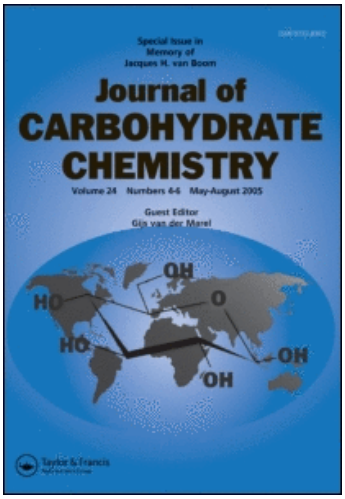
This article was downloaded by:
On: *23 January 2011*
Access details: *Access Details: Free Access*
Publisher *Taylor & Francis*
Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Journal of Carbohydrate Chemistry
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713617200

Synthesis and Antimicrobial Activity of 4-Aryl-5-phenyl-imino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidines (Hydrochlorides)

Madhukar G. Dhonde[a]; Shirish P. Deshmukh[a]
[a] Department of Chemistry, Shri Shivaji College, Akola, India

Online publication date: 28 November 2004

To cite this Article Dhonde, Madhukar G. and Deshmukh, Shirish P.(2004) 'Synthesis and Antimicrobial Activity of 4-Aryl-5-phenyl-imino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidines (Hydrochlorides)', Journal of Carbohydrate Chemistry, 23: 5, 305 — 311
To link to this Article: DOI: 10.1081/CAR-200030097
URL: http://dx.doi.org/10.1081/CAR-200030097

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.informaworld.com/terms-and-conditions-of-access.pdf

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

JOURNAL OF CARBOHYDRATE CHEMISTRY
Vol. 23, No. 5, pp. 305–311, 2004

Synthesis and Antimicrobial Activity of 4-Aryl-5-phenyl-imino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidines (Hydrochlorides)

Madhukar G. Dhonde* **and Shirish P. Deshmukh**

Department of Chemistry, Shri Shivaji College, Akola, India

Downloaded At: 06:58 23 January 2011

CONTENTS

*Correspondence: Madhukar G. Dhonde, Department of Chemistry, Shri Shivaji College, Akola 444003, India; Fax: 0724-2450722; E-mail: madhudash2001@yahoo.co.in.

DOI: 10.1081/CAR-200030097
0732-8303 (Print); 1532-2327 (Online)
Copyright © 2004 by Marcel Dekker, Inc.
www.dekker.com

Request Permissions / Order Reprints
powered by RIGHTSLINK

ABSTRACT

Synthesis of 4-aryl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidines (hydrochlorides) is described. These compounds were screened for their antibacterial and antifungal activity against *Escherichia coli*, *Staphylococcus aureus*, *P. vulgaris*, *Pseudomonas*, *Bacillus*, *Salomonella* sp., *Aspergilus niger*, and *Fusarium*. The identities of these new N-glucosides have been established on the basis of usual chemical transformation IR, NMR, and mass spectral studies.

Key Words: Synthesis; Thiocarbamides; Isothiocarbamoylchloride; 1,2,4-Dithiazolidines.

