OBJECT OF PRESENT WORK

The chemistry of 'dicyandiamide' and N-aryl/alkylisocyanodichloride' with special reference to their importance and utility as the intermediates in the synthesis of nitrogen, nitrogen and sulphur containing heteroacyclic and heterocyclic compounds has been briefly reviewed (General Introduction, Page No. 1 to 27). As evident from the structure of dicyandiamide, this molecule is bifunctional molecule having reactive formamidino group and cyano/nitrilo group. Therefore, dicyandiamide has been considered as intermediate in the synthesis of various heteroacycles. So, it appeared sufficiently interesting to investigate the chemistry of diacyndiamide with a view to synthesise a new series of nitrogen and sulphur containing heterocycles.

The synthetic chemistry of N-aryl/alkyl isocyanodichlorides in the synthesis of several 6-membered sulphur and nitrogen containing heterocyclic ring have been exhaustively investigated. And hence, it was thought interesting to explore the synthetic application of N-isocyanodichlorides by further making the use of t-butyl, ethyl, methyl, phenyl, p-chlorophenyl and p-toly groups as blocking groups introducing an isocyanodichloride to synthesise yet new series of 1,3,5-thiadiazine and s-triazine having mercapto group (−SH), imino group (−NH) or guanidino group \( \text{N} \equiv \text{C} \equiv \text{N} \) and to study antimicrobial analysis of some compounds, to investigate and to explore the agricultural, pharmacological and medicinal values as well as structural properties of those compounds was planned.

The synthesis of following compounds have been proposed to be carried out by using the reagent dicyandiamide, 1,3-diformamidino-thiocarbamide, phenylisothiocyanate, methylisothiocyanate, ethylisothiocyanate,
Object of Present Work

$p$-chlorophenylisothiocyanate, $p$-tolylisothiocyanate, N-phenylisocyanodichlorides, N-$t$-butylisocyanodichlorides, N-ethylisocyanodichlorides, N-$p$-chlorophenylisocyanodichlorides.

1. 1,3-Diformamidinothiocarbamide
2. N-Phenylformamidinoformamidinothiocarbamide
3. N-Allylformamidinoformamidinothiocarbamide
4. 1-Formamidino-3-thioamido-N-substitutedformamidinothiocarbamides
5. 1-Formamidino-(N-substituted thioamido)-5-substituted-2-thio-4-imino-biurets
6. 1,3-Bis-(N-substitutedamidinothiocarbamido)-thiocarbamides
7. 1,3-Bis-(N-substitutedthioamido)-guanidines
8. 2-Substitutedimino-4-(2-imino-4-thio-biureto-5-yl-carbamidino)-6-substitutedimino-1,3,5-thiadiazines
9. 2-Substitutedamino-4-[(4-amino-6-substitutedimino-1,3,5-thiadiaz-2-yl)] amino-6-substitutedimino-1,3,5-thiadiazines
10. 1-Substituted-2-thio(1H)-4-[(2-imino-4-thiobuureto-5-yl) guanyl]-6-substituted amino-1,2-dihydro-s-triazines
11. 1-Substituted-2-thio(1H)-4-[(1-substituted-2-thio(1H)-4-amino-1,2-dihydro-s-triazin-6-yl)]-amino-6-substitutedamino-1,2-dihydro-s-triazines
12. 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substitutedthiocarbamido-1-yl)-6-substitutedimino-1,3,5-thiadiazines
13. 1,3-Bis (2-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-4-yl) thiocarbamides
14. 1-Substituted (2H)-2-thio-4-(3-substitutedthiocarbamido-1-yl)-6-(2-imino-4-thio-5-substitutedbiureto-1-yl)-1,2-dihydro-s-triazines
Object of Present Work

15] 1,3-Bis-(1-substituted-2-thio(1H)-6-substitutedamino-1,2-dihydro-s-triazin-4-yl)-thiocarbamides

16] 2-(1-substitutedguanidino-3-yl)-4-(3-substitutedthiocarbamidino-1-yl)-6-substitutedimino-1,3,5-thiadiazines

17] 2-Substitutedamino-4-[4-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-2-yl]-6-substitutedimino-1,3,5-thiadiazines

18] 1-Substituted-2-thio(1H)-4-(3-substitutedthiocarbamido-1-yl)-6-(1-substitutedguanidino-3-yl)-1,2-dihydro-s-triazines

19] 1-Substituted-2-thio(1H)-4-(1-substituted-2-thio(1H)-4-substitutedamino-1,2-dihydro-s-triazin-6-yl)-amino-6-substitutedamino-1,2-dihydro-s-triazines

20] 2-Substitutedamino-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedimino-1,3,5-thiadiazines

21] 1-Substitutedimino-2-thio(1H)-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedamino-1,2-dihydro-s-triazines

The antimicrobial activity of these prepared compounds was posposed to be carried out using bacterial organisms such as, *S. aureus*, *S. typhi*, *A. aerogenes*, *E. coli* and *B. megatherium*.

