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ANHYDRO ARYLOSAZONES

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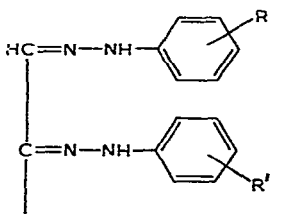
ABSTRACT

A number of mixed arylosazones were prepared and converted into dianhydro derivatives of the Percival type (2) by deacetylation of their tetra-*O*-acetyl derivatives, and into dianhydrides of the pyrazole type (3 and 4) by boiling with acetic anhydride.

INTRODUCTION

In this paper, we describe the preparation of some new, mixed arylosazones and their conversion (together with some other known arylosazones) into (*a*) dianhydro-osazones of the Percival type, by deacetylation of their acetates[1], and (*b*) dianhydro-osazones of the pyrazole type, by boiling with acetic anhydride[2].

The mixed osazones prepared, of type (1) (see Table I), were: D-*arabino*-hexulose 2-(*p*-chlorophenyl)-1-phenyl-, 2-(*p*-bromophenyl)-, and 2-(*p*-iodophenyl)-osazones; and 2-(*p*-chlorophenyl)-1-*p*-tolyl-, 2-(*p*-bromophenyl)-, and (2-*p*-iodophenyl)-osazones. Crystalline tetra-*O*-acetyl derivatives were obtained from the mixed (2-*p*-bromophenyl)-1-phenylosazone and the 2-(*p*-iodophenyl)-1-phenylosazone, as well as from simple arylosazones of D-*arabino*-hexulose and D- or L-*erythro*-pentulose (see Table I). Deacetylation of the hexose derivatives yielded dianhydro-osazones of the Percival type (2) (see Table II).



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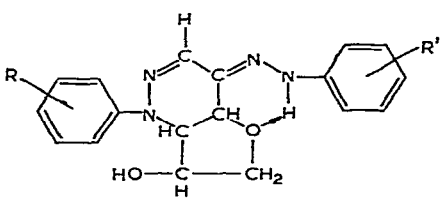

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On boiling D-*arabino*-hexulose *o*-tolylosazone with acetic anhydride, and hydrolyzing the product, we obtained 5-(D-*glycero*-1,2-dihydroxyethyl)-3-formyl-1-*o*-tolylpyrazole *N*-acetyl-*o*-tolylosazone (3, R = *o*-Me). Similar treatment of D-*arabino*-hexulose *m*-tolylosazone and *p*-tolylosazone yielded 5-(D-*glycero*-1,2-

TABLE I

OSAZONES AND THEIR *O*-ACETYL DERIVATIVES (1)

