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A Novel Studies of Synthesis of Nanopartical of 2-S-Tetra-O-Acetyl-B-D-Galactosyl-1-Aryl-5-Tetra-O-Acetyl-B-D-Glucosyl-2-Isothiobiurets and Their XRD Studies

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Abstract:

The use of microwave irradiation in organic synthesis has become increasingly popular within the pharmaceutical and academic arenas, because it is a new enabling technology for drug discovery and development. By taking advantage of this efficient source of energy, Presently, thermally driven organic transformations take place by either of two ways: conventional heating or microwave- accelerated heating. The chemistry of thiourea of carbohydrate is extensively elaborated and well documented. These compounds arouse interest as potential biologically active substances and versatile intermediates for preparing various derivatives. This reaction is frequently used as a tool for structure determination. They have been found useful in the treatment of hypertension, as appetite suppersant and as a potential anti oxidant cardio protective agent.Chemistry of sugar isothiocyanate with special reference to their utility as intermediate in the synthesis of nitrogen and sulphur containing open ch[illegible] and cyclic compound. Several glucosyl thiobiurets deravaives has been prepare by condensation of Tetra-O-acetyl-B-D-glucosyl isocyanate with various aryl thiocarbamides by both convensational and microwave method. The identites of newly synthesis compounds have been established on the basis of usual chemical transformation and IR, NMR, Mass spectral studies.

Keywords : 1-tetra-O-acetyl-B-D-glucosyll isocyanate, Aryl thiocarbamides , glucosyl isothiobiurtes.

Introduction :-

The use of microwave irradiation in organic synthesis has become increasingly popular within the pharmaceutical and academic arenas, because it is a new enabling technology for drug discovery and development. By taking advantage of this efficient source of energy, compound libraries for lead generation and optimization can be assembled in a fraction of the time required by classical thermal methods. Presently, thermally driven organic transformations take place by either of two ways: conventional heating or microwave- accelerated heating. In the first way, reactants are slowly activated by a conventional external heat source. Heat is driven into the substance, passing first through the walls of the vessel in order to reach the solvent and reactants. This is a slow and inefficient method for transferring energy into the reacting system. In the second way, microwaves couple directly with the molecules of the entire reaction mixture, leading to a rapid rise in temperature. Since the process is not limited by the thermal conductivity of the vessel, the result is an instantaneous localized superheating of any substance that will respond to either dipole rotation or ionic conduction—the two fundamental mechanisms for transferring energy from microwaves to the substance(s) being heated.

Microwave technology has been applied beneficially into a number of organic reactions. The microwave assisted hydrolysis of esters is well-known but the regioselective hydrolysis of esters at the anomeric position in sugars under this condition has not been described.

Microwave assisted organic synthesis has become an important tool to medicinal chemists for rapid organic synthesis.A huge number of research papers have appeared over the last decades on the application of microwave technology in organic synthesis.[1] Some of the major advantages include spectacular decrease in reaction time,improved conversions,clean product formation and wide scope for the development ofnew reaction conditions.

The use of polymer-supported reagents and scavengers is a powerful technique for expedited synthesis and purification.[2] Rapid transformations using microwave technology has shifted the bottleneck from synthesis to the work-up and purification step.Therefore,chemists are increasingly looking for an expedited synthesis and purification strategy that would combine the use of microwave heating with polymer-assisted solution- phase organic synthesis. This overview [3] covers the recent literature on the significant new applications of polymer-supported reagents and scavengers using microwave heating.

Carbohydrates derivatives have been extensively investigated including synthesis, characterization and biological activity. Partly due to the facts that many natural occurring saccharides and synthesized analogues exhibit various and potent biological activities and they have been widely employed as agrochemicals and pharmaceuticals[4-7]. Several S-glucosylated isothiobiurets with potential microbial activities have been reported . The exhaustive literature survey revealed that the isothiobiurets having both glucosyl and galactosyl substitutents are not prepared earlier. So it was interesting were to study the chemistry of such new type of isothiobiurets.

The N-glucopyranosylated compounds have been known for their great biological importance. They have been found several applications in paper[8], textile[9,10] and food industries[11]. Besides these applications they have been found use as divertic agents, analgesics, antidiabetic compounds, bacteriosatic agents and in many other ways[12]. Some of them have been found to be valuable oxidation dyes[13] for printing and padding the animals and vegetable fibers by standard oxidation dyeing methods. Quite few of them have antitumor and tuberculostatic activity[14].