With the above aim and objectives, the present research work has been undertaken, this thesis is an account of these investigations. Most of the above reactions have been fully realized wherever possible attempts have been made to investigate structural properties, as well as medicinal values of some synthesised compounds. Synthesis and the chemistry of all these compounds are described in the following chapters.
PRESENT WORK

The thesis is divided into 6 chapters. Each chapter is completed within itself.

Chapter - 1 : Synthesis of 1,3-diformamidinothiocarbamide and N-substitutedformamidinoformamidinothiocarbamide.

This chapter deals with the interaction of dicyandiamide and different thioureas to synthesise 1,3-diformamidinothiocarbamide and N-substitutedformamidinoformamidinothiocarbamide.

Chapter - 2 : This chapter is divided into two sections i.e. Section-A and Section-B.

Section-A :- (i) Synthesis of 1-formamidino-3-thioamido-N-substituted formamidinothiocarbamides (3).

This section describes the interaction of 1,3-diformamidinothiocarbamide with aryl/alkyl isothiocyanate (2a) in 1:1 ratio to synthesise 1-formamidino-3-thioamido-N-substitutedformamidinothiocarbamides.

(ii) Synthesis of 1-formamidino-(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiurets (3).

The interaction of N-phenyl/allyl formamidinoformamidinothiocarbamide with aryl/alkyl isothiocyanate (2a) in 1:1 molar ratio to yield 1-formamidino-(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiuret.

Section-B :- Synthesis of 1,3-Bis-(N-substitutedamidinothiocarbamido)-thiocarbamide (4).

This section describes the interaction of 1,3-diformamidinothiocarbamide with aryl/alkyl isothiocyanate in 1:2 molar proportion to synthesise 1,3-Bis-(N-substitutedamidinothiocarbamido) thiocarbamide.
Chapter - 3 : Synthesis of 1,3-Bis-(N-substitutedthioamido) guanidine.

This chapter explores the interaction of guanidine carbonate with different aryl/alkyl isothiocyanate (2a) in acetone-ethanol medium in 1:2 molar ratio to yield 1,3-Bis-(N-substitutedthioamido) guanidine.

Chapter - 4 : This chapter gives synthesis of 1,3,5-thiadiazine in three sections, while Section A and B are subdivided into two Classes i.e. Class (i) and Class (ii).

Section-A :- This section is subdivided into two classes.

Class - (i) : Synthesis of 2-substitutedamino-4-(2-imino-4-thiobiureto-5-yl-carbamidino)-6-substitutedimino-1,3,5-thiadiazine.

Class (i) gives detailed information of the interaction of 1-formamidino-3-thioamido-2-substitutedformamidino-thiocarbamide with N-aryl/alkyl isocyanodichloride (2b) in 1:1 molar ratio in carbon tetrachloride medium to obtain 2-substitutedamino-4-(2-imino-4-thiobiureto-5-yl-carbamidino)-6-substitutedimino-1,3,5-thiadiazine. Similarly, new series of thiadiazines were synthesized from 1-formamidino-(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiurets.

Class - (ii) : Synthesis of 2-substitutedamino-4[-(4-amino-6-substituted imino-1,3,5-thiadiaz-2-yl)] amino-6-substitutedimino-1,3,5-thiadiazine.

Class (ii) comprises the interaction of 1-formamidino-3-thioamido-2-substitutedformamidinothiocarbamide with N-aryl/alkyl isocyanodichloride (2b) in 1:2 molar proportion in acetone-ethanol medium to obtain 2-substitutedamino-4[-(4-amino-6-substitutedimino-1,3,5-thiadiaz-2-yl)] amino-6-substitutedimino-1,3,5-thiadiazine. Similarly, new series of thiadiazines were synthesized from 1-formamidino-(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiurets.
Object of Present Work

Section-B :- This section is also subdivided into two classes.

Class - (i) : Synthesis of 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substitutedthiocarbamido-1-yl)-6-substitutedimino-1,3,5-thiadiazine.

Class (i) consists of the interaction of 1,3-Bis-(N-substituted amidinothiocarbamido)-thiocarbamide with N-aryl/alkyl isocyanodichloride (2b) in 1:1 ratio in carbontetrachloride medium to obtain 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substitutedthiocarbamido-1-yl)-6-substitutedimino-1,3,5-thiadiazine.

Class - (ii) : Synthesis of 1,3-Bis-(2-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-4-yl)-thiocarbamide.

Class (ii) explore the detail information of the interaction of 1,3-Bis-(N-substitutedamidinothiocarbamido)-thiocarbamide with N-aryl/alkyl isocyanodichloride (2b) in 1:2 molar ratio in acetone-ethanol medium to obtain 1,3-Bis-(2-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-4-yl)-thiocarbamide.

Section-C :- Synthesis of 2-substitutedamino-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedimino-1,3,5-thiadiazine.

