Final Project of Minor Research Project of Prof. Dr. S. P. Deshmukh

The work on the project entitled **Studies on Synthesis, Characterization and Biological Evaluation of Sugar Containing Open Chain and Cyclic Compounds** was commenced with literature survey on N-Glycosylated compounds from June 2012. After completing the literature survey on N-Glycosylated compounds, we moved for synthesis of compounds which were targeted during first year of the project, this included:

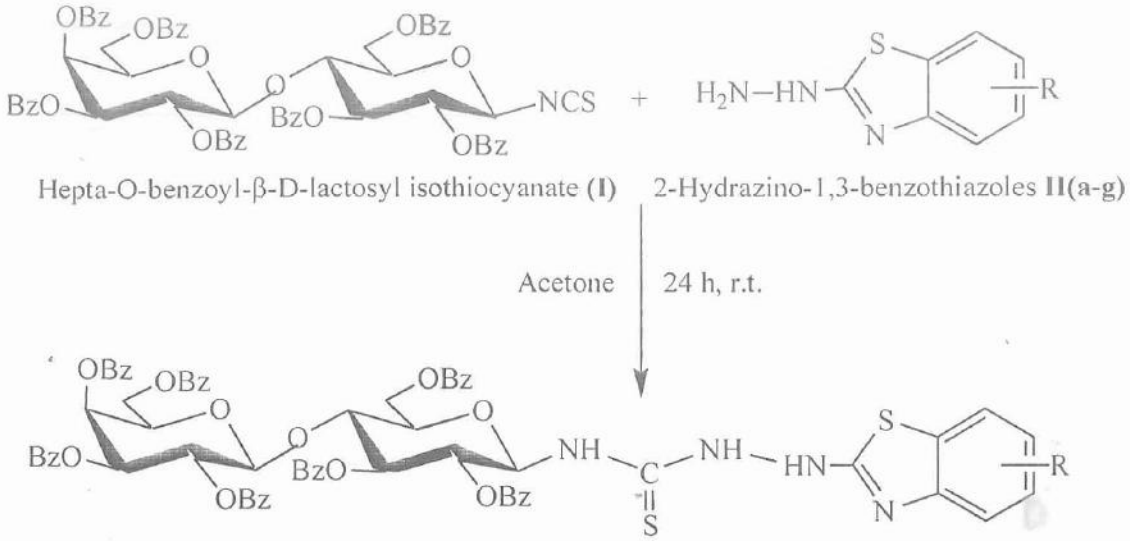
i) Developing a suitable method for the synthesis of sugar bromides by using sugar octa benzoate/ octa acetate as a starting product and molecular bromine in acetic acid in the presence of red phosphorous.

ii) We also develop novel and cheaper method for the preparation of sugar isocyanates and isothiocyanates by interaction of sugar bromides and lead isocyanate/isothiocyanate respectively in boiling xylene medium.

Synthesis and Antimicrobial Activity of Hepta-*O*-Benzoyl-β-D-Lactosyl-3-(2)-Hydrazino-1, 3-Benzothiazolyl Thiocarbamides

Benz-fused compounds have been employed in the synthesis of various compounds which show very potential pharmacological activities. Carbohydrate is the key element in variety of biological phenomena and its *N*-linked sugar derivatives also exhibit wide range of medicinal activities. Keeping in this view, when one biological active molecule is linked to another, the resultant molecule generally has increased potency.

Hence for the first time, in present work, we have interacted two pharmocophores, hepta-*O*-benzoyl-β-D-lactosyl isothiocyanate and substituted 2-hydrazino-1,3-benzothiazoles in acetone medium to yield 1-hepta-*O*-benzoyl-β-D-lactosyl-3-(2)-hydrazino-1,3-benzothiazolyl thiocarbamides. The identities of these newly synthesised 1-hepta-*O*-benzoyl-β-D-lactosyl-3-(2)-hydrazino-1,3-benzothiazolyl thiocarbamides have been established on the basis of usual chemical transformations and IR , ^{1}H NMR and Mass spectral studies. The antibacterial and antifungal activities of also reported. Some of these derivatives exhibit significant antimicrobial activity.