Downloaded At: 06:58 23 January 2011

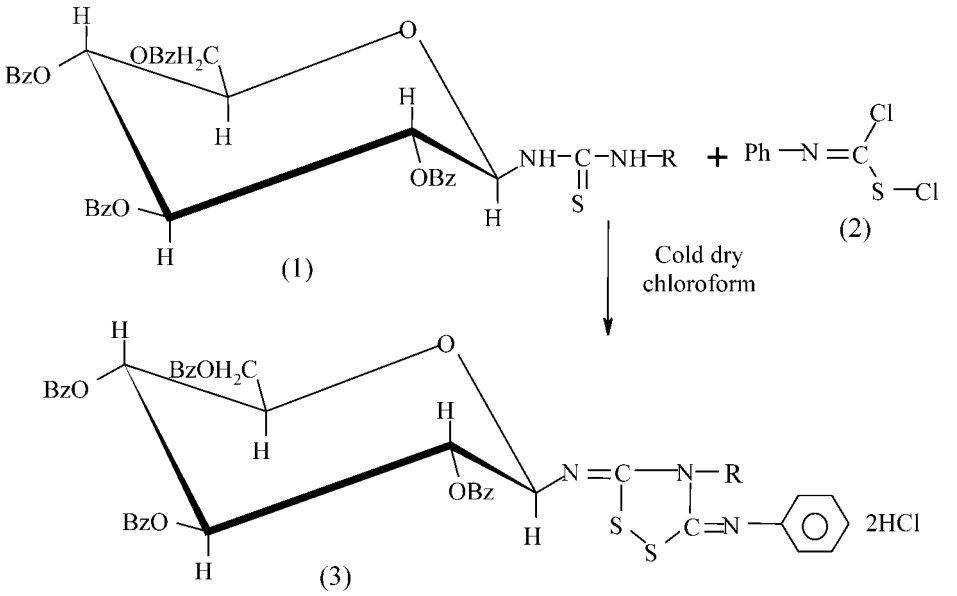
1. INTRODUCTION

Benzoylated glucosyl nucleosides having 1,2,4-dithiazolidine heterocyclic bases are not synthesized earlier. In view of growing interest in synthetic nucleosides in general and our interest in glucosyl nucleoside in particular a direct synthetic method has been evolved for the synthesis of glucosyl nucleoside having 1,2,4-dithiazolidine ring. These compounds were screened for their antibacterial and antifungal activities against *Escherichia coli*, *Staphylococcus aureus*, *P. vulgaris*, *Pseudomonas*, *Bacillus*, *Salomonella* sp., *Aspergilus niger*, and *Fusarium*.

Several 4-aryl-5-phenylimino-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidines (**3**) has been prepared for the first time by the interaction of 1-tetra-*O*-benzoyl-β-D-glucopyranosyl-3-aryl thiocarbamides (**1**) and *N*-phenyl-*S*-chloroisothiocarbamoyl chloride (**2**). The identities of these new N-glucosides have been established on the basis of usual chemical transformations, IR, NMR, and mass spectral studies along with their antibacterial and antifungal studies. Recently, in our laboratory, several 1-tetra-*O*-benzoyl-β-D-glucopyranosyl-3-aryl thiocarbamides has been prepared by interaction of tetra-*O*-benzoyl-β-D-glucopyranosyl isothiocyanate with aryl amines and ammonia.[1] In view of our interest in N-glucosylated compounds, we now report the synthesis of several 4-aryl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidines along with their antimicrobial activity.

2. RESULTS AND DISCUSSION

The reaction of 1-tetra-*O*-benzoyl-β-D-glucopyranosyl-3-aryl thiocarbamides (**1**) and *N*-phenyl-*S*-chloroisothiocarbamoyl chloride (**2**) was carried out in cold dry chloroform 24 hr. The solvent was distilled off and the resulting sticky mass was isolated as a residue. This when triturated several times with petroleum ether was converted to a granular yellow solid (3; Sch. 1), crystallized from ethanol. The melting points are uncorrected. The product was found non-desulfurisable when boiled with alkaline plumbite solution. The specific rotation[2] was shown in Table 1. The purity of products was check by TLC and recorded the R_f values[3] in Table 1.



Scheme 1. Bz = C_6H_5CO; R = (a) phenyl; (b) *o*-tolyl; (c) *m*-tolyl, (d) *p*-tolyl; (e) *o*-Cl-phenyl; (f) *m*-Cl-phenyl; (g) *p*-Cl-phenyl.

2.1. Microbial Activity

2.1.1. Antibacterial Activity

The compounds were screened for their antibacterial activities against various pathogenic bacteria such as *E. coli*, *S. aureus*, *P. vulgaris*, *Pseudomonas*, *Bacillus*, and *Salomonella* sp. by cup plate method at a concentration 100 $\mu g\,mL^{-1}$ in DMF by using the standard co-trimazine (25 $\mu g\,mL^{-1}$) for bacteria. Amongst the compounds tested for the antibacterial activity, compounds **3a–d** showed higher and other compounds showed moderate activity.

2.1.2. Antifungal Activity

All the compounds were also screened for their antifungal activities by the cup plate method at a concentration 100 $\mu g\,mL^{-1}$ in DMF by using the standard griseofulvin (10 $\mu g\,mL^{-1}$) against *A. niger* and *Fusarium*. The compound **3b** and **3c** showed good activity against *A. niger*. While other compounds found resistant against *Fusarium*.

3. EXPERIMENTAL

3.1. General Methods

Melting points are uncorrected. Optical rotations were measured at 29°C. IR spectra[4–11] were recorded for flat, smooth, abex in range 4000 $1/\nu$ 200 cm^{-1}.

