A REVIEW ON SYNTHETIC UTILITIES OF GALACTOSYL DERIVATIVES IN CARBOHYDRATE CHEMISTRY

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Abstract

Carbohydrates are more suited for straightforward chemical transformations with various efforts towards the conversion of inexpensive, bulk-scale accessible mono and disaccharides into products with potential biological and industrial profiles. Thereby, the practicality of the conversion methodologies is emphasized such as the use of simple reactions, use of inexpensive reagents and use of simple protecting groups in the 'reaction channels' leading from sugars to pharmacutical and industrially relevant products with good yields and fair stability. Galactose is an aldose, hexose and a reducing sugar, and component of disaccharide, lactose present along with glucose. It is also found in two forms α–D-galactose and β-D-galactose. The hydrolysis of lactose to glucose and galactose is catalyzed by the enzyme beta-galactosidase. As noticed earlier, Very few thioamido derivatives of N- galactosides have been reported. In view of the applications of N-glycosides and N- galactosides in medicinal Chemistry and industries, it appeared quite interesting to describe the synthetic utilites of Galacosyl isothiocyanate and N-galactosylated Compounds related to thiocarbamides, substituted benzothaizolyl thaicarbamides, carbamates, isodithio biurets, thiadiazines (hydrochlorides) and dithiazolidines (hydrochlorides).

Keywords: Carbohyrdates, Galactose, Reaction channels, Derivatives.

Introduction:

Carbohydrates represent 95% of the annually renewable biomass, yet their vast potential, as organic raw materials for chemical industries as well as medical field are mostly unexploited. The challenge is posed by the necessity, to increasing the applied research for opening new medicinal and non-medicinal application fields for carbohydrates. In general mono, disaccharides and oligosaccharides [1,2,3] are key participants in the biological processes with wide range of recognition event[4]. Carbohydrates are more suited for straightforward chemical transformations with various efforts towards the conversion of inexpensive, bulk-scale accessible mono and disccharides (mostly, Glucose, Lactose, Galactose and Maltose) into products with potential biological and industrial profiles[7]. Thereby, the practicality of the conversion methodologies is emphasized such as the use of simple reactions, use of inexpensive reagents and use of simple protecting groups in the 'reaction channels' leading from sugars to pharmacutical[8] and industrially relevant products with good yields and fair stability. Due to biological and industrial importance, carbohydrates have aroused much interest in synthetic and medicinal chemistry.

Background of Galactose and Sugar Isothiocyanates:

Glactose[5,6] is an aldohexose epimeric with glucose at the C#4 (I). It occurs naturally in both D-and L-forms. D-form is most common, found in Lactose and other oligosaccharides, cerebrosides, gangliosides and various glycolipids and glycoprotein. While L-form occurs in Agar, gum Arabic, mesquite gum, galactan (a polymer of galactose) and a variety of other gums and mucilage, peas and plants. Galactose is absorbed in the Jejunum

part of the intestine. Mainly metabolized in the liver. Out of which 30% is converted to glycogen, other 27-47% into CO_2 and remaining is utilized for glycoprotein and glycolipid and biosynthesis for nutritional distribution. It is mainly excreted by kidneys, using a glucose transporter. It is also found in faeces of infants who are breast-fed. Galactose does not stimulate insulin secretion in humans and hence serum galactose level is not affected in diabetic patients.

Sugar isothiocyanates[7,8] are among the most versatile synthetic intermediates in carbohydrate chemistry. They play a pivotal role in the preparation of a broad series of functional groups such thioamides, isonitrile, carbodiimide and N-thiocarbonyl derivatives allowing, simultaneously, the covalent coupling of a quite unrestricted variety of structures to the saccharide part. Moreover, isothiocyanates are important reagents in heterocyclic chemistry which may be exploited in the synthesis of nucleosides and other N- glycosyl structures. The development of several efficient general methods for the introduction of the isothiocyanate functionality at different positions of the carbohydrate molecule has translated these considerations into practical approaches. Anup Kumar Mishra and co-workers[9] have reported solvent-free synthesis of galactosyl pentacetate Catalyzed by $HClO_4$-SiO_2 using stioichiometric quantity of acetic anhydride.