N-glucopyranosylated compounds are broadly classified into two types. The first in which the glucopyranosyl group attached to ring nitrogen while second in which glucopyranosyl group is attached to the nitrogen of non-cyclic compounds or exocyclic nitrogen. For eg. Nucleosides represent the first category while the glucopyranosyl amines, glucopyranosyl urieds, belong to second category.

If N-glucopyranosyl group has been consider as main structural and function of nucleosides then both the categories of N-glucosides may be referred to as the nucleosides.

The N-glucopyranosylated derivatives are versatile intermediate in organic chemistry due to their availability and tendency to undergoes nucleophillic addition and cycloaddition reaction[15] particularly in carbohydrate field N-linked sugar derivatives play pivotal role in the preparation of a broad spectrum, for biological and pharmaceutical interest Numerous antiviral, antibacterial and antitumor agents have been prepared by reaction of glucopyranosyl isocyanate and isothiocyanate with biologically active amines. Recently, glucopyranosyl isothiocyanate are being used to prepare thiourea linked symmetrical and unsymmetrical carbohydrate mimics.

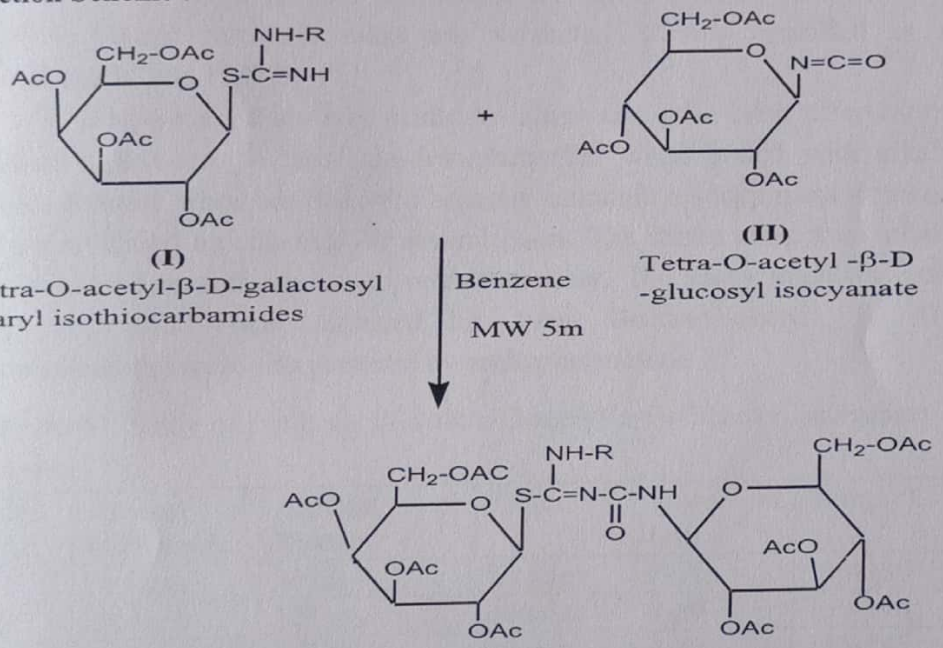
Such as pseudooligosaccharides thioureylene-di-nucleosides and another glucopyranosyl thiourea[26] for molecular recognition studies

Results And Disscussion:

Nanoparticles:

A sub-classification of ultrafine particle with lengths in two or three dimensions greater than 0.001 micrometer (1 nanometer) and smaller than about 0.1 micrometer (100 nanometers) and which may or may not exhibit a size-related intensive property. This term is a subject of controversy regarding the size range and the presence of a size-related property. Current usage emphasizes size and not properties in the definition. The length scale may be a hydrodynamic diameter or a geometric length appropriate to the intended use of the nanoparticle. The chemistry of thiourea of carbohydrate is extensively elaborated and well documented. These compounds arouse interest as potential biologically active substances and versatile intermediates for preparing various derivatives

Reaction Scheme :-



(I)
S-tetra-O-acetyl-β-D-galactosyl -1-aryl isothiocarbamides

(II)
Tetra-O-acetyl -β-D -glucosyl isocyanate

(III)
2-S-tetra-O-aceryl-β-D-galactosyl -1aryl-5-tetra-O-acetyl-β-D-glucosyl -2-isothiobiurets

