OBJECT OF THE PRESENT WORK
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As noticed earlier (see general introduction) not much work has been reported on S-hepta-O-acetyl lactosyl derivatives related to the thiocarbamides. In view of the applications of S-lactosylated compounds in the medicinal chemistry as diuretic agents, analgesics it appeared interesting to carry out the synthesis of following S-lactosyl compounds related to isothiocarbamides, dithiocarbamates, isothiobiurets isodithiobiurets, -1, 2, 4-thiadiazolines and -1, 3, 5 thiadiazines

\[
\begin{align*}
\text{HAL-S-C-NHR} & \quad \text{HAL-S-C-NHR} \\
\text{S-Hepta-O-acetyl lactosyl} & \quad \text{S-Hepta-O-acetyl lactosyl} \\
\text{-1-aryl isothiocarbamides} & \quad \text{aryl dithiocarbamates} \\
\text{NHR} & \\
\text{HAL-S-C=NC-NHR'} & \\
\text{S-Hepta-O-acetyl lactosyl} & \quad \text{S-Hepta-O-acetyl lactosyl} \\
\text{1 aryl 5-phenyl-2-isothiobiurets} & \quad \text{-1-aryl-5-phenyl-2,4-isodithiobiurets} \\
\text{HAL-S} & \\
\text{4-Aryl-5-phenylimino-3-S-hepta-O-acetyl-lactosyl} & \quad \text{3-Aryl-2,6-diphenylimino-4-S-hepta-O-acetyl lactosyl-2,3-dihydro} \\
\text{-1,2,4-thiadiazolines} & \quad \text{-1,3,5-thiadiazine hydrochlorides} \\
\end{align*}
\]

Where, R, R', R'' are suitable alkyl or aryl group

HAL - Hepta-O-acetyl lactosyl

With above end in view, the research work involving hepta-O-acetyl lactosyl bromide as lactosylating reagent has been carried out.
Hepta-O-acetyl lactosyl bromide

It must be mentioned here that the above objectives of the synthesis of S-hepta-O-acetyl lactosyl compounds have been almost fully realized. Synthesis and chemistry of all these compounds are described in the following chapter.

* The present research work deals only with the synthetic and structural chemistry of certain S-hepta-O-acetyl lactosyl group containing nitrogen sulphur compounds. The stereochemical aspects of these compounds have not been investigated in the present work.
PRESENT WORK

The thesis has been divided into seven chapters.

The first chapter describes the synthesis of S-Hepta-O-acetyl lactosyl-1-arylisothiocarbamides. This involved the interaction of hepta-O-acetyl lactosyl bromide and arylthiocarbamides.

Second chapter is an account of the synthesis of S-hepta-O-acetyl lactosyl arylthiocarbamates. This involved the interaction of hepta-O-acetyl lactosyl bromide and ammonium aryldithiocarbamates.

Third chapter deals with the synthesis of S-Hepta-O-acetyl lactosyl-1, 5-disubstituted-2-isothiobiurets. This synthesis involved the interaction of S-hepta-O-acetyl lactosyl-1-arylthiocarbamides and phenyl isocyanate.

Fourth chapter is an account of the synthesis of S-Hepta-O-acetyl lactosyl - 1,5- disubstituted - 2,4 - isodithiobiurets. This synthesis involved the interaction of S-Hepta-O-acetyl lactosyl-1-arylthiocarbamides and phenyl isothiocyanate.

Fifth chapter describes the synthesis of 4-Aryl-5-phenylimino-3-S-hepta-O-acetyl lactosyl-1, 2, 4-thiadiazolines. These synthesis involved the interaction of S-Hepta-O-acetyl lactosyl-1-arylthiocarbamides and S-chloro-N-phenyl isothiocarbamoyl chloridc.

Sixth chapter deals with the synthesis of 3-Aryl-2, 6-diphenylimino-4- S-hepta-O-acetyl lactosyl -2,3- dihydro-1, 3, 5-thiadiazine hydrochlorides. This synthesis involved the interaction of S-Hepta-O-acetyl lactosyl-1, 5-disubstituted-2, 4-isodithiobiurets and phenyl isocyanodicloride.