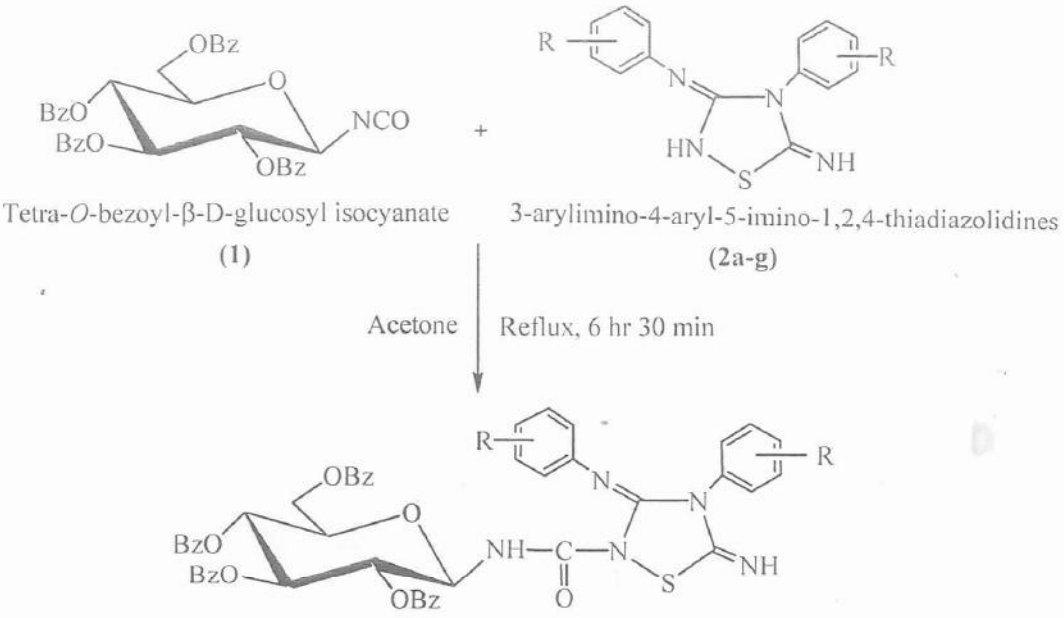
Hepta-O-benzoyl-β-D-lactosyl isothiocyanate (**I**) 2-Hydrazino-1,3-benzothiazoles **II(a-g)**

1-Hepta-O-benzoyl-β-D-lactosyl-3-(2)-hydrazino-1,3-benzothiazolyl thiocarbamide **III(a-g)**

Where, Bz = COC_6H_5, R = a) Hydrogen, b) 4-Chloro, c) 5-Chloro, d) 6-Chloro, e) 4-methyl, f) 5-methyl, g) 6-methyl.

Synthesis and Antimicrobial Activity of *N*-Glucosylated Derivatives of Thiadiazolidines

Glycosyl isocyanate and its derivatives have been widely used as important intermediate in the synthesis of nucleoside anologs. So herein, we report the synthesis of 1-(3-arylimino-4-aryl-5-imino-1,2,4-thiadiazolidines)-3-tetra-*O*-benzoyl-β-D-glucosyl carbamides (**3**a-g) by the interaction of tetra-*O*-benzoyl-β-D-glucosyl isocyanate (**1**) with 3-arylimino-4-aryl-5-imino-1,2,4-thiadiazolidines (**2**a-g). The reaction was refluxed for six and half hr in acetone medium. The identities of these newly synthesised *N*-glucosylated thiadiazolidine carbamides have been established on the basis of usual chemical transformations and IR, ^1H NMR and Mass spectral studies. These compounds were screened for their antibacterial activity and antifungal activity against some selected pathogenic organisms to get potent bioactive molecule. It appeared interesting to carry out the synthesis of *N*-glucosylated derivatives of thiadiazolidines.



Tetra-*O*-bezoyl-β-D-glucosyl isocyanate (1)

3-arylimino-4-aryl-5-imino-1,2,4-thiadiazolidines (2a-g)

1-(3-arylimino-4-aryl-5-imino-1,2,4-thiadiazolidines) -3-tetra-*O*-benzoyl-β-D-glucosyl carbamides

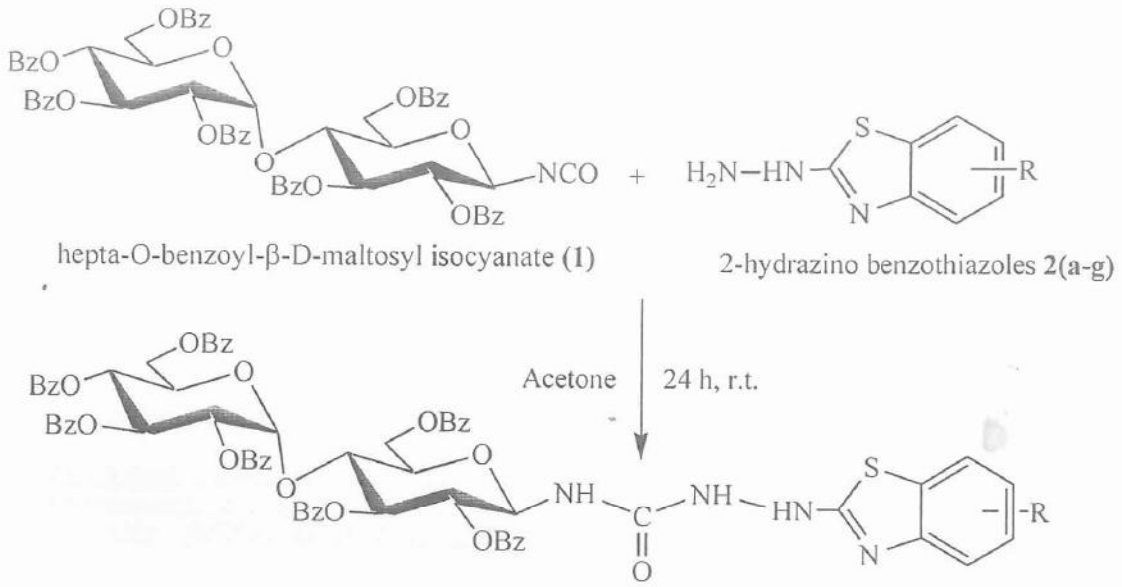
(3a-g)