Where, R = a) phenyl, b) o-Cl-phenyl, c) o-tolyl,
Ac = $COCH_3$

The benzene solution of S-tetra-O-acetyl- β -D-galactosyl-1-phenyl isothiocarbamide and Tetra-O-acetyl- β -D-glucosyl isocyanate was under Microwave irradiation for 5min. The benzene was distilled off. The sticky mass obtained was triturated several times with petroleum ether (60-80°) furnished a white solid , Crystallized with ethanol-water m.p. 90-95°C. The elemental analysis of this product indicated the molecular formula $C_{36}H_{44}O_{19}N_3S$.

Experimental:

Melting points were recorded on electro thermal melting point apparatus are uncorrected. Specificrotations were measured on Equip-Tronic digital polarimeter model no. EQ 800 at 30^0C in $CHCl_3$. IRspectra were recorded on a Perkin Elmer spectrometer. ^{1}H NMR were obtained on a Bruker DRX-300(300 MHz FT NMR) NMR spectrometer in $CDCl_3$ solution with TMS as an internal reference.[17-18] Purity of the compounds was checked by thin layer chromatography using Merck silica gel coated aluminum plates and petroleum ether: ethylacetate as eluent

Preparation of S-tetra-O-acetyl- β -D-galactosyl-1-aryl-isothiocarbamides:

The required S-tetra-O-acetyl- β -D-galactosyl-1-aryl isothiocarbamides were prepared by the already describe procedure. Details of the typical preparation (where, aryl = phenyl) are as follows :

The isopropanolic suspension of tetra-O-acetyl-α-D-galactosyl bromide (0.014 M 6.0g in 20 ml) was mixed with the isoproponalic suspension of Phenyl thiocarbamide (0.014 M, 2.22 g in 10 ml). This mixture was warmed at 70°C until the clear solution was obtained. This clear solution was then kept at room temperature for 18 hr. Then it was mixed with distilled water (100 ml). Some semisolid mass was separated. It was identified as unreacted phenyl thiocarbamide, m.p 152°C.

The aqueous filtrate was acidic to litmus and gave brisk effervescences with sodium bicarbonate solution. It was non-desulphurisable when boiled with alkaline plumbite.The aqueous solution when basified with aqueous ammonia a sticky mass was separated out which was not solidified on standing for several hours. The sticky mass was failed to afford a solid when triturated several times with petroleum ether. The sticky mass was purified by ethanol-water and solid was obtained.The other S-tetra-O-acetyl- β -D-galactosyl-1-aryl isothiocarbamides were also prepared by analogous method.

Table No-1-: Study of synthesis of 1-tetra-O-acetyl-α-D-Glucosyl isocyanate under microwave irradiation

Sr. No.	Amount of G-Bromide	Amount of Xylene	Time	Power in watt	Temp. °C	% Yield
1	10.0 gm	80 ml	35 min	P-70	120-130	90%
2	20.0 gm	120 ml	40 min	P-80	130-140	80%
3	30.0 gm	150 ml	40 min	P-80	135-145	65%

- Lead cyanate was taken in equimolar proportion of G-Bromide.
- G-Bromide :- 1-tetra-O-acetyl-α-D-Glucosyl-Bromide

Analytical And Spectral Data Of Compounds:

Synthesis of 2-S-tetra-O-acetyl- β -D-galactosyl-1-Phenyl-5-tetra-O-acetyl- β -D-glucosyl-2-isothiobiuret

Yield 72 (%); Mp.90-95^{0}C;[□]$_D^{32}$+175°(0.1, in $CHCl_3$);Rf (Hexane:EtOAC)(1:1)0.82; **IR** (KBr)cm- 1:ν 2966 (Ar-H)str ,3354 (N-H)Str, 1746 (C=O)str, 1597(C=N) str, , 1375 (C-N)str, 941(char. of glucopyranosyl ring), 755 (C-S) str.,1038(char. of galactosyl ring). ^{1}HNMR (CDCl3)ppm: 8.3-7.3 (m,8H, Ar-H), 6.26 (N-H Proton)5.57-4.2 (m, 7H, glucosyl-H), 2.31-2.01 (m, 12H,OAc),. (Anal.Calcd. For . [Found: C, 50.42; H, 5.22; N, 4.82; S, 3.65, $C_{36}H_{44}O_{19}N_3S$ requires; C, 50.58, H, 5.15; N, 4.91, S, 3.74%]).

