 3080 (m)	1785 (s) 1740 (i) 1710 (i)	1630 (i)	15.10 11.80 11.60	300
4	NO ₂	H	H	3187 (i) 3086 (i)	1759 (s) 1738 (i) 1713 (i) 1674 (i)	1649 (i) 1610 (m)	15.28 11.75 11.50	277
5	NO ₂	H	NO ₂	3170 (i) 3094 (i)	1748 (i) 1719 (i) 1667 (i)	1616 (s) 1607 (m)	15.25 11.86 11.62	322

IR spectras of azo ↔ hydrazo derivatives obtained from barbituric acid present the group of bands in the region of 3260-3080 cm⁻¹ due to the valence vibrations of NH groups from both the pyrimidine skeleton, and also from the group hydrazonic. The emergence of these bands at relatively small wave numbers indicates the existence

of hydrogen bonds that can be inter- or intra-molecular. Intermolecular hydrogen bonds is the formation of dimers by intermolecular association (=NH---O=C=), while the intramolecular bonds can be established between hydrazonic NH group and an carbonyl group of a pyrimidine cycle **(4a)**:



The compounds (4) and (5) of Table 1 and 2, can be involved also the group o-NO₂ in creating intramolecular hydrogen bonds **(4b)**:



Final remarks

In the valence vibrations field of carbonyl groups there are a number of bands that can not be attributed with certainty to the group C=O vibration-free, or those involved in the inter or intramolecular association.

As we can see in the Table 2, the ¹H-NMR spectras record different signals for the three NH groups. The corresponding protons for the barbituric ring (N1 and N3) appear at the higher fields namely δ between 11-12 ppm, while the NH phenylhydrazonic proton signal appears on the lower fields, between 13-16 ppm. In the literature mentioned [8, 9] the fact that the chemical displacement of NH hydrazonic protons are very sensitive to hydrogen bond creation. The compound (4b) which contains also the o-nitro group, participates, certainly, to the intramolecular association, and δ (NH) occurs at even lower fields, situated at 15.28 ppm, and 15.25 ppm. In these cases the hydrogen bonds are probably trycentered, like =C=O-NH-O₂N-. This would explain the strong nonshielding of this proton.

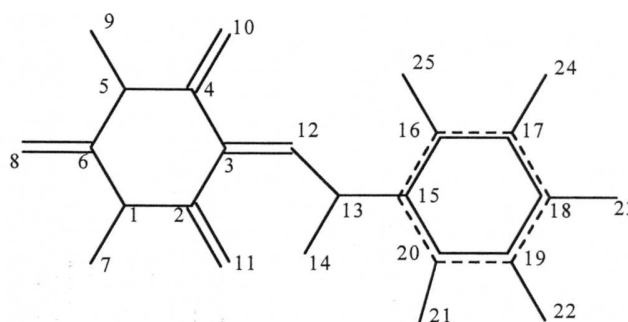
Hyper Chem computational study

In order to obtain additional arguments on the adoption of azo-hydrazo structure of these compounds, we undertook a computational study HyperChem5 following the following steps:

- we create the usual molecule Draw

- bring home the conformation using the routine „Add Hydrogen and Model Building. „ The program brings the startup configuration to a model plane, which leads to the conclusion that there is steric refer clips.
- define the torsion angles α , β and, in some cases, θ to be rotated.
- it is a study of conformation with the routine „conformational search „ turning angles chosen with a pitch of 0.1 degrees, and the energy changes by 0.05 kcal / mol. For each rotation of the molecular mechanics program from the HyperChem package we make an optimization showing the minimum energy where the convergence were achieved and the values of torsion angles for the conformation chosen.
- we make a new geometry optimization with the lowest molecular energy using the AM1 program from the semiempiric software package, then we will read again the torsion angles results.
- we calculate the atomic tasks, dipolemoment, heat of creation, interatomic distance and valence angle.

The results of this study are presented in Tables 3 and 4.



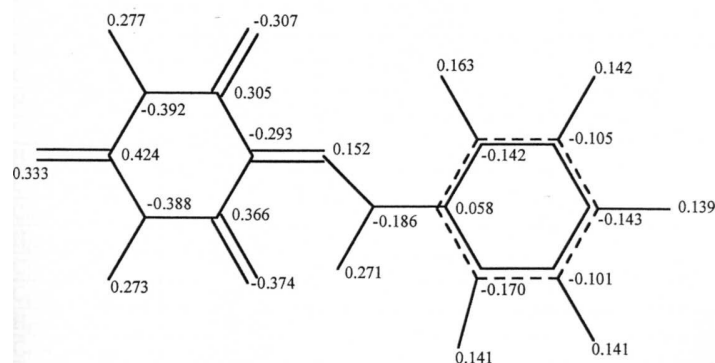


Figure 1. Charge densities of tautomeric hydrazone (4.1)

