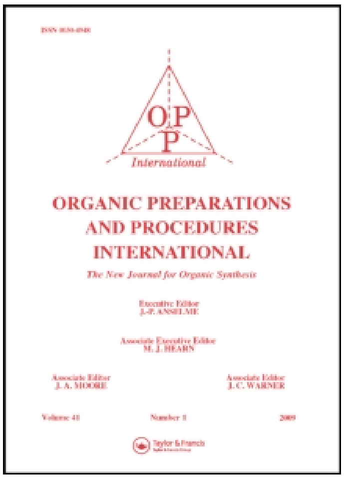


Organic Preparations and Procedures International
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t902189982

SACCHARIDE 1,3,4-OXADIAZOLES

M. Shaban[a][b]; M. Nassr[a]
[a] Chemistry Department, Faculty of Science, Alexandria University, Alexandria, Egypt [b] Laboratory for Carbohydrate Research, Harvard Medical School at Massachusetts General Hospital, Boston, MA, USA

To cite this Article Shaban, M. and Nassr, M.(1976) 'SACCHARIDE 1,3,4-OXADIAZOLES', Organic Preparations and Procedures International, 8: 3, 107 — 112

To link to this Article: DOI: 10.1080/00304947609355602

URL: http://dx.doi.org/10.1080/00304947609355602

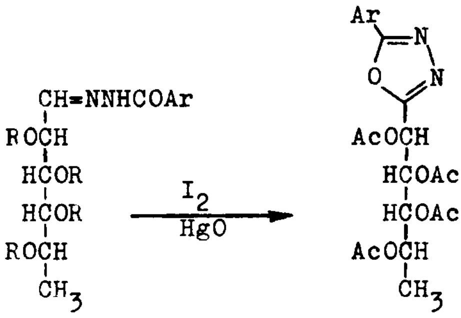
ORGANIC PREPARATIONS AND PROCEDURES INT. 8(3), 107-112 (1976)

SACCHARIDE 1,3,4-OXADIAZOLES

M. Shaban* and M. Nassr

Chemistry Department, Faculty of Science
Alexandria University, Alexandria, Egypt

In previous publications,[1-3] we have described the first synthesis of saccharide 1,3,4-oxadiazoles[1,2] and oxadiazolines[3] by the oxidative,[1] dehydrative,[2] and condensative[3] cyclization of saccharide aroylhydrazone acetates. We now describe the application and anomaly of the oxidative cyclization approach to 6-deoxy-aldehydo-hexose aroylhydrazone acetates.



I R = H

II R = Ac

III

a) Ar = C_6H_5

b) Ar = m-MeC_6H_4

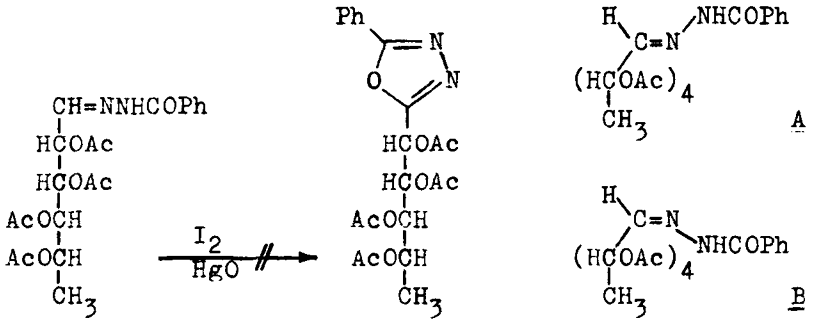
c) Ar = p-MeC_6H_4

L-Fucose (6-deoxy-L-galactose) was condensed with equimolar amounts of aroylhydrazines to give the corresponding aldehydo-L-fucose aroylhydrazones (Ia–Ic). Acetylation of these hydrazones with acetic anhydride and pyridine gave the crystalline tetra-O-acetyl derivatives (IIa–IIc) which showed, in addition to the amide I and amide II bands, ester carbonyl absorptions at 1760 cm^{-1}. The nmr spectrum of Ia showed the phenyl group at δ 8.00-7.20 as a 5-proton multiplet, the four O-acetyl groups as 3-proton singlets at δ 2.16, 2.03, 1.93, and 1.66 and the sugar methyl group as 3-proton doublet at δ 1.30 (J = 5.5 Hz).

aldehydo-Rhamnose (6-deoxy-L-mannose) benzoylhydrazone (IV) and its tetra-O-acetyl derivative (V) were similarly prepared.