Seventh chapter is an account of the antibacterial and antifungal activities of newly synthesized thiolactosides.
A CHAPTERWISE SUMMARY IS AS FOLLOWS:

Chapter I:

This chapter describes a novel, convenient and cheaper method of preparation of hepta-O-acetyl lactosyl bromide by the interaction of lactose octaacetate and brominating reagent. This preparation of hepta-O-acetyl lactosyl bromide opened a new line in the synthesis of S-lactosylated thiocompounds.

This chapter also describes the synthesis of S-hepta-O-acetyl lactosyl-1-arylisothiocarbamides. It involved the interaction of hepta-O-acetyl lactosyl bromide (I) and arylthiocarbamides (II).

In a typical preparation of S- hepta-O-acetyl lactosyl-1-phenylisothiocarbamide (where, aryl = phenyl) the reaction of hepta-O-acetyl lactosyl bromide and phenylthiocarbamide was carried out in propan-2-ol by heating on water bath at 70°C until it get cleared. The resultant clear solution on addition in water was acidic in nature, which on basification by aq. ammonia afforded a sticky mass. It was purified with ethanol-water gives granular solid, m.p. 121°C.

The structure of the compound has been established on the basis of elemental analysis and IR, NMR and Mass spectral studies. The specific rotation of the compound was also recorded.

When the interaction of hepta-O-acetyl lactosyl bromide was extended to other arylthiocarbamides, the corresponding S-hepta-O-acetyl lactosyl-1-arylisothiocarbamides (IIIa-IIIg) have been isolated.

The probable mechanism of the formation of III may be depicted as follows:
Chapter II:

This chapter is an account of S-hepta-O-acetyl lactosyl aryl dithiocarbamates. The synthesis involved the interaction of hepta-O-acetyl lactosyl bromide (I) and ammonium aryl dithiocarbamates (II).

In a typical preparation of S-hepta-O-acetyl lactosyl phenylidithiocarbamate (where, aryl=phenyl) the reaction of hepta-O-acetyl lactosyl bromide and ammonium phenylidithiocarbamate was carried out in propan-2-ol medium by heating on water bath at 70°C until the solution got cleared. The clear solution was kept at room temperature for 18 hr. Then mixed with distilled water, a semisolid mass was obtained. The semisolid mass was purified with ethanol-water and crystals were obtained, m.p. 115-118°C.
The structure of the compound has been established on the basis of elemental analysis and IR, NMR and Mass spectral studies. The specific rotation of the compound was also recorded.

When the interaction of hepta-O-acetyl lactosyl bromide was extended to other ammonium aryldithiocarbamates, the corresponding S-hepta-O-acetyl lactosyl aryldithiocarbamates (IIIb-IIIg) have been isolated.

\[ \begin{align*}
\text{Hepta-O-acetyl lactosyl bromide} & \quad + \quad R - \text{NH} - C - S \quad \text{NH}_3 \\
\text{Ammonium aryl dithiocarbamate} \quad \xrightarrow{\text{isopropanol, } 70^\circ C} \quad \text{S-Hepta-O-acetyl lactosyl aryldithiocarbamate}
\end{align*} \]

Where, \( R = \) a) phenyl, b) m-Cl-phenyl, c) p-Cl-phenyl \\
(\text{d) } \eta \text{-tolyl, e) } m \text{-tolyl, f) } \eta \text{-tolyl}) \\
\text{Ac} = \text{COCH}_3

Chapter III:

This chapter deals with the synthesis of S-hepta-O-acetyl lactosyl-1,5-disubstituted-2-isothiobiurcts. The synthesis involved the interaction of S-hepta-O-acetyl lactosyl -1-arylisothiocarbamides (I) and phenyl isocyanate (II).