Where, Bz = COC_6H_5, R = a) Hydrogen, b) *o*-Chloro, c) *m*-Chloro, d) *p*-Chloro, e) *o*-methyl, f) *m*-methyl, g) *p*-methyl.

Synthesis and *In Vitro* Biological Evaluation of 1-Hepta-*O*-Benzoyl-β-D-Maltosyl-4-Benzothiazolyl Semicarbazides

Isocyanates of sugars are one of the versatile reagents in the field of synthetic carbohydrate chemistry. Many of these derivatives have been found to possess wide applications in industry as carbohydrate base detergent and in medicine as anticancer and antifungal agents. The maltosylated derivatives show great potential in biological process and in medicinal chemistry. These findings encouraged us to explore the synthesis and to examine antibacterial and antifungal properties of new synthesized semicarbazides.

The present work aims to synthesize and screen the antifungal and antibacterial activities of a series of new 1-hepta-*O*-benzoyl-β-D-maltosyl-4-benzothiazolyl semicarbazides by the interaction of hepta-*O*-benzoyl-β-D-maltosyl isocyanate and substituted 2-hydrazino benzothiazoles in acetone medium. The identities of these newly synthesised 1-hepta-*O*-benzoyl-β-D-maltosyl-4-benzothiazolyl semicarbazides have been established on the basis of usual chemical transformations and IR, H^1 NMR and Mass spectral studies. These synthesized products were evaluated for their antimicrobial activity against some selected organisms. Some of the products displayed promising activity.



hepta-O-benzoyl-β-D-maltosyl isocyanate **(1)**

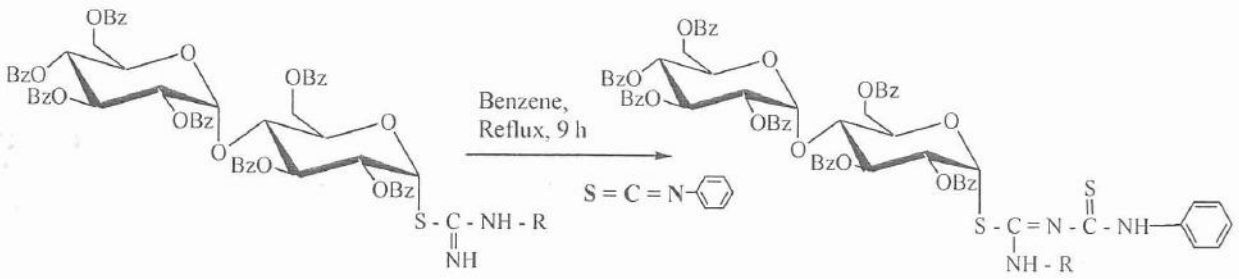
2-hydrazino benzothiazoles **2(a-g)**

1-hepta-O-benzoyl-β-D-maltosyl-4-benzothiazolyl semicarbazides **3(a-g)**

Where, Bz = COC_6H_5, R = a) Hydrogen, b) 4-Chloro, c) 5-Chloro, d) 6-Chloro, e) 4-methyl, f) 5-methyl, g) 6-methyl.

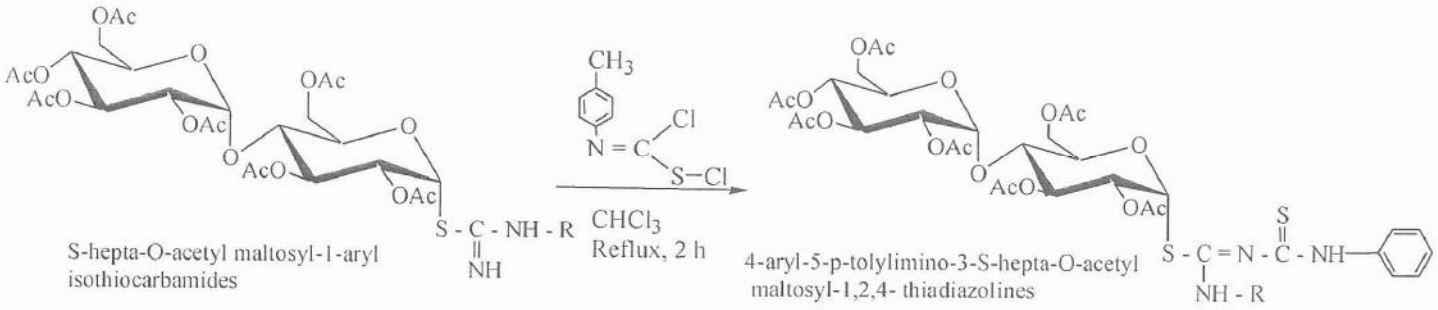
Synthesis of some biologically important per-*O*-benzoyl maltosyl isothiocarbamides and isodithiobiurets as antibacterial and antifungal agents