This section gives detail information of the interaction of 1,3-Bis-(N-substitutedthioamido) guanidine with N-aryl/alkyl isocyanodichloride (2b) in 1:1 ratio in carbontetrachloride medium to obtain 2-substitutedamino-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedimino-1,3,5-thiadiazine.

Chapter - 5 : This chapter gives synthesis of s-triazine from the isomerisation of 1,3,5-thiadiazine in following section.

Section-A :-

(i) Synthesis of 1-substituted-2-thio(1H)-4[(2-imino-4-thiobiureto-5-yl) guanyl]-6-substitutedamino-1,2-dihydrors-triazine

This part gives detail information of the isomerisation of 2-substituted-4-(2-imino-4-thiobiureto-5-yl-carbamidino)-6-substitutedimino-1,3,5-
thiadiazine in presence of aqueous ethanolic sodium bicarbonate solution to obtain 1-substituted-2-thio(1H)-4-[(2-imino-4-thiobiureto-5-yl) guanyl]-6-substitutedamino-1,2-dihydro-s-triazine. Similarly, new series of s-triazine was prepared by the isomerisation of 2-(1-substitutedguanidino-3-yl)-4-(3-substitutedthio carbamidino-1-yl)-6-substituted-1,3,5-thiadiazines.

(ii) Synthesis of 1-substituted-2-thio(1H)-4-[(1-substituted-2-thio(1H)-4-amino-1,2-dihydro-s-triazin-6-yl)] amino-6-substitutedamino-1,2-dihydro-s-triazine.

This part consists of isomerisation of 2-substituted amino-4-[(4-amino-6-substitutedamino-1,3,5-thiadiaz-2-yl)]-amino-6-substitutedamino-1,3,5-thiadiazine in presence of aqueous ethanolic sodium bicarbonate solution to obtain 1-substituted-2-thio(1H)-4-[(1-substituted-2-thio(1H)-4-amino-1,2-dihydro-s-triazin-6-yl)] amino-6-substitutedamino-1,2-dihydro-s-triazine. Similarly, other s-triazines were prepared by the isomerisation of 2-Substitutedamino-4-[4-substitutedamino-6-substitutedamino-1,3,5-thiadiaz-2-yl]-6-substitutedamino-1,3,5-thiadiazines.

Section - B :-

(i) Synthesis of 1-substituted (2H)-2-thio-4-(3-substitutedthiocarbamido-1-yl)-6-(2-imino-4-thio-5-substitutedbiureto-1-yl)-1,2-dihydro-s-triazine.

This part gives detail information of isomerisation of 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substitutedthiocarbamido-1-yl)-6-substitutedamino-1,3,5-thiadiazine in presence of aqueous ethanolic sodium bicarbonate solution to obtain 1-substituted (2H)-2-thio-4-(3-substitutedthiocarbamido-1-yl)-6-(2-imino-4-thio-5-substitutedbiureto-1-yl)-1,2-dihydro-s-triazine.
(ii) Synthesis of 1,3-Bis-(1-substituted-2-thio-(1H)-6-substitutedamino-1,2-dihydro-s-triazin-4-yl) thiocarbamide.

This part explains the isomeric change of 1,3-Bis-(2-substituted-amino-6-substituteddimino-1,3,5-thiadiaz-4-yl) thiocarbamide in presence of aqueous ethanolic sodium bicarbonate solution to obtain 1,3-Bis-(1-substituted-2-thio-(1H)-6-substitutedamino-1,2-dihydro-s-triazin-4-yl) thiocarbamide.

Section-C: Synthesis of 1-substituted-2-thio(1H)-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedamino-1,2-dihydro-s-triazine.

This section explores the detailed information of isomerisation of 2-substitutedamino-4-(1-substitutedthiocarbamido-3-yl)-6-substituteddimino-1,3,5-thiadiazine in presence of aqueous ethanolic sodium bicarbonate solution to obtain 1-substituted-2-thio(1H)-4-(1-substitutedthiocarbamido-3-yl)-6-substituteddimino-1,2-dihydro-s-triazine.

Chapter-6: Antimicrobial Activity of Synthesized Compounds.

This chapter contains antimicrobial activity of newly synthesized compounds by using bacterial organisms such as, S. aureus, S. typhi, A. aerogenes, E. coli and B. subtilis.

Chapterwise summary of the thesis is as follows.

Chapter-1: Synthesis of 1,3-diformamidinothiocarbamide and N-substitutedformamidinoformamidinothiocarbamide.

This chapter deals with the synthesis of 1,3-diformamidino-thiocarbamide (3a) and N-substitutedformamidinoformamidinothiocarbamide (3b) by the interaction of dicyandiamide (1) with various thioureas (2) in presence of hydrochloric acid and in acetone medium.
With the above objective the interaction of dicyandiamide and thiourea have been carried out into two different reaction conditions.

(i) In presence of aqueous hydrochloric acid in acetone medium, and
(ii) In presence of hydrogen chloride gas in acetone-ethanol medium.