Oxidation of aldehydo-L-fucose benzoylhydrazone acetate (IIa) with iodine and yellow mercuric oxide in dry ether, a reagent known to oxidize 1,2-dicarbonyl compounds bis(aroylhydrazones) into 1,2,3-triazoles,[4,5] gave a crystalline product having two hydrogens less than the parent hydrazone IIa. The ir spectrum of the oxidation product revealed the absence of the amide absorption band with concomitant absorption at 1385 and 980 cm^{-1} due to the newly formed 1,3,4-oxadiazole ring.[6,7] The product was therefore assigned the structure of 2-(6-deoxy-L-galacto-1,2,3,4-tetraacetoxypentyl)-5-phenyl-1,3,4-oxadiazole (III)

aldehydo-L-Rhamnose benzoylhydrazone acetate V showed an anomalous behaviour towards this oxidizing agent by resisting all attempts to obtain the corresponding 1,3,4-oxadiazole VI. This result, in contrast to the oxidation of IIa as well as other pentoses and hexoses,[1] may be due to the existence of IIa and V in the syn and anti forms (A and B). In A the benzoylhydrazone and aldehydo methine functions are in proximity to each other, thus allowing the facile cyclization of the intermediate formed by abstraction of the hydrazone imino



IV R = H
V R = Ac

VI

and aldehyde methine protons by the oxidizing agent. In B the polacetoxyalkyl chain renders this cyclization difficult if not impossible.

EXPERIMENTAL

Melting points were determined with a Kofler block and are uncorrected. The ir spectra were recorded as KBr pellets on a Unicam SP200 spectrophotometer. The nmr spectra were detrmined at 60 MHz with a Varian A-60 spectrometer in $CDCl_3$ containing 1% tetramethylsilane as the internal standard. The homogeneity of the products was checked by tlc on Silica Gel G plates (layer thickness 0.25 mm) and the spots were detected by spraying with anisaldehyde-sulfuric acid-ethanol (1:1:18, v/v) (ref. 8) followed by heating the chromatograms on a hot plate for a few minutes.

aldehydo-L-Fucose aroylhydrazones (Ia-Ic) (TABLE 1).— A solution of L-fucose (1 g) in water (5 ml) was treated with a solution of the corresponding aroylhydrazine (1.2 equivalent) in methanol (100 ml) and the mixture was refluxed for 15 min. After being kept at room temperature for 24 hrs, the crystalline hydrazone was collected, washed with cold methanol and ether and crystallized from hot methanol.

TABLE 1.- aldehydo-L-Fucose aroylhydrazones (Ia-Ic).

Cpd	Yield %	mp.,(^{o}C)	Formula	Anal. $\frac{\text{Found}}{\text{Calcd}}$ C	H	N	ν_{max}(cm^{-1}) CONH
Ia	73	193-195*	$C_{13}H_{18}N_2O_5$	$\frac{55.01}{55.31}$	$\frac{6.52}{6.43}$	$\frac{9.92}{9.92}$	1655
Ib	69	187-188	$C_{14}H_{20}N_2O_5$	$\frac{56.80}{56.75}$	$\frac{6.92}{6.80}$	$\frac{9.58}{9.45}$	1650
Ic	75	203-205*	$C_{14}H_{20}N_2O_5$	$\frac{57.02}{56.75}$	$\frac{6.90}{6.80}$	$\frac{9.50}{9.45}$	1650

*Melts with decomposition.

aldehydo-L-Rhamnose benzoylhydrazone(IV).- L-Rhamnose (1 g) was treated with benzoylhydrazine (1 g) as described above. The hydrazone (72%) was crystallized from methanol-benzene; mp., 193-195^{o} (dec.); ν_{max}^{KBr} 3500 (broad, OH and NH), 1625 (amide-I) and 1550 cm^{-1} (amide-II).

Anal. Calcd for $C_{13}H_{18}N_2O_5$: C, 55.31: H, 6.43: N, 9.92. Found: C, 54.97; H, 6.63; N, 10.04.