Structure[a] 1	*R*	*R'*	*m.p.*, *degrees*[b]	$[\alpha]_D^{20}$ *degrees*[c]	*Formula*	*Calc.* C	H	N	*Found* C	H	N	ν_{max}^{KBr} C=N	OH	λ_{max}^{EtOH}	*log ε*	λ_{min}^{EtOH}	*log ε*
2	H	*p*-Cl	200–203(d.)	+98.5	$C_{18}H_{21}ClN_4O_4 \cdot 0.5H_2O$	53.8	5.5	13.9	54.3	6.0	13.9	—					
	H	*p*-Br	197–198(d.)	+33.3	$C_{18}H_{21}BrN_4O_4$	49.4	4.8	12.8	49.6	4.8	12.4	—		392,311,259	3.6,3.0,2.9	333,285	1.7,0.9
	H	*p*-I	184–187(d.)	—	$C_{18}H_{21}IN_4O_4 \cdot H_2O$	—	—	11.1			10.9	—					
	p-Me	*p*-Cl	204–208(d.)	—	$C_{19}H_{23}ClN_4O_4 \cdot H_2O$	53.8	5.9	13.2	54.1	5.4	13.6	—					
	p-Me	*p*-Br	200–203(d.)	—	$C_{19}H_{23}BrN_4O_4 \cdot 0.5H_2O$	49.5	5.2	12.2	49.0	5.3	11.9	—					
	p-Me	*p*-I	222–224(d.)	—	$C_{19}H_{23}IN_4O_4 \cdot H_2O$	44.2	4.9	10.9	44.4	5.0	10.8	—					
O-Acetyl derivatives																	
2	H	*p*-Br	138–139	+70.3	$C_{26}H_{29}BrN_4O_8$	51.6	4.8	9.3	51.1	4.6	9.0			*C=N OAc*			
	H	*p*-I	144–146	+84.9	$C_{26}H_{29}IN_4O_8$	47.9	4.4	8.6	47.4	4.4	8.1						
	R = R'																
	4-Br-2-Me		172–174	−32.6	$C_{28}H_{32}Br_2N_4O_8$	47.2	4.5	7.9	47.3	4.5	7.6	1580	1740	406,335,265	4.2,0.6,5.2	351,322	0.3,0.5
3	*p*-Br		173–174	—	$C_{26}H_{28}Br_2N_4O_8$	45.6	4.1	8.2	45.8	4.4	7.7	1600	1745	394,316,264	3.3,0.9,2.6	343,287	1.0,0.8
4	*o*-Me		155–157	+80	$C_{25}H_{30}N_4O_6$	62.2	6.2	11.6	62.0	6.6	11.6	1595	1740	400,305,256	2.8,2.8,1.7	346,280	0.9,0.8
	p-Me		146–148	—	$C_{25}H_{30}N_4O_6$	62.2	6.2	11.6	62.6	6.5	11.8	1595	1740	406,317,259	3.5,1.5,3.5	356,284	0.9,0.6
5	*o*-Me		156–158	−78.3	$C_{25}H_{30}N_4O_6$	62.2	6.2	11.6	62.6	6.6	12.0	1615	1740	400,305,256	3.2,3.3,1.8	347,284	0.9,0.8

[a] 1, *Parent sugar*; 2, D-Glucose; — 3, D-Galactose; — 4, D-Xylose; — 5, L-Xylose.
[b] The symbol d. indicates decomposition. [c] Specific rotations were determined in methanol.

dihydroxyethyl)-3-formyl-1-*m*-tolylpyrazole *N*-acetyl-*m*-tolylhydrazone (3, R = *m*-Me) and 5-(D-*glycero*-1,2-dihydroxyethyl)-3-formyl-1-*p*-tolylpyrazole *N*-acetyl-*p*-tolylhydrazone (3, R = *p*-Me). Acetylation of the last compound afforded 5-(D-*glycero*-1,2-diacetoxyethyl)-3-formyl-1-*p*-tolylpyrazole *N*-acetyl-*p*-tolylhydrazone.

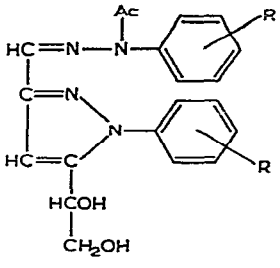
TABLE II

DIANHYDRO-OSAZONES OF THE PERCIVAL TYPE (2)

Parent sugar	*R*	*R'*	*m.p., degrees*[a]	*Formula*	*Calc.*			*Found*			ν_{max}^{KBr}	
					C	*H*	*N*	*C*	*H*	*N*	*C=N*	*OH*
D-Glucose	H	*p*-Br	251–255 (d.)	$C_{18}H_{17}BrN_4O_2$	53.8	4.2	14.0	53.4	4.1	13.6		
	p-Me	H	224–227 (d.)	$C_{19}H_{20}N_4O_2$	67.8	6.0	—	67.5	6.3	—		
	R = R'											
	4-Br-2-Me		204–206 (d.)	$C_{20}H_{20}Br_2N_4O_2$	47.2	3.9	—	46.9	4.0	—		
D-Galactose	*p*-Br		268–271 (d.)	$C_{18}H_{16}Br_2N_4O_2$	45.0	3.3	11.7	45.4	3.8	11.3		
L-Sorbose	*p*-Br		270–272 (d.)	$C_{18}H_{16}Br_2N_4O_2$	45.0	3.3	11.7	45.1	3.6	11.5	1595	3500
	o-Me		208–210[5]	$C_{20}H_{22}N_4O_2$	68.6	6.3	16.0	68.5	6.8	15.8	1595	3350
	p-Me		264–266[5]	$C_{20}H_{22}N_4O_2$	68.6	6.3	16.0	68.8	6.8	16.0	1615	3550

[a]The symbol d. indicates decomposition.