During boiling the reaction mixture, the suspended dicyandiamide went into the solution and new product was found to be gradually separated out. It was crystallised from aqueous ethanol. The resultant solids have been assigned structure 1,3-diformamidinothiocarbamide (3a) and N-substitutedformamidinoformamidinothiocarbamide (3). The structures of compounds (3a, 3b and 3c) have been established on the basis of chemical characteristics IR and NMR spectral data.

\[
\begin{align*}
\text{Acetone-ethanol} & \\
H_2N-C-NH-C\equiv N + HCl & \rightarrow H_2N-C-NH-C=NH \quad H_2N-C-NH-R' \\
\text{NH} & \quad \text{NH} \quad \text{Cl} \quad + \quad \text{S} \\
(1) & \\
\begin{array}{c}
\text{H}_2\text{N-C-NH-C-NH-C-NH-R'} \\
\text{NH} \quad \text{S} \quad \text{NH} \cdot 2\text{HCl}
\end{array} & \leftarrow \\
\begin{array}{c}
\text{H}_2\text{N-C-NH-C-S}_2\text{C-NH-R'} \\
\text{NH} \quad \text{NH} \quad \text{NH} \cdot 2\text{HCl}
\end{array}
\]

Unstable monosulphide

Where, \( R' \) - 
(3a) = \( H \)
(3b) = phenyl, (3c) = allyl

Chapter - 2 :

Section-A :- (i) Synthesis of 1-formamidino-3-thioamido-N-substituted formamidinothiocarbamide AND 1-Formamidino-(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiuret (3)

This section of Chapter-2 describes the synthesis of 1-formamidino-3-thioamidino-N-substitutedformamidinothiocarbamide (3a), 1-formamidino-
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(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiuret (3) by the interactions of 1,3-diformamidinothiocarbamide (1a), N-substituted formamidinoformamidinothiocarbamide (1b) and (1c) with different N-aryl/alkyl isothiocyanate (2) in carbontetrachloride medium in 1:1 molar proportion on boiling water bath. During boiling the suspended 1,3-diformamidinothiocarbamide (1a) and N-substituted formamidinoformamidinothiocarbamide (1b) went into solution and a new product was found to be gradually separated out. The compounds (3a), (3b) and (3c) have been assigned structure 1-formamidino-3-thioamido-N-substitutedformamidinothiocarbamide, 1-formamidino-(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiuret (3b) and (3c) respectively on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.

\[
\begin{align*}
\text{H}_2\text{N} & \text{-C-NH-C-NH-C-NH-R'} + S = C = N - R \\
\text{NH} & \quad S \quad \text{NH} \\
\text{NH} & \quad S \quad \text{NH}
\end{align*}
\]

(2)

\[
\begin{align*}
\text{R-NH-C-NH-C-NH-C-NH-C-NH-C-NH-R'} \\
\text{S} \quad \text{NH} \quad \text{S} \quad \text{NH}
\end{align*}
\]

(3)

Where, R' -
(3a) = H
(3b) = phenyl, (3c) = allyl
R = phenyl, \( p \)-chlorophenyl, \( p \)-tolyl, ethyl, methyl, \( t \)-butyl

Section-B :- Synthesis of 1,3-Bis-(N-substitutedamidinothiocarbamido)-thiocarbamides (3).

This section of Chapter-2 describes the synthesis of 1,3-Bis-(N-substitutedamidinothiocarbamido) thiocarbamides (3) with the interaction of 1,3-diformamidinothiocarbamide (1) and N-aryl/alkyl isothiocyanate (2) in
acetone-ethanol medium in 1:2 molar ratio on water bath. During boiling the suspended 1,3-diformamidinothiocarbamide (1) went into the solution and new product was found to be gradually separated out. The compound (3) have been assigned structure 1,3-Bis-(N-substitutedamidinothiocarbamido) thiocarbamides on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.

\[
\begin{align*}
H_2N-C-NH-C-NH-C-NH_2 & + 2 R = N = C = S \\
\text{(1)} & \\
\downarrow \text{Acetone-Ethanol} \\
R-NH-C-NH-C-NH-C-NH-C-NH-C-NH-C-NH-R \\
\text{(3)} & \\
\end{align*}
\]

Where, R = phenyl, \(p\)-chlorophenyl, \(p\)-tolyl, ethyl, methyl, \(t\)-butyl

Chapter - 3 : Synthesis of 1,3-Bis-(N-substitutedthioamido) guanidine (3).

This chapter describes the synthesis of 1,3-Bis-(N-substituted thioamido) guanidine (3) with the interaction of guanidine carbonate (1) with aryl/alkyl isothiocyanate (2) in acetone-ethanol medium in 1:2 molar proportion on water bath. During boiling the suspended guanidine carbonate (1) went into solution and new product was found to be gradually separated out. The compound (3) have been assigned structure 1,3-Bis-(N-substitutedthioamido) guanidine on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Chapter - 4 : This chapter gives synthesis of 1,3,5-thiadiazine in three sections, viz. Section-A, Section-B and Section-C.