2,3,4,5-Tetra-O-acetyl-aldehydo-L-fucose aroylhydrazones (IIa-IIc) (TABLE 2).- A solution of I (1 g) in pyridine (10 ml) was treated with acetic anhydride (15 ml) for 24 hrs at room temperature. The reaction mixture was poured into ice and water and the product which separated, was collected washed with water and dried. The hydrazone acetates were crystallized from methanol.

TABLE 2.– *2,3,4,5-Tetra-O-acetyl-aldehydo-L-fucose aroylhydrazones* (IIa-IIc).

Cpd	Yield %	mp.,(°C)	Formula	Anal. $\frac{\text{Found}}{\text{Calcd}}$			ν_{max}(cm^{-1})	
				C	H	N	CONH	OAc
IIa	69	190-192	$C_{21}H_{26}N_2O_9$	$\frac{56.00}{56.00}$	$\frac{6.00}{5.82}$	$\frac{6.33}{6.22}$	1640	1760
IIb	65	182-183	$C_{22}H_{28}N_2O_9$	$\frac{57.02}{56.89}$	$\frac{6.26}{6.08}$	$\frac{6.25}{6.03}$	1645	1765
IIc	77	196-198*	$C_{22}H_{28}N_2O_9$	$\frac{56.97}{56.89}$	$\frac{6.10}{6.08}$	$\frac{6.07}{6.03}$	1645	1760

---

*Melts with decomposition.

2,3,4,5-Tetra-O-acetyl-aldehydo-L-rhamnose benzoylhydrazone (V).– Compound IV (1 g) was acetylated with pyridine (15 ml) and acetic anhydride (15 ml) as described above and crystallized from benzene, mp., 210-211° (67%), ν_{max}^{KBr} 3300 (NH), 1745 (OAc), 1650 (amide-I), 1525 (amide-II), and 755 and 675 cm^{-1} (Ph).

Anal. Calcd for $C_{21}H_{26}N_2O_9$: C, 56.00; H, 5.82; N, 6.22. Found: C, 55.79; H, 5.74; N, 6.00.

2-(6-Deoxy-L-galacto-1,2,3,4-tetraacetoxypentyl)-5-phenyl-1,3,4-oxadiazole (III).– A suspension of IIa (1 g) in absolute ether (100 ml) was successively treated with yellow mercuric oxide (1.5 g), magnesium oxide (0.2 g), and iodine (0.8 g) and stirred at room temperature for 24 hrs. The mixture was filtered on a Celite layer and the inorganic residue was washed with ether (100 ml). The combined filtrate and washings were washed with saturated solutions of potassium iodide (3 x 50 ml), sodium thiosulfate (2 x 50 ml), and water (2 x 50 ml) and dried (sodium sulfate). Evaporation of the solvent gave a residue which was crystallized from methanol-water, mp., 157° (52%); ν_{max}^{KBr} 1750 (OAc), 1385 and 980 (oxadiazole ring) and 725 cm^{-1} (Ph).

Anal. Calcd for $C_{21}H_{24}N_2O_9$: C, 56.25; H, 5.39; N, 6.26. Found: C, 56.41; H, 5.49; N, 6.39.

Acknowledgment.- We thank Professor A. Sakla, Cairo University Cairo, Egypt, for making the microanalyses available.

REFERENCES

*Present address: Laboratory for Carbohydrate Research, Harvard Medical School at Massachusetts General Hospital, Boston, MA 02114, U.S.A. To whom inquiries should be addressed.

1. H. El Khadem, M. Shaban and M. Nassr, Carbohydrate Res., 23, 103 (1972).
2. M. Shaban and M. Nassr, ibid., 36, C12 (1974).
3. M. Shaban, E. El Ashry, M. Nassr and V. N. Reinhold, ibid., 42, C1 (1975).
4. D. Y. Curtin and N. E. Alexandrou, Tetrahedron, 19, 1697 (1963).
5. M. Shaban, M. Nassr and M. Moustafa, J. Heterocyclic Chem., 12, 1295 (1975) and preceding papers.
6. J. A. Young, W. S. Durell and R. D. Dresdner, J. Am. Chem. Soc., 84, 2105 (1962).
7. M. Milone and E. Borello, Gazz. Chim. Ital., 81, 677 (1951).
8. P. J. Dunphy, J. D. Kerr, J. F. Pennock and K. J. Whittle, Chem. Ind. (London), 1549 (1966).

(Received April 6, 1976; in revised form May 25, 1976)