Similar treatment of D-*threo*-pentulose *p*-tolylosazone with boiling acetic anhydride yielded 5-(acetoxymethyl)-3-formyl-1-*p*-tolylpyrazole *N*-acetyl-*p*-tolylhydrazone, which, on hydrolysis, afforded 3-formyl-5-(hydroxymethyl)-1-*p*-tolylpyrazole *N*-acetyl-*p*-tolylhydrazone (4).



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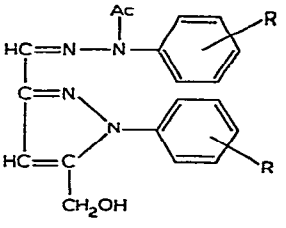

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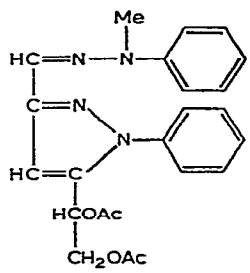
The *N*-acetylated derivatives (3 and 4) (see Table III) showed infrared spectra absorption characteristic of the *N*-acetyl group at 1690–1660 cm^{-1}, whereas the fully acetylated compound showed the ester band at 1740, the amide band at 1690, and the C=N band at 1610 cm^{-1}. Similar treatment, with acetic anhydride, of D-*arabino*-hexulose 1-(2-methyl-2-phenyl)-2-phenylosazone yielded 5-(D-*glycero*-1,2-diacetoxyethyl)-3-formyl-1-phenylpyrazole (2-methyl-2-phenyl)hydrazone (5), which is further proof that closure of the pyrazole ring involves the phenylhydrazone residue on C-2 of the osazone, and not that on C-1.

TABLE III

DIANHYDRO-OSAZONES OF THE PYRAZOLE TYPE (3 AND 4) AND THEIR *O*-ACETYL DERIVATIVES

Parent sugar	*R*	*m.p., degrees*	*Formula*	*Calc.*			*Found*			ν_{max}^{KBr}		
				C	*H*	*N*	*C*	*H*	*N*	*C=NNAc*		*OH*
D-Xylose	*p*-Me	129–131	$C_{21}H_{22}N_4O_2$	—	—	15.5			15.5	1610	1660	3450
D-Glucose	*o*-Me	164–166	$C_{22}H_{24}N_4O_3$	67.3	6.1	14.3	67.0	6.2	14.3	1610	1690	3400
	m-Me	173–175	$C_{22}H_{24}N_4O_3$	67.3	6.1	14.3	67.1	6.2	14.5	1610	1660	3400
	p-Me	185–188	$C_{22}H_{24}N_4O_3$	67.3	6.1	14.3	67.4	6.6	14.5	1610	1685	3420
	p-OMe	164–165	$C_{22}H_{24}N_4O_5$	62.3	5.5	13.2	62.1	5.4	13.4			
L-Sorbose	*p*-Me	186	$C_{22}H_{24}N_4O_3$	67.3	6.1	14.3	67.5	6.3	14.6	1610	1680	3400
***O*-Acetyl derivatives**												*ν*OAc
D-Xylose	*p*-Me	88–90	$C_{23}H_{24}N_4O_3$	68.3	5.9	13.9	68.5	6.2	14.3			
D-Glucose	*p*-Me	128–130	$C_{26}H_{28}N_4O_5$	65.5	5.9	11.8	65.5	5.9	11.6	1610	1690	1740
	p-I	166–168	$C_{20}H_{22}I_2N_4O_5$	41.1	3.1	8.0	41.1	3.4	7.8	1610	1690	1740



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EXPERIMENTAL

Infrared spectra were recorded on a Unicam SP-200 spectrophotometer, and ultraviolet spectra on a Unicam SP-800 spectrophotometer. Microanalyses were performed by A. Bernhardt, Mulheim, Germany.