Section-A :- This section is subdivided into two classes (i) and (ii).

Class - (i) : (a) Synthesis of 2-substituted amino-4-(2-imino-4-thiobiureto-5-yl-carbamidino)-6-substituted imino-1,3,5-thiadiazine (3).

This part describes the synthesis of 2-substituted amino-4-(2-imino-4-thiobiureto-5-yl-carbamidino)-6-substituted imino-1,3,5-thiadiazine (3) by the interaction of 1-formamidino-3-thioamido-N-substituted formamidino-thiocarbamide (1) and N-aryl/alkyl isocyanodichloride (2) in 1:1 molar proportion in carbon tetrachloride medium on water bath. During boiling the suspended compound (1) went into solution and new product was found to be separated out. The compound (3) have been assigned structure 2-substituted amino-4-(2-imino-4-thiobiureto-5-yl-carbamidino)-6-substituted imino-1,3,5-thiadiazine on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Where, R = phenyl, p-chlorophenyl, p-tolyl, ethyl, methyl, t-butyl
R₁ = phenyl, p-chlorophenyl, ethyl, t-butyl

(b) 2-(1-substitutedguanidino-3-yl)-4-(3-substitutedthiocarbamidino-1-yl)-6-substitutedimino-1,3,5-thiadiazines (3).

This part describes the synthesis of 2-(1-substitutedguanidino-3-yl)-4-(3-substitutedthiocarbamidino-1-yl)-6-substituted-1,3,5-thiadiazines (3) by the interaction of 1-formamidino-(N-substitutedthioamido)-5-substituted-2-thio-4-iminobiurets (1) and N-aryl/alkyl isocyanodichloride (2) in 1:1 molar proportion in carbontetrachloride medium on water bath. During boiling the suspended compound (1) went into solution and new product was found to be separated out. The compound (3) have been assigned structure 2-(1-substitutedguanidino-3-yl)-4-(3-substitutedthiocarbamidino-1-yl)-6-substituted-1,3,5-thiadiazines on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
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Where, \( R = \text{phenyl, } p\text{-chlorophenyl, } p\text{-tolyl, ethyl, methyl, } t\text{-butyl} \)
\[ R_1 = \text{phenyl, ethyl} \]
\[ R' = \text{phenyl, allyl} \]

Class - (ii) : (a) Synthesis of 2-substitutedamino-4[-(4-amino-6-substituted imino-1,3,5-thiadiaz-2-yl)]-amino-6-substitutedimino-1,3,5-thiadiazine (3).

This part describes the synthesis of 2-substitutedamino-4[-(4-amino-6-substitutedimino-1,3,5-thiadiaz-2-yl)]-amino-6-substitutedimino-1,3,5-thiadiazine (3) by the interaction of 1-formamidino-3-thioamido-N-substituted formamidinothiocarbamide (1) with N-aryl/alkyl isocyanodichloride (2) in 1:2 molar ratio in acetone-ethanol medium on water bath, during boiling the suspended compound (1) went into solution and new product was found to be gradually separated out. The compound (3) have been assigned the structure 2-substitutedamino-4[-(4-amino-6-substitutedimino-1,3,5-thiadiaz-2-yl)] amino-6-substitutedimino-1,3,5-thiadiazine on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
(b) **Synthesis of 2-Substitutedamino-4-[4-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-2-yl]-6-substitutedimino-1,3,5-thiadiazines**

This part describes the synthesis of 2-Substitutedamino-4-[4-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-2-yl]-6-substitutedimino-1,3,5-thiadiazines (3) by the interaction of 1-formamidino-(\(N\)-substituted-thioamido)-5-substituted-2-thio-4-iminobiurets (1) with \(N\)-aryl/alkyl

Where, \(R = \text{phenyl, } p\text{-chlorophenyl, } p\text{-tolyl, ethyl, methyl, } t\text{-butyl}\)

\(R_1 = \text{phenyl, } p\text{-chlorophenyl, ethyl, } t\text{-butyl}\)
Object of Present Work

isocyanodichloride (2) in 1:2 molar ratio in acetone-ethanol medium on water bath. during boiling the suspended compound (1) went into solvent and new product was found to be gradually separated out. The compound (3) have been assigned the structure 2-substitutedamino-4[-(4-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-2-yl)] amino-6-substitutedimino-1,3,5-thiadiazine on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.

\[
\begin{align*}
\text{R-NH-C=} & \text{NH-C=} \text{NH-C=} \text{NH-C=} \text{NH-C=} \text{NH-} \text{R'} \\
\text{S} & \text{NH} \text{S} & \text{NH} \\
\end{align*}
\]

(1)

\[
\begin{align*}
\text{Cl} & \text{C=} \text{Cl} \\
\text{N-} & \text{R}_1 \\
\end{align*}
\]