In a typical preparation of S-hepta-O-acetyl lactosyl -1,5-diphenyl-2-isothiobiuret (where, ary1 =phenyl) the benzene solution of S-hepta-O-acetyl lactosyl-1-phenylisothiocarbamide was mixed with the benzene solution of phenyl isocyanate. The resultant mixture after standing at room temperature for 24 hr gave clear solution. The benzene was distilled off. The sticky mass obtained
was triturated several times with petroleum ether furnished a white solid. It was purified with ethanol-water, m.p. 163-165°C.

The compound was characterized on the basis of elemental analysis and IR, NMR and Mass spectral studies. The specific rotation of the compound was also recorded.

When the reaction of phenyl isocyanate was extended to other $S$-hepta-$O$-acetyl lactosyl-$1$-$arylisothiocarbamides$, the related $S$-hepta-$O$-acetyl lactosyl-$1$-$aryl$ -5-phenyl-2-isothiobiurets ($\text{III}_b$-$\text{III}_g$) were isolated.

The reaction is represented as follows:

![Chemical reaction diagram]

Where, $R = a)$ phenyl, $b)$ o-Cl-phenyl, $c)$ m-Cl-phenyl, $d)$ p-Cl-phenyl, $e)$ o-tolyl, $f)$ m-tolyl, $g)$ p-tolyl

$\text{Ac} = \text{COCH}_3$  $\text{Ph} = \text{Phenyl}$

**Chapter IV:**

This chapter is a record of the synthesis of $S$-hepta-$O$-acetyl-$1,5$-disubstituted-$2,4$-isodithiobiurets. The synthesis involved the interaction of $S$-hepta-$O$-acetyl lactosyl-$1$-$arylisothiocarbamides$ (I) and phenyl isothiocyanate (II).

In a typical preparation of $S$-hepta-$O$-acetyl lactosyl-$1,5$-diphenyl-$2,4$-isodithiobiuret (where, aryl = phenyl), condensation of $S$-hepta-$O$-acetyl lactosyl-$1$-phenylisothiocarbamide and phenyl isothiocyanate was carried out by refluxing in dry benzene for 9 hr.
It gave clear solution. The benzene was distilled off. The sticky mass obtained was triturated several times with petroleum ether furnished a granular solid. It was purified with ethanol-water, m.p. 142-145°C.

The structure of the compound has been established on the basis of elemental analysis and IR, NMR and Mass spectral studies. The specific rotation of the compound was also recorded.

When the interaction of phenyl isothiocyanate was extended to other S-hepta-O-acetyl lactosyl-1-arylisothiocarbamides, the corresponding S-hepta-O-acetyl lactosyl-1-aryl-5-phenyl-2,4-isodithiobiurets (IIIb-IIIg) were isolated.

The reaction scheme was represented as follows:

![Reaction Scheme](image)

Where,  
\[ R = \begin{array}{llllll}
  a) & \text{phenyl}, & b) & \alpha-\text{Cl-phenyl}, & c) & \beta-\text{Cl-phenyl}, \\
  d) & \beta-\text{Cl-phenyl}, & e) & \alpha-\text{tolyl}, & f) & \beta-\text{tolyl}, \\
  g) & \beta-\text{tolyl}, & & & &
\end{array} \]

\[ \text{Ac} = \text{COCH}_3 \]

\[ \text{Ph} = \text{Phenyl} \]

**Chapter V:**

This chapter describes the synthesis of 4-Aryl-5-phenylimino-3-S-hepta-O-acetyl lactosyl-1,2,4-thiadiazolines. These have been synthesized by the interaction of S-hepta-O-acetyl lactosyl-1-arylisothiocarbamides (I) and S-chloro-N-phenyl isothiocarbamoyl chloride (II).

In a typical preparation of 4-Phenyl-5-phenylimino-3-S-hepta-O-acetyl lactosyl-1,2,4-thiadiazoline (where, aryl = phenyl).
$S$-chloro-$N$-phenyl isothiocarbamoyl chloride was added gradually to a cold chloroform solution of $S$-hepta-$O$-acetyl lactosyl-1-phenyliiso thiocarbamide. Elimination of hydrogen chloride was noticed. After standing for several hours no solid was separated out. However on mixing with petroleum ether, a viscous mass was converted into granular solid. It was purified with ethanol-water, m.p. 125-1270°C.