Table 3. Valence angles and interatomic distances in tautomeric hydrazone

Atom nature	Valence angle (°)	Atom nature	Interatomic distance (Å)
H ₇ -C ₁ -C ₂	118,31	N ₁ -C ₂	1,38
N ₁ -C ₂ -O ₁₁	117,60	C ₂ -C ₃	1,36
N ₁ -C ₂ -C ₃	119,97	C ₃ -C ₄	1,36
O ₁₁ -C ₂ -C ₃	122,42	C ₃ -N ₅	1,38
C ₃ -C ₂ -C ₄	118,88	N ₅ -C ₆	1,38
C ₃ -C ₄ -O ₁₀	121,79	C ₆ -N ₅	1,38
C ₃ -C ₄ -C ₅	119,98	O ₈ -C ₆	1,20
O ₁₀ -C ₄ -N ₅	118,23	H ₇ -N ₁	1,01
C ₄ -N ₅ -H ₉	118,19	O ₁₁ -C ₂	1,21
H ₉ -N ₅ -C ₆	118,45	H ₆ -N ₅	1,01
C ₄ -N ₅ -C ₆	123,32	O ₁₀ -C ₄	1,21
N ₅ -C ₆ -O ₈	122,81	C ₂ -N ₁₂	1,35
N ₅ -C ₆ -N ₁	114,52	N ₁₂ -N ₁₃	1,35
O ₈ -C ₆ -N ₁	122,68	H ₁₄ -N ₁₃	1,02
C ₆ -N ₁ -C ₂	123,32	N ₁₃ -C ₁₅	1,34
C ₂ -C ₃ -N ₁₂	122,49	O ₅ -C ₂₀	1,39
C ₂ -N ₁₂ -N ₁₃	124,74	C ₂₀ -C ₁₉	1,39
N ₁₂ -N ₁₃ -H ₁₄	122,37	C ₁₉ -C ₁₈	1,39
N ₁₂ -N ₁₃ -C ₁₅	124,84	C ₁₈ -C ₁₇	1,39
H ₁₄ -N ₁₃ -C ₁₅	112,78	C ₁₇ -C ₁₆	1,39
N ₁₃ -C ₁₅ -C ₂₀	118,02	C ₁₆ -C ₁₅	1,39
C ₁₅ -C ₂₀ -H ₂₂	120,31	C ₂₀ -H ₂₁	1,10
H ₂₁ -C ₂₀ -C ₁₉	119,53	C ₁₉ -H ₂₂	1,10
C ₁₅ -C ₂₀ -C ₁₉	120,13	C ₁₈ -H ₂₃	1,10
C ₂₀ -C ₁₉ -H ₂₂	119,97	C ₁₇ -H ₂₄	1,10
C ₂₀ -C ₁₉ -C ₁₈	120,00	C ₁₅ -H ₂₅	1,10
H ₂₂ -C ₁₉ -C ₁₈	120,02		
C ₁₉ -C ₁₈ -H ₂₃	120,02		
H ₂₃ -C ₁₈ -C ₁₇	120,08		
C ₁₉ -C ₁₈ -C ₁₇	119,89		
C ₁₈ -C ₁₇ -H ₂₄	119,82		
H ₂₄ -C ₁₇ -C ₁₆	119,98		
C ₁₈ -C ₁₇ -C ₁₆	120,20		
C ₁₇ -C ₁₆ -H ₂₅	119,02		
H ₂₅ -C ₁₆ -C ₁₅	121,08		
C ₁₇ -C ₁₆ -C ₁₅	119,89		
C ₁₆ -C ₁₅ -N ₁₃	122,11		