(2)

\[
\begin{align*}
\text{R-NH-C=} & \text{NH-C=} \text{NH-C=} \text{C=NH-} \text{R'} \\
\text{S} & \text{C=NH-} \text{2HCl} \\
\text{S} & \text{N} \\
\text{N-} & \text{R}_1 \\
\end{align*}
\]

dilute NH\text{OH}

\[
\begin{align*}
\text{R-NH-C=} & \text{NH-C=} \text{NH-C=} \text{C=NH-} \text{R'} \\
\text{S} & \text{C=NH-} \text{R'} \\
\text{S} & \text{N} \\
\text{N-} & \text{R}_1 \\
\end{align*}
\]

Where, R = phenyl, p-chlorophenyl, p-tolyl, ethyl, methyl, t-butyl
R\text{,} = phenyl; R' = phenyl, allyl

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Section-B :- This section is subdivided into two classes.

Class - (i) : Synthesis of 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substitutedthiocarbamido-1-yl)-6-substituted imino-1,3,5-thiadiazine (3).

This class describes the synthesis of 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substitutedthiocarbamido-1-yl)-6-substituted imino-1,3,5-thiadiazine (3) by the interaction of 1,3-Bis-(N-substitutedamidino thiocarbamido) thiocarbamide (1) with N-aryl/alkyl isocyanodichloride (2) in 1:1 molar ratio in carbontetrachloride medium on water bath for 8 hrs. During boiling the suspended compound (1) went into solution and new product was found to be gradually separated out. The compound (3) have been assigned the structure 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substituted thiocarbamido-1-yl)-6-substituted imino-1,3,5-thiadiazine on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Object of Present Work

Class - (ii) : **Synthesis of 1,3-Bis-(2-substitutedamino-6-substituted imino-1,3,5-thiadiaz-4-yl) thiocarbamide (3).**

This class describes the synthesis of 1,3-Bis-(2-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-4-yl) thiocarbamide (3) by the interaction of 1,3-Bis-(N-substitutedamidinothiocarbamido) thiocarbamide (1) with N-aryl/alkyl isocyanodichloride (2) in 1:2 molar ratio in ethanol-acetone medium on water bath for 8 hrs. During boiling the suspended compound (1) went into solvent and new product was found to be gradually appeared. The compound (3) have been assigned the structure 1,3-Bis-(2-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-4-yl) thiocarbamide on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Section-C :- Synthesis of 2-substitutedamino-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedimino-1,3,5-thiadiazine (3).

This section describes the synthesis of 2-substitutedamino-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedimino-1,3,5-thiadiazine (3) by the interaction of 1,3-Bis-(N-substitutedthioamido) guanidine (1) with N-aryl/alkyl isocyanodichloride (2) in 1:1 molar ratio in carbontetrachloride medium on water bath for 8 hrs. During boiling the suspended compound (1) went into solution and new product was found to be gradually separated out. The compound (3) have been assigned the structure of 2-substitutedamino-4-(1-substituted thiocarbamido-3-yl)-6-substitutedimino-1,3,5-thiadiazine on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.

Where, R = phenyl, \( p \)-chlorophenyl, \( p \)-tolyl, ethyl, methyl, \( t \)-butyl

\( R_1 = \) phenyl, \( p \)-chlorophenyl, ethyl
Object of Present Work

\[
\begin{align*}
\text{R-NH-C-NH-C-NH-C-NH-R} & \\ \\
\text{S NH S} & \\
\text{(1)} & \\

\text{+} & \\
\text{Cl} & \\
\text{Cl} & \\
\text{\(\ \\text{N - R}_1\)} & \\
\text{(2)} & \\

\text{R-NH-C-NH-C-NH-C-NH-R} & \\
\text{HCl S} & \\
\text{\(\ \\text{N - R}_1\)} & \\
\text{dilute NH}_3\text{OH} & \\
\downarrow & \\
\text{R-NH-C-NH-C-NH-C-NH-R} & \\
\text{\(\ \\text{N - R}_1\)} & \\
\text{(3)} & \\
\end{align*}
\]

Where, \(R = \text{phenyl, } p\text{-chlorophenyl, } p\text{-tolyl, ethyl, methyl, } t\text{-butyl}\)
\(R_1 = \text{phenyl, } p\text{-chlorophenyl, ethyl}\)

Chapter - 5 : This chapter gives synthesis of \text{s-triazine} in three sections, viz. Section-A, Section-B and Section-C.