The structure of the compound has been established on the basis of elemental analysis and IR, NMR and Mass spectral studies. Specific rotation of the compound was also recorded.

When the interaction of $S$-chloro-$N$-phenyl isothiocarbamoyl chloride was extended to other $S$-hepta-$O$-acetyl lactosyl-1-arylisothiocarbamides, the related 4-aryl-5-phenylimino-3-$S$-hepta-$O$-acetyl lactosyl-1,2,4-thiadiazolines ($\text{III}_b$-$\text{III}_g$) were isolated.
Chapter VI:

This chapter deals with the synthesis of 3-Aryl-2,6-diphenylimino-4-S-hepta-O-acetyl lactosyl-2, 3-dihydro-1, 3, 5-thiadiazines hydrochlorides. These synthesis involved the interaction of S-hepta-O-acetyl lactosyl-1,5-disubstituted-2,4-isodithiobiurets (I) and phenyl isocyanodichloride (II).
In a typical preparation of 3-\(p\)-Tolyl-2,5-diphenylimino-4- \(S\)-hept\(a\)-\(O\)-acetyl lactosyl -2,3- dihydro-1,3,5- thia diazine hydrochloride (where, aryl = \(p\)-tolyl) the reaction of phenyl isocyanodichloride has been carried out with \(S\)-hepta-\(O\)-acetyl lactosyl-1-\(p\)-tolyl-5-phenyl-2,4-isodithiobiuret in boiling chloroform medium for 2 and half hour. Evolution of hydrogen chloride was clearly noticed. The chloroform was distilled off. The viscous residue thus obtained was triturated several times with petroleum ether furnished a granular solid. It was purified with ethanol water, m.p. 182-184°C.

The structure of the compound has been established on the basis of elemental analysis, IR, NMR and Mass spectral studies. The specific rotation of the compound was also recorded.

When interaction of phenyl isocyanodichloride was extended to other \(S\)-hepta-\(O\)-acetyl lactosyl-1-aryl-5-phenyl-2,4-isodithiobiurets, the corresponding 3-Aryl-2,6-diphenylimino-4-\(S\)-hepta -\(O\)- acetyl lactosyl - 2,3- dihydro-1, 3, 5- thia diazine hydrochlorides (\(III_b\)-\(III_g\)) were isolated.

The reaction is represented as follows:
\[
\begin{align*}
\text{Reflux, 21/2} & \quad \text{Phenyl isocyano-dichloride} \\
\text{Chloroform} & \\
\text{Reflux, 21/2} & \\
\end{align*}
\]

\[
\begin{align*}
\text{3-hepta-O-acetyl lactosyl-1-aryl-5-phenyl-2,4-isodithiolbiuret} \\
\text{3-aryl-2,4-diphenyliminu+3-hepta-O-acetyl lactosyl-2,3-dihydro-1,3,5-thia diazine hydrochloride} \\
\end{align*}
\]

Where, \( K = \) a) phenyl, b) o-Cl-phenyl, c) m-Cl-phenyl, d) p-Cl-phenyl, e) o-tolyl, f) m-tolyl, g) p-tolyl

\[
\begin{align*}
\text{Ac} & = \text{COCH}_3 \\
\text{Ph} & = \text{Phenyl}
\end{align*}
\]

Chapter VII:

This chapter is an account of the antibacterial and antifungal activities of the thiolactosides synthesized in the chapter I to VI.

The newly synthesized thiolactosides were screened for their antibacterial activities against \textit{E. coli}, \textit{P. vulgaris}, \textit{S. aureus} and \textit{S. typhi} and antifungal activities against \textit{Candida guilliermondii} and \textit{A. niger}.

The compounds exhibited moderate to good activities while some of them was found to be resistant.