Review on N- Galactosides:

M. Wojtowicz et. al.[10] have reported the interaction of (iso)nicotinic acid hydrazide with galatosyl isothiocyanate to form a thiosemicarbazide which on treatment with mercury (II) oxide afforded the oxidazoles as follows

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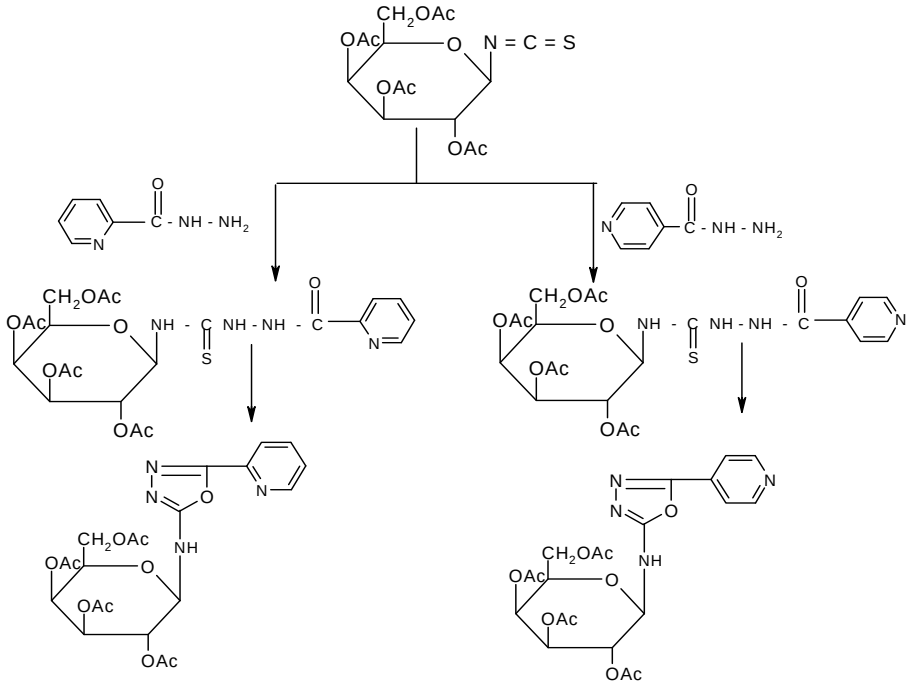
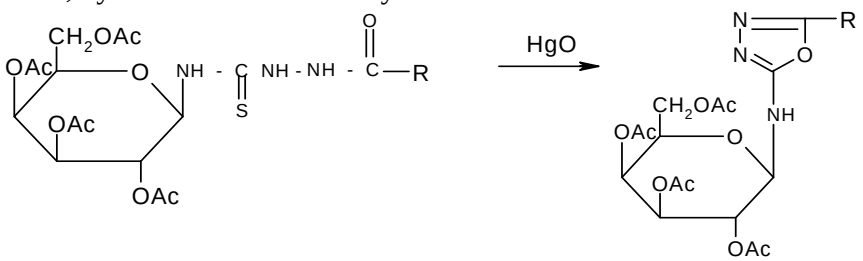
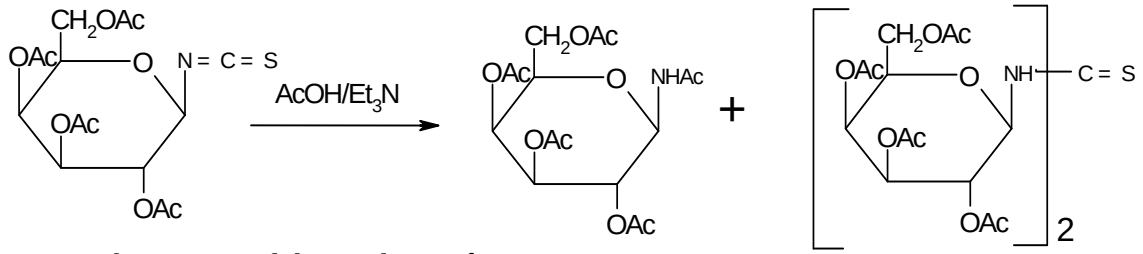