Section-A :-

(i) Synthesis of 1-substituted -2-thio(1H)-4-[(2-imino-4-thiobiureto-5-yl) guanyl]-6-substitutedamino-1,2-dihydro-s-triazine (2)

This part explores the detail information of the isomerisation of 2-substitutedamino-4-(2-imino-4-thiobiureto-5-yl-carbamidino)-6-substitutedimino-1,3,5-thiadiazine (1) on boiling for 2 hrs with aqueous ethanolic sodium bicarbonate solution to isomerise into 1-substituted-2-thio(1H)-4-[(2-imino-4-thiobiureto-5-yl) guanyl]-6-substitutedamino-1,2-dihydro-s-triazine (2). The compound (2) have been assigned structure on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Object of Present Work

Where, \( R = \) phenyl, \( p \)-chlorophenyl, \( p \)-tolyl, ethyl, methyl, \( t \)-butyl
\( R_1 = \) phenyl, \( p \)-chlorophenyl, ethyl, \( t \)-butyl

(ii) **Synthesis of 1-Substituted-2-thio(1H)-4-(3-substitutedthiocarbamido-1-yl)-6-(1-substitutedguanidino-3-yl)-1,2-dihydro-\( s \)-triazines**

This part explores the detail information of the isomerisation of 2-(1-substitutedguanidino-3-yl)-4-(3-substitutedthiocarbamidino-1-yl)-6-substitutedimino-1,3,5-thiadiazine (1) on boiling for 2 hrs with aqueous ethanolic sodium bicarbonate solution to isomerise into 1-Substituted-2-thio(1H)-4-(3-substitutedthiocarbamidino-1-yl)-6-(1-substitutedguanidino-3-yl)-1,2-dihydro-\( s \)-triazine (2). The compound (2) have been assigned structure on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Object of Present Work

\[ R^NH-C-NH-C-NH-C-NH-R' \]

\[ \xrightarrow{\text{Isomerisation}} \]

\[ \text{Aqueous ethanolic sodium bicarbonate} \]

\[ R-NH-C-NH-C-NH-C-NH-R' \]

\( (1) \)

Where, \( R = \text{phenyl, } p\text{-chlorophenyl, } p\text{-tolyl, ethyl, methyl, } t\text{-butyl} \)
\( R_1 = \text{phenyl, ethyl} \)
\( R' = \text{phenyl, allyl} \)

(iii) **Synthesis of 1-substituted-2-thio(1H)-4-[(1-substituted-2-thio(1H)-4-amino-1,2-dihydro-s-triazin-6-yl)] amino-6-substitutedamino-1,2-dihydro-s-triazine (2).**

This part gives the detail information of isomerisation of 2-substituted-amino-4-[-(4-amino-6-substitutedimino-1,3,5-thiadiaz-2-yl)]-amino-6-substitutedimino-1,3,5-thiadiazine (1) on boiling for 2 hr with aqueous ethanolic sodium bicarbonate solution to isomerise 1-substituted-2-thio(1H)-4-[(1-substituted-2-thio(1H)-4-amino-1,2-dihydro-1,3,5-triazin-6-yl)] amino-6-substitutedamino-1,2-dihydro-s-triazine. The compound (2) have been assigned structure on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Object of Present Work

(iv) **Synthesis of 1-Substituted-2-thio(1H)-4-(1-substituted-2-thio(1H)-4-substitutedamino-1,2-dihydro-s-triazin-6-yl)-amino-6-substitutedamino-1,2-dihydro-s-triazines (2).**

This part gives the detail information of isomerisation of 2-substitutedamino-4-[4-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-2-yl]-6-substitutedimino-1,3,5-thiadiazine (1) on boiling for 2 hrs with aqueous ethanolic sodium bicarbonate solution to isomerise 1-Substituted-2-thio(1H)-4-(1-substituted-2-thio(1H)-4-substitutedamino-1,2-dihydro-s-triazin-6-yl)-amino-6-substitutedamino-1,2-dihydro-s-triazine (2). The compound (2) have been assigned structure on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.

Where, $R = \text{phenyl, } p\text{-chlorophenyl, } p\text{-tolyl, ethyl, methyl, } t\text{-butyl}$  
$R_1 = \text{phenyl, } p\text{-chlorophenyl, ethyl, } t\text{-butyl}$
Object of Present Work

\[ R-N\begin{array}{c} \text{C} \end{array} \text{C-NH-C} \begin{array}{c} \text{C} \end{array} \text{C-NH-R'} \]

\[ \begin{array}{c} \text{S} \\ N \end{array} \text{N} \begin{array}{c} \text{C} \end{array} \text{C} \begin{array}{c} \text{C} \end{array} \text{N} \begin{array}{c} \text{C} \end{array} \text{C} \begin{array}{c} \text{C} \end{array} \text{N} \begin{array}{c} \text{C} \end{array} \text{C} \begin{array}{c} \text{C} \end{array} \text{R} \quad (1) \]

Isomerisation \[ \rightarrow \] Aqueous ethanolic sodium bicarbonate

\[ R-N\begin{array}{c} \text{C} \end{array} \text{C-NH-C} \begin{array}{c} \text{C} \end{array} \text{C-NH-R'} \]

\[ \begin{array}{c} \text{S} \\ R_1 \end{array} \text{N} \begin{array}{c} \text{C} \end{array} \text{C} \begin{array}{c} \text{C} \end{array} \text{N} \begin{array}{c} \text{C} \end{array} \text{C} \begin{array}{c} \text{C} \end{array} \text{N} \begin{array}{c} \text{C} \end{array} \text{C} \begin{array}{c} \text{C} \end{array} \text{R} \quad (2) \]