Synthesis of 2-S-tetra-O-acetyl- β -D-galactosyl-1-o-Cl-phenyl-S-tetra-O-acetyl- β -D-glucosyl-2-isothiobiuret Yield 84(%);Mp.140-145^{0}C;[□]$_D^{32}$+255°(0.1, in $CHCl_3$);Rf (Hexane:EtOAC)(1:1)0.67; IR (KBr)cm- 1:ν 2966 (Ar-H)str ,3455 (N-H)Str, 1746 (C=O)str, 1588(C=N) str, , 1378 (C-N)str, 941(char. of glucopyranosyl ring), 755 (C-S) str.,1037(char. of galactosyl ring). ^{1}HNMR (CDCl3)ppm: 7.8-7.1 (m,8H, Ar-H), 6.30 (N-H Proton)5.57-3.8 (m, 7H, glucosyl-H), 2.1-1.4 (m, 12H,OAc),. (Anal.Calcd. For . [Found : C, 48.16; H, 4.50; N, 4.52; S, 3.76; $C_{36}H_{44}O_{19}N_3SCl$, requires; C, 48.64; H, 4.95; N, 4.72; S, 3.60%]).

Synthesis 2-S-tetra-O-acetyl- β -D-galactosyl-1-o-tolyl-5-tetra-O-acetyl- β -D-glucosyl-2-isothiobiuret Yield 70(%);Mp.125-130^{0}C;[□]$_D^{32}$+136°(0.1, in $CHCl_3$);Rf (Hexane:EtOAC)(1:1)0.83; IR (KBr)cm- 1:ν 3066 (Ar-H)str ,3391 (N-H)Str, 1745 (C=O)str, 1593(C=N) str, , 1377 (C-N)str, 941(char. of glucopyranosyl ring), 755 (C-S) str.,1037(char. of galactosyl ring). ^{1}HNMR (CDCl3)ppm: 8.2-7.1 (m,8H, Ar-H), 6.30 (N-H Proton)5.57-4.1 (m, 7H, glucosyl-H), 2.1-1.4 (m, 12H,OAc),. (Anal.Calcd. For . [Found : C, 50.30; H, 5.45; N, 4.75; S, 3.71; $C_{37}H_{48}O_{19}N_3S$, requires; C, 51.30; H, 5.51, N, 4.82; S, 3.67%).

Preparation of Nanoparticles 2-S-tetra-O-acetyl- β -D-galactosyl-1-o-tolyl-5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiuret

Take about 1 gm of 2-S-tetra-O-acetyl- β -D-galactosyl-1-o-tolyl-5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiuret and dissolve it completely in the 50ml of solvent in 250 ml beaker. Now put this beaker in sonicator. The highly penetrating acoustic waves are passed through mixture, which create high pressure bubbles in the beaker due to which breakdown of the bulk material is takes place and desired sized nanoparticles are formed. The size determination of nanoparticlesis done by the X-ray diffraction studies

Characterization of Nanoparticles:

Characterization using UV-Spectrophotometer:

Single Beam UV-Spectrophotometer with software BI/CI/SP/SB-S-03 of Bio Era make. The UV-Visible Spectroscopy reveals the formation of Nanoparticles Characterization of Nanoparticles was done using visible Spectrophotometer by using model by showing different absorption those from bulk material.

Size determination of

2-S-tetra-O-acetyl- β -D-galactosyl-1-o-tolyl-5-tetra-O-acetyl- β -D-glucosyl-2-isothiobiuret. Nanoparticles by X-ray Diffraction studies: From the X-ray diffraction it comes to know that size of nano 2-S-tetra-O-acetyl- β -D-galactosyl-1-o-tolyl-5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiuret is 42.29 nm.