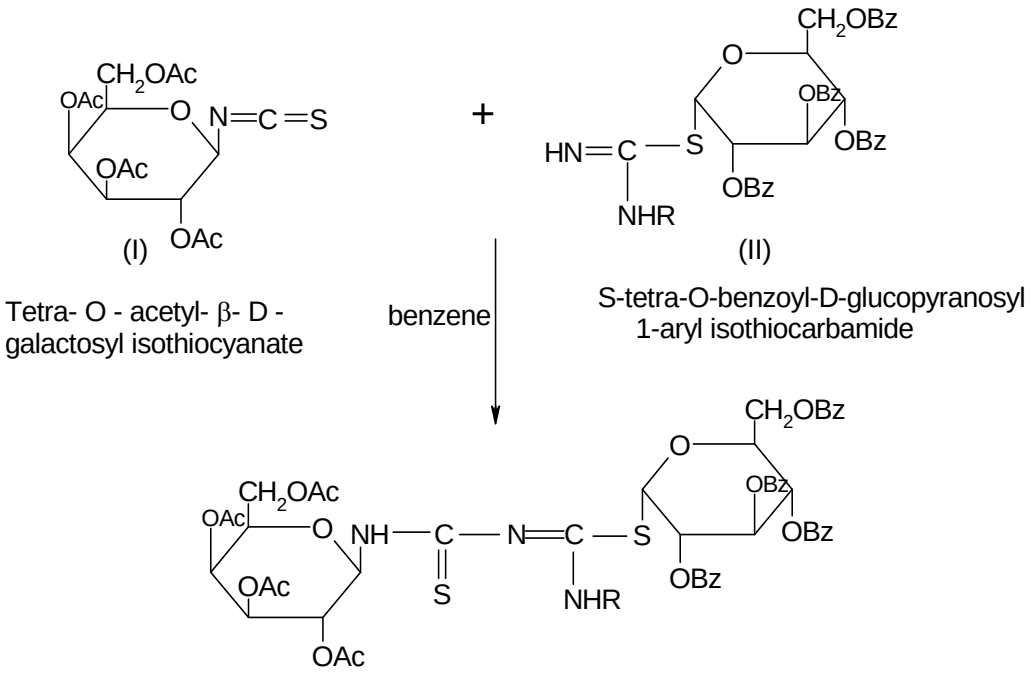
Similarly, D. Gumien and C. Gmernicka-Haftek[11] have reported the 1,3, 4 oxidazole derivative, by the treatment of 2-furyl and 2-quinyl derivatives of tetra acetyl-D-galactopyranosyl thiosemicarbazide with HgO.



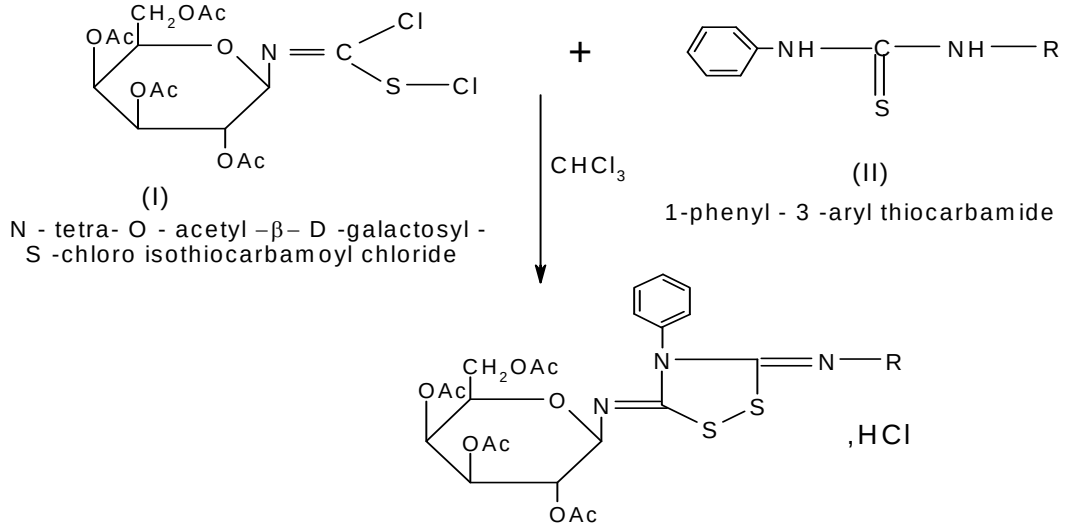
Khorlin and Co-workers[12] have synthesized N-glucosyl and N-galactosyl acetamide by the reaction of glucosyl and galactosyl isothiocyanates with acetic acid in presence of triethylamine in 35% yield and 1,3-bis (glycosyl) thioureas as co products.



We have reported the synthesis of Galactosylated Isothiobiuretes[13] by the condensation of Galactosyl isothiocyanate and Glucosyl isothiocarbamides.



Recently we have reported the antimicrobial activities of Certain arylimino N- Galactosyl dithiazolidines[14]



Conclusion:

By the above referential review it is quite evident that N- Galactosyl derivatives have been synthesized and showed theirs utilities in the field of Carbohydrate chemistry. The synthetic route of the desired compounds may be complicated, the expenditure for the reactions and chemicals may be variable but it is clear that the Galactosyl compounds have significant Role in the Carbohydrate chemistry as well as Synthetic Organic chemistry.

Acknowledgement:

Author is thankful to Dr. S. P. Deshmukh, Shri Shivaji College, Akola without whom the research on the related topic cannot be possible . Author is also thankful to Dr. N. N. Gawande, Principal, Late. B. S. Arts, Prof. N. G. Science & A. G. Commerce College, Sakharkherda for encouragement and providing necessary facilities.

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