Downloaded At: 06:58 23 January 2011

Downloaded At: 06:58 23 January 2011

Table 1. 4-Aryl-5-phenylimino-3-(tetra-*O*-benzoyl-*β*-D-glucopyranosylimino)-1,2,4-dithiazolidines (hydrochlorides).

	1-Tetra-*O*-benzoyl-*β*-D-glucopyranosyl-3-aryl thiocarbamides			4-Aryl-5-phenylimino-3-(tetra-*O*-benzoyl-*β*-D-glucopyranosylimino)-1,2,4-dithiazolidines (hydrochlorides)							Analysis	
S. no.	Derivatives	g	**1**	Derivatives	g	**3**	Yield (%)	Mp (°C)	$[\alpha]_D^{29}$ in $CHCl_3$	R_f	Found	Calcd.
1	−3-phenyl-	3.6	**a**	−4-phenyl−	3.5	**a**	75.92	116	+250(*c*, 0.200)	0.58	N, 4.13; S, 6.92	N, 4.48;S, 6.83
2	−3-*o*-tolyl-	3.7	**b**	−4-*o*-tolyl−	2.5	**b**	52.96	124	−234(*c*, 0.128)	0.46	N, 4.22;S, 6.82	N, 4.42;S, 6.73
3	−3-*m*-tolyl-	3.7	**c**	−4-*m*-tolyl−	2.8	**c**	59.32	118	−223(*c*, 0.224)	0.64	N, 4.18;S, 6.53	N, 4.42;S, 6.73
4	−3-*p*-tolyl-	3.7	**d**	−4-*p*-tolyl−	2.2	**d**	46.61	136	+101(*c*, 0.394)	0.78	N, 4.31;S, 6.34	N, 4.42;S, 6.73
5	−3-*o*-cl-ph−	3.8	**e**	−4-*o*-cl-ph−	2.7	**e**	56.01	130	+84(*c*, 0.236)	0.38	N, 4.11;S, 6.62	N, 4.32;S, 6.59
6	−3-*m*-cl-ph−	3.8	**f**	−4-*m*-cl-ph−	1.9	**f**	39.41	115	−357(*c*, 0.112)	0.52	N, 4.17;S, 6.72	N, 4.32;S, 6.59
7	−3-*p*-cl-ph−	3.8	**g**	−4-*p*-cl-ph−	3.0	**g**	62.24	105	+266(*c*, 0.300)	0.33	N, 4.41;S, 6.38	N, 4.32;S, 6.59

Note: Reactant; *N*-phenyl-*S*-chloroisothiocarbamoyl chloride (**2**) (1.03 g, 0.005 mol). Satisfactory C, H, and Cl analysis found in all cases.

^{1}H NMR spectra[7,12–14] were obtained at 300 MHz for solutions in $CDCl_3$. The FAB mass spectra[15–17] were recorded on a JEOL SX 102/DA-6000 mass spectrometer/data system using argon/xenon (6 kV, 10 mA) as the FAB gas. The accelerating voltage was 10 kV and the spectra were recorded at room temperature *m*-nitro benzyl alcohol (NBA) was used as the matrix unless specified otherwise. Thin-layer chromatography was conducted on *E*. Merck TLC aluminium sheet Silica Gel 60 F_{254}. The compounds were screened for their antibacterial and antifungal activities by the cup-plate method[18].

The required 1-tetra-*O*-benzoyl-β-D-glucopyranosyl-3-aryl thiocarbamides (**1**) and *N*-phenyl-*S*-chloroisothiocarbamoyl chloride (**2**) were prepared by the methods described earlier.[19,20]