Mixed osazones. — A solution of D-*arabino*-hexosulose 1-phenylhydrazone[3] (0.7 g), or 1-*p*-tolylhydrazone[4] (0.6 g) in ethanol (10 ml) was treated with (*p*-chlorophenyl)hydrazine (0.6 g), (*p*-bromophenyl)hydrazine (0.6 g), or (*p*-iodophenyl)-hydrazine (0.5 g) in ethanol. A few drops of acetic acid were added, and the mixture was warmed on a hot-water bath for 10 min, and cooled. The osazone obtained was collected, washed with dilute ethanol, and dried. The mixed osazones (see Table I) were recrystallized from dilute ethanol, giving yellow needles, soluble in methanol, ethanol, or acetone, and insoluble in water.

O-Acetyl derivatives of osazones. — A solution of the osazone (0.5 g) in pyridine (10 ml) was treated with acetic anhydride (10 ml), and the mixture was kept overnight at room temperature. It was then poured onto crushed ice, and the acetate obtained (see Table I) was filtered off, and recrystallized from dilute ethanol, to give yellow needles, soluble in methanol, ethanol, or ether, and insoluble in water.

Dianhydro-osazones of the Percival type. — A solution of the osazone acetate (0.3 g) in acetone (25 ml) was deacetylated with 1.5% aqueous sodium hydroxide (30 ml) overnight at room temperature. The dianhydro derivative that separated was filtered off, and recrystallized from ethanol, to give yellow needles, soluble in methanol, ethanol, or ether, and insoluble in water (see Table II).

Dianhydro-osazones of the pyrazole type. — A solution of the osazone (5 g) in acetic anhydride (50 ml) was refluxed for 2 h, and then poured onto crushed ice. After 24 h, the aqueous layer was decanted and discarded, and the residual oil was washed with water. This product was then hydrolyzed for 24 h at room temperature with ethanolic ammonia (20%, 30 ml). The solution was evaporated almost to dryness on a hot-water bath, whereupon the dianhydro-osazone of the pyrazole type (see Table III) separated. It was recrystallized from dilute ethanol, to give colorless plates, soluble in methanol, ethanol, or ether, and insoluble in water.

O-*Acetyl derivatives of the dianhydro-osazones of the pyrazole type.* — A solution of the dianhydro-osazone (0.4 g) in pyridine (10 ml) was treated with acetic anhydride (5 ml), and the mixture was kept overnight at room temperature. It was then poured onto crushed ice, and the *O*-acetyl derivative that separated was recrystallized from dilute ethanol, to give colorless plates, soluble in methanol, ethanol, or ether, and insoluble in water (see Table III).

5-(D-glycero-*1,2-Diacetoxyethyl)-3-formyl-1-phenylpyrazole (2-methyl-2-phenyl)-hydrazone.* — D-*arabino*-Hexulose 1-(2-methyl-2-phenyl)-2-phenylosazone (0.5 g) was refluxed with acetic anhydride (5 ml) for 30 min, and the mixture was poured onto crushed ice. The residue obtained (0.1 g) was washed, and recrystallized from ethanol, to give colorless, prismatic needles, m.p. 155–156°; soluble in methanol, ethanol, or chloroform, and insoluble in water.

Anal. Calc. for $C_{23}H_{24}N_4O_4$: C, 65.7; H, 5.7; N, 13.3. Found: C, 65.3; H, 6.0; N, 13.2.

REFERENCES

1. E. G. V. PERCIVAL, *J. Chem. Soc.*, (1936) 1770; (1938) 1384.
2. H. EL KHADEM AND M. M. MOHAMMED-ALY, *J. Chem. Soc.*, (1963) 4929.
3. G. HENSEKE AND M. WINTER, *Ber.*, 89 (1956) 956.
4. G. HENSEKE AND M. WINTER, *Ber.*, 93 (1960) 93.
5. H. EL KHADEM AND M. M. A. ABDEL RAHMAN, *J. Org. Chem.*, 31 (1966) 1178.