Several *S*-hepta-*O*-benzoyl maltosyl-1-arylisothiocarbamides II (a-f) have been synthesized through several steps *viz.* Benzoylation, Bromination and interaction of hepta-*O*-benzoyl maltosyl bromide I with aryl thiocarbamides. *S*-hepta-*O*-benzoyl maltosyl-1-aryl-5-phenyl-2, 4 isodithiobiurets III (a-f) were synthesized by the interaction of *S*-hepta-*O*-benzoyl maltosyl-1-arylisothiocarbamides II (a-f) with phenyl isothiocyanate. All new compounds have been characterized by spectral analysis such as IR, ^{1}H NMR and Mass spectra as well as elemental analysis and *In-vitro* antimicrobial activity of maltosyl isothiocarbamides and related isodithiobiurets has been evaluated against several human pathogens. Out of 12 compounds prepared and screened, four compounds have shown significant activity against different human pathogens



Synthesis and Biological Evaluation of *S*-Maltosylated 1,2,4-Thiadiazoline Derivatives Agaist Human Pathogens

Nitrogen containing five/six membered heterocyclic compounds occupy enormous significance in the of drug discovery process. Likewise sugars with heterocyclic nucleus are known to have multifaceted biological and pharmacological properties. In view of these observation a series of new 4-aryl-5-*p*-tolylimino-3-*S*-hepta-*O*-acetyl maltosyl-1,2,4-thiadiazolines were synthesised by the interaction of *N*-*p*-tolyl-*S*-chloro isothiocarbamoyl chloride with *S*-hepta-*O*-acetyl maltosyl-1-aryl isothiocarbamides. These compounds were screened for their antibacterial and antifungal activities. The identities of these newly synthesised compounds have been established on the basis of usual chemical transformations and IR, H^1 NMR and Mass spectral studies.



Paper Presented/ Published:

1. Synthesis and Antimicrobial Activity of 1-Hepta-*O*-Benzoyl-β-D-Lactosyl-3-(2)-Hydrazino-1, 3-Benzothiazolyl Thiocarbamides, *American Journal of PharmTech Research,* 2(3), 1101-1109 (2012).
2. Synthesis and *In Vitro* Biological Evaluation of 1-Hepta-*O*-Benzoyl-β-D-Maltosyl-4-Benzothiazolyl Semicarbazides, *Rasayan Journal of Chemistry,* 6(3), 238-241 (2013).
3. Synthesis and Antimicrobial Activity of *N*-Glucosylated Derivatives of Thiadiazolidines, *Indian Journal of Heterocyclic Chemistry,* 23, 257-260 (2014).
4. Synthesis of some biologically important per-*O*-benzoyl maltosyl isothiocarbamides and isodithiobiurets as antibacterial and antifungal agents, Indian J. Chemistry, B
5. Synthesis and Biological Evaluation of *S*-Maltosylated 1,2,4-Thiadiazoline Derivatives Against Human Pathogens, *Indian Journal of Heterocyclic Chemistry,* 24, 163-166 (2014).

6. Synthesis of 1-hepta-*O*-benzoyl-β-D-lactosyl-3-(2)-hydrazino-1, 3-benzothiazolyl thiocarbamides, 99th Session of The Indian Science Congress, Jan. 03rd-07th, 2012 held at KIITS University, Bhubaneswar (Odisha). Abstract No. PP-114.
7. Synthesis and biological evaluation of hepta-*O*-benzoyl-β-D-maltosyl-3-(2)-substituted hydrazino-1, 3-benzothiazolyl carbamides, 100th Session of The Indian Science Congress, Jan. 03rd-07th, 2013 held at Kolkata University, Kolkata (West Bengal). Abstract No. PP-113.
8. Synthesis and biological evaluation of *N*-glucosylated thiadiazolidine carbamides, National Conference on Frontier Areas in Chemistry, Oct. 23rd-24th, 2013 held at Shri Shivaji Science College, Amravati (Maharashtra). Abstract No. OP-06.

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