4-Phenyl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidine (hydrochloride, 3a). The reaction of 1-tetra-*O*-benzoyl-β-D-glucopyranosyl-3-phenyl thiocarbamide (**1a**; 3.65 g, 0.005 mol) and *N*-phenyl-*S*-chloroisothiocarbamoyl chloride (**2**) (1.03 g, 0.005 mol) was carried out in cold dry chloroform for 24 hr. The chloroform was then evaporated to leave an sticky syrup was triturated with petroleum ether until a yellow solid resulted **3a** (3.5 g, 75.92%) crystallized from ethanol had mp 116°C; $[\alpha]_D^{29}$ +250° (*c*, 0.200 in $CHCl_3$). The purity of product was checked by TLC and recorded R_f, 0.58; IR(KBr): ν 3060.5 (Ar-H), 2965.2 (C–H, aliphatic), 1728.6 (C═O), 1597 (C═N), 1272.9 (C—O), 897.0 (β-D-glucopyranosyl ring deformation), 720 (C—S), 708 cm^{-1} (monosubstituted). ^{1}H NMR data ($CDCl_3$); δ 8.00–6.92 (m, 30H, Ar-H), 5.30–4.21 (m, 5H, β-D-glucopyranosyl ring), 4.5–4.1 (d, 2H, CH_2O). MS: *m*/*z* 936 (M^+); 863 (M-2HCl); 848 (M-CH_3 and 2HCl); 819 (M-$C_2H_6OCl_2$); 790 (M-$C_4H_{11}OCl_2$); 743 (M-$C_8H_{10}OCl_2$); 729 (M-$C_8H_8O_2Cl_2$); 579 (TBG^+); 460 (TBG-C_8H_7O); 335 (TBG-2C_6H_5COOH); 227 (M-$C_{15}H_{14}O_7NS$); 120 ($C_6H_4COO^+$); 105 ($C_6H_5CO^+$) (Table 1). Anal. Calcd for $C_{48}H_{37}O_9N_3S_2$ 2HCl: C, 61.53; H, 4.16; Cl, 7.58; N, 4.48; S, 6.83. Found: C, 61.37; H, 4.05; Cl, 7.22; N, 4.13; S, 6.92.

On the basis of all above facts the product with mp 116°C as assigned the structure 4-phenyl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidine (hydrochloride, **3a**).

When the reaction of *N*-phenyl-*S*-chloroisothiocarbamoyl chloride was extended to several other 1-tetra-*O*-benzoyl-β-D-glucopyranosyl-3-aryl thiocarbamides and corresponding 4-aryl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidines (hydrochlorides) (**3b–3g**) have been isolated (Table 1).

4-*O*-Tolyl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidine (hydrochloride, 3b). Mp 124°C; $[\alpha]_D^{29}$ −234° (*c*, 0.128 in $CHCl_3$), R_f, 0.46; IR(KBr): ν 3071.4 (Ar-H), 2945.5 (C—H, aliphatic), 1719.6 (C═O), 1585.7 (C═N), 1248.7 (C—O), 855 (β-D-glucopyranosyl ring deformation), 765.8 (1,2-disubstituted ring), 750 (C–S), 710.0 (monosubstituted). ^{1}H NMR data ($CDCl_3$): δ 8.05–7.21 (m, 29H, Ar-H), 5.28–4.20 (m, 5H, β-D-glucopyranosyl ring), 4.2–4.0 (d, 2H, CH_2O), 1.2–1.5 (s, 3H, Ar-CH_3), MS: *m*/*z* 950 (M^+); 877 (M-2HCl); 786 (M- $C_7H_9Cl_2$); 709 (M-$C_{13}H_{14}Cl_2$); 637 (M-$C_{14}H_{14}N_2SCl_2$); 579 (TBG^+); 335 (TBG-2C_6H_5COOH); 105 ($C_6H_5CO^+$) (Table1). Anal. Calcd for $C_{49}H_{39}O_9N_3S_2$ 2HCl: C, 61.89; H, 4.31; Cl, 7.47; N, 4.42; S, 6.73. Found: C, 61.68; H, 4.11; Cl, 7.12 N, 4.22; S, 6.82.

On the basis of all above facts the product with mp 124°C was assigned the structure 4-*O*-tolyl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidine (hydrochloride, **3b**).

Downloaded At: 06:58 23 January 2011

4-*p*-Chlorophenyl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidine (hydrochloride, 3g). Mp 105°C; $[\alpha]_D^{29} + 266^\circ$ (*c*, 0.300 in $CHCl_3$), R_f, 0.33; IR(KBr): ν 3064.4 (Ar-H), 2937.4 (C—H, aliphatic), 1730 (C═O), 1601.1 (C═N), 1269.0(C—O), 829.4 (β-D-glucopyranosyl ring deformation), 795.9 (1,4-disubstituted ring), 756.3 (C—S), 709.4 monosubstituted). ^{1}H NMR data ($CDCl_3$): δ 7.95–7.01 (m, 29H, Ar-H), 5.32–4.22 (m, 5H, β-D-glucopyranosyl ring), 4.25–4.0 (d, 2H, CH_2O), MS: *m*/*z* 970 (M^+); 897 (M-2HCl); 786 (M-$C_6H_6Cl_3$); 709 (M-$C_{12}H_{11}Cl_3$); 579 (TBG$^+$); 335 (TBG-2C_6H_5COOH); 121 ($C_6H_5COO^+$); 105 ($C_6H_5CO^+$) (Table 1). Anal. Calcd for $C_{48}H_{36}O_9N_3S_2Cl$ 2HCl: C, 59.38; H, 3.91; Cl, 10.97; N, 4.32; S, 6.59. Found: C, 59.09; H, 3.52; Cl, 10.81; N, 4.41; S, 6.38.