Electric moment: 4,044 D

Heat creation : 12,21 kcal / mol

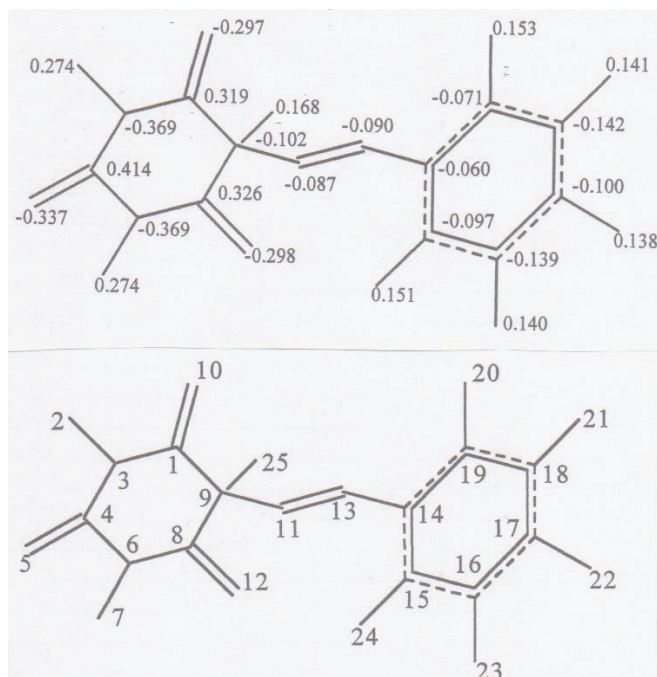


Figure 2. Charge densities of tautomeric azo (1 cu $R^1, R^2, R^3 = H$)

Table 4. Valence angles and interatomic distances in tautomeric azo

Atom nature	Valence angle(°)	Atom nature	Interatomic distance(A)
$O_5-C_4-N_6$	120,64	O_5-C_4	1,24
$C_4-N_6-H_7$	116,75	C_4-N_6	1,40
$C_4-N_6-C_8$	123,82	H_7-N_6	0,99
$H_7-N_6-C_8$	119,43	N_6-C_8	1,39
$N_6-C_8-O_8$	120,13	C_8-O_8	1,23
$N_6-C_8-C_{12}$	118,57	C_8-C_{12}	1,53
$O_8-C_8-C_9$	121,29	C_8-H_{25}	1,13
$C_{12}-C_8-C_9$	114,41	C_9-C_1	1,53
$H_{25}-C_9-C_1$	106,26	C_1-O_1	1,23
$C_9-C_1-O_{10}$	121,21	C_1-N_3	1,39
$O_{10}-C_1-N_3$	120,68	N_3-H_2	0,99
$C_9-C_1-N_3$	118,62	N_3-C_2	1,40
$C_1-N_3-H_2$	119,43	C_2-N_3	1,48
$C_1-N_3-C_2$	123,79	N_3-N_{11}	1,22
$H_2-N_3-C_2$	116,76	$N_{11}-C_{13}$	1,43
$N_3-C_2-O_3$	120,57	$C_{13}-C_{14}$	1,40
$O_3-C_2-N_{11}$	114,42	$C_{14}-H_{15}$	1,10
$C_9-N_3-N_{11}$	118,089	$C_{15}-C_{24}$	1,39
$N_{11}-N_{13}-C_{14}$	120,32	$C_{15}-H_{16}$	1,10
$H_{15}-C_{14}-C_{15}$	124,59	$C_{16}-C_{23}$	1,39
$C_{13}-C_{14}-H_{15}$	120,71	$C_{16}-C_{17}$	1,39
$C_{14}-C_{15}-C_{24}$	120,01	$C_{17}-C_{18}$	1,39
$C_{14}-C_{15}-H_{16}$	119,57	$C_{18}-C_{19}$	1,31
$C_{14}-C_{15}-C_{23}$	120,42	$C_{19}-H_{14}$	1,10
$H_{16}-C_{15}-C_{17}$	120,01	$C_{16}-H_{24}$	1,10
$C_{23}-C_{16}-C_{17}$	120,07	$C_{17}-H_{22}$	1,10
$C_{16}-C_{17}-H_{22}$	119,89	$C_{18}-H_{21}$	1,10
$C_{16}-C_{17}-C_{18}$		$C_{19}-H_{20}$	1,10



H ₂₂ -C ₁₇ -C ₁₈	120,04		
C ₁₇ -C ₁₈ -H ₂₁	119,95		
H ₂₁ -C ₁₈ -C ₁₉	119,48		
C ₁₇ -C ₁₈ -C ₁₉	120,56		
C ₁₈ -C ₁₉ -H ₂₀	119,76		
C ₁₈ -C ₁₉ -C ₁₄	119,81		
H ₂₀ -C ₁₉ -C ₁₄	120,42		
C ₁₉ -C ₁₄ -N ₁₃	116,07		

Electric moment: 3,057 D

Heat creation: 11,98 kcal / mol

CONCLUSIONS

From the HyperChem study that we done we can bring the conclusion that the charge densities of atoms are suitable for the atoms and for the type of hybridization. Also, the valence angles and the interatomic distances correspond to a flush system quasiaromatic with acceptable values.

The tautomeric hydrazone electric moment is higher than the of tautomeric azo. Following the heat of formation, it appears that would be more stable azo tautomer with 0.23 kcal/mol. Of course, the spectral data show that in solid and solution we can meet only the tautomeric hydrazone, whose stability is determined by hydrogen bond creation, as shown in structural formulas **(4.a)** and **(4.b)**.

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