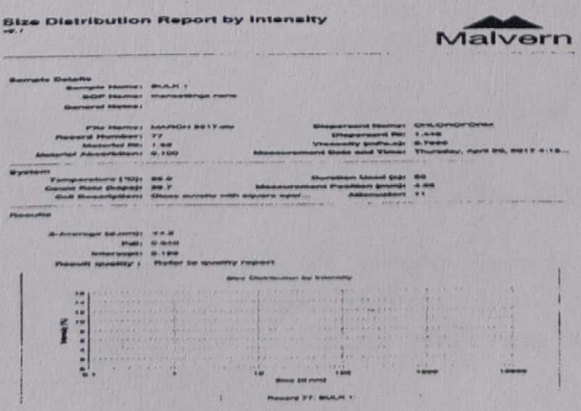


Table No.3:- Characterization data of synthesis of 2-S-tetra-O-acetyl- β -D-galactosyl-1-aryl-5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiuret

Sr. No.	S-tetra-O-acetyl- β -D-galactosyl-1-aryl thiocarbamides	2-S-tetra-O-acetyl- β -D-galactosyl-1-aryl-5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiure	M.P. (^{0}C)	% yield	Optical Rotation $[\alpha]_D^{32}$	R_f value
1	O-toludine	2-S-tetra-O-acetyl- β -D-galactosyl-1-o-tolyl-5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiure	125-130	70.00	$[\alpha]_D^{32}$ = +136.94° (c, 0.373 in chloroform).	0.83
2	o-Cl-aniline	2-S-tetra-O-acetyl- β -D-galactosyl-1-o-Cl phenyl -5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiure	140-145	84.24	$[\alpha]_D^{32}$ = + 255.19° (c, 0.386 in chloroform).	0.67
3	Phenyl	2-S-tetra-O-acetyl- β -D-galactosyl-1-phenyl-5-tetra-O-acetyl- β -D-glucosyl-2- isothiobiure	90-95	72.00	$[\alpha]_D^{32}$ = + 175.42° (c, 0.333 in chloroform).	0.82

References

1. R. A. Dwek Chem. Rev. 96, 683 (1996)
2. E. V. Efimtseva, S. N. Mikhailov Biochemistry, (Moscow), 67, 1136, (2002)
3. T. S. Rao, G. R. Ravankar, R. S. Vinayak, R. K. Robin, J. Heterocyclic Chem., 28, 1779 (1991)
4. G. S. Singh, A. K. Mishra, L. Prakash, Indian J. Chem., 37B, 517 (1998)
5. P. Singh, L. L. Hingorain, G. K. Trivedi, Indian J. Chem., 27B, 498 (1988)
6. C. Tournaire – Arellano, S.Y.E. Hage, P. Vsles, R. Coujale, A. Sanon, R. C. Bories, P. M. Loiseau, Carbohydr. Res., 314, 47 (1998)
7. R. Schirrmacher, U. Muhlhausen, B. Wangler, E. Schirrmacher, J. Reinhard, G. Nagle, B. Kiana, M. Piel, F. Rosch, Tetrahedron Lett., 43, 6301 (2002)
8. K. J. Yarema, C. R. Bertozzi, Curr. Opin. Chem. Bail. 2, 49 (1998)
9. Z. J. Witezak, K. A. Neiforth, Carbohydrate in drug Design, Marcel Daucer, New York, 1997
10. H. W. J. H. Meijer, U. S. Pat. 2, 596, 268 (1952) Chem. Abst., 46, 10636 (1952)
11. H. W. J. H. Meijer, U. S. Pat. 2, 612, 497 (1952) Chem. Abst., 47, 1402 (1953)
12. K. Quehl, U. S. Pat. 2, 116, 640 (1938) Chem. Abst., 32, 500 (1938)
13. J. S. Opplt, U. S. Pat. 2, 694, 719 (1954) Chem. Abst., 49, 2639 (1955)
14. Goodmann, "Advances in carbohydrate chemistry' 13, 233 (1958) (Academic press INC Publisher, New York)
15. K. Weis, O. Bayer and H. Kleiner, Ger. Pat., 1, 011, 849 (1957) Chem. Abst. 54, 9312a (1960)
16. M. Tomoya, N. Shigeru, K. Kazuo, S. Testuo, Bull. Chem. Soc. Japan, 48(12), 3763-4 (1975)
17. R. M. Silverstein, G. C. Bassler and T. C. Morrill Spectroscopic Identification of Organic Compounds", 5th Ed., John Wiley and Sons, Inc., New York (1991)
18. Jose Fuentes Mota, J. M. Gracia-Fernandez, C. O. Mellet and Maria Angeles Praddera Adrian Carbohydr. Res., 188, 35-44 (1989)