Where, \( R = \) phenyl, \( p \)-chlorophenyl, \( p \)-tolyl, ethyl, methyl, \( t \)-butyl
\( R_1 = \) phenyl; \( R' = \) phenyl, allyl

Section - B :-

(i) Synthesis of 1-substituted-(2H)-2-thio-4-(3-substituted-thiocarbamido-1-yl)-6-(2-imino-4-thio-5-substituted biureto-1-yl)-1,2-dihydro-s-triazine (2).

This class gives detail information of isomerisation of 2-(2-imino-4-thio-5-substitutedbiureto-1-yl)-4-(3-substitutedthiocarbamido-1-yl)-6-substitutedimino-1,3,5-thiadiazine (1) on boiling for 2 hrs into aqueous ethanolic sodium bicarbonate solution to isomerise into 1-substituted-(2H)-2-thio-4-(3-substitutedthiocarbamido-1-yl)-6-(2-imino-4-thio-5-substitutedbiureto-1-yl)-1,2-dihydro-s-triazine (2). The compound (2) have been assigned structure on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Object of Present Work

$R\text{-NH-C-NH-C^-N-C-NH-C-NH-R}^{\text{S-N}}$

(1)

Isomerisation $\xrightarrow{\text{Aqueous ethanolic sodium bicarbonate}}$

$R\text{-NH-C-NH-C^-N-C-NH-C-NH-R}^{\text{S-N-R_1}}$

(2)

Where, $R =$ phenyl, $p$-chlorophenyl, $p$-tolyl, ethyl, methyl, $t$-butyl

$R_1 =$ phenyl, $p$-chlorophenyl, ethyl

(ii) **Synthesis of 1,3-Bis-(1-substituted-2-thio-(1H)-6-substituted amino-1,2-dihydro-s-triazin-4-yl) thiocarbamide (2).**

This class explores detail information of the isomerisation of 1,3-Bis-(2-substitutedamino-6-substitutedimino-1,3,5-thiadiaz-4-yl) thiocarbamide (1) on boiling for 2 hrs into aqueous ethanolic sodium bicarbonate solution to isomerise into 1,3-Bis-(1-substituted-2-thio-(1H)-6-substitutedamino-1,2-dihydro-1,3,5-triazin-4-yl) thiocarbamide (2). The compound (2) have been assigned structure on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.
Object of Present Work

Section-C :- Synthesis of 1-substituted-2-thio(1H)-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedamino-1,2-dihydro-s-triazines (2).

This section explores the isomerisation of 2-substitutedamino-4-(1-substitutedthiocarbamido-3-yl)-6-substitutedimino-1,3,5-thiadiazine (1) on boiling for 2 hrs on water bath in presence of aqueous ethanolic sodium bicarbonate solution to isomerise into 1-substituted-2-thio(1H)-4-(1-substituted thiocarbamido-3-yl)-6-substitutedamino-1,2-dihydro-s-triazine (2). The compound (2) have been assigned structure on the basis of chemical characteristics, elemental analysis, IR and NMR spectral data.

Where, R = phenyl, p-chlorophenyl, p-tolyl, ethyl, methyl, t-butyl
R₁ = phenyl, p-chlorophenyl, ethyl
Object of Present Work

\[
\begin{align*}
R-\text{NH} & \text{C} & \equiv & \text{N} - \text{C-} & \text{NH} - & \text{C-NH-R} \\
\text{S} & \text{S} & \text{N} - R_1
\end{align*}
\]

(1)

Isomerisation \[\text{Aqueous ethanolic sodium bicarbonate}\]

\[
\begin{align*}
R-\text{NH} & \text{C} & \equiv & \text{N} - \text{C-} & \text{NH} - & \text{C-NH-R} \\
R_1 & \text{N} & \text{C} & \text{N} & \text{S}
\end{align*}
\]

(2)

Where, \(R = \text{phenyl}, \ p\text{-chlorophenyl}, \ p\text{-tolyl}, \ \text{ethyl}, \ \text{methyl}, \ t\text{-butyl}\)
\(R_1 = \text{phenyl}, \ p\text{-chlorophenyl}, \ \text{ethyl}\)

Chapter - 6 : Antimicrobial Activity.

This chapter is an account of the antimicrobial activity of the newly synthesised compounds in Chapter 1 to 5.

These compounds were screened for their antibacterial activity using agar well diffusion method. The bacterial organisms used includes both gram positive and gram negative strains like \(S. \text{aureus}, \ S. \text{typhi}, \ A. \text{aerogenes}, \ E. \text{coli} \) and \(B. \text{subtilis} \).