On the basis of all above facts the product with mp 105°C was assigned the structure 4-*p*-chlorophenyl-5-phenylimino-3-(tetra-*O*-benzoyl-β-D-glucopyranosylimino)-1,2,4-dithiazolidine (hydrochloride, **3g**).

ACKNOWLEDGMENT

The authors acknowledge the help of R. S. I. C., C. D. R. I. Lucknow for providing the spectral data. They are also thankful to Prof. R. N. Kale, Head of the Department, Department of Chemistry and Principal Dr. V. B. Wagh for encouragement and necessary facilities.

Downloaded At: 06:58 23 January 2011

REFERENCES

1. Korpe, G.V.; Deshmukh, S.P. Oriental J. Chem. **2001**, *17* (2), 307–310.
2. Arnold, W. *Physical Methods of Organic Chemistry, Part II*, 2nd Ed.; Interscience Publisher, Inc: New York, 1949.
3. Fried, B.; Sherama, S.H. *Thin-Layer Chromatography*, 2nd Ed.; Chromatographic Science Series, Dekker: New York, 1986; 35.
4. Williams, D.H.; Iram, F. *Spectroscopic Methods in Organic Chemistry*, 4th Ed.; Tata McGraw-Hill Publication Company Ltd: New Delhi, 1988.
5. Silverstein, R.M.; Bassler, G.C.; Morrill, T.C. *Spectroscopic Identification of Organic Compounds*, 5th Ed.; John Wiley: New York, 1981.
6. Jose, Fuentes; Wenceslao, Moreda; Carmen, Ortiz; Inmaculada, Robina; Colin, Welsh. Tetrahedron **1992**, *48* (31), 6413–6424.
7. Reyes, Babiano Caballero; Jose, Funtes Mota. Carbohydr. Res. **1986**, *154*, 280–288.
8. Jose, Fuentes Mota; Jose, Manuel Garcia Fernandez; Carmen, Ortiz Mellet; Maria, Angeles pradera Adrian. Carbohydr. Res. **1989**, *188*, 35–44.
9. Colthup, N.B.; Daly, L.H.; Wiberley, S.E. *Introduction to Infrared and Raman Spectroscopy*; Academic Press: New York, 1964; 240–344.
10. Margareta, A.; Mateesau, C. *Infrared Spectroscopy Application in Organic Chemistry*; John Wiley and Sons Inc: New York, 1970; 293.
11. Spedding, H. *Adv. Carbohydr. Chem*; Academic Press, Inc: New York, 1964; Vol. 19; 31.
12. Dyer, J.R. *Applications of Absorption Spectroscopy of Organic Compounds*, 8th Ed.; Prentice-Hall: New Delhi, 1991; 34–88.

13. Barker, S.A.; Homer, J.; Keith, M.C.; Thomas, L.F.J. Chem. Soc. **1963**, 1538.
14. Norma, B.D. Accorsa; Inge, M.E. Thiel. Carbohydr. Res. **1983**, *124*, 177–184.
15. Biemann, K.; Dejongh, D.C.; Schones, H.K. J. Am. Chem. Soc. **1963**, *85*, 1763–1771.
16. Budzikiewicz, H.; Djerassi, C.; Williams, D.H. *Structural Elucidation of Natural Products by Mass Spectroscopy*; Holden-Day: San Francisco, London, Amsterdam, 1964; Vol. II, 207.
17. Norma, B.D. Accorsa; Inge, M.E. Thiel. Carbohydr. Res. **1984**, *129*, 43–53.
18. Kavangh, F. *Analytical Microbiology*; Academic Press: New York, 1963.
19. Ottman, G.; Hooks, H. J. Org. Chem. **1966**, *31*, 838.
20. Paranjpe, M.G.; Mahajan, A.S. Ind. J. Chem. **1972**, *10*, 1138.

Downloaded At: 06:58 23 January 2011