



**SYNTHESIS AND CHARACTERIZATION OF SUBSTITUTED  
THIOCARBAMIDE AND FORMAMIDINE BY REDUCTIVE  
DESULFURIZATION**

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**Abstract:**

It is found that the reaction of aryl isothiocyanate and o-phenylene diamine in chloroform (CHCl<sub>3</sub>) gives thiocarbamide<sup>1</sup>. Thiocarbamide may also be prepared in good yield in the reaction of Benzene-1,2-Diamine and 1-Isothiocyanato-2-methyl-benzene in toluene solvent. Whereas it is also reported an efficient FeCl<sub>3</sub> catalyzed synthesis of N,N'-Diaryl formamidines<sup>2</sup>. Formamidines may also be prepared by reflux 1-o-Tolyl-3-[2-(3-o-tolyl-thioureido)-phenyl]-thiocarbamide with Raney-Ni which carries reductive desulfurization of thiocarbamide. The formamidines, a relatively new group of acaricide – insecticides are useful as they show range of biological activities. They are toxic to spider, mites, ticks, certain insects and juvenile and resistant forms of these organisms.

**Keywords :** OEt, DMSO, THF, Toluene.

**Introduction:**

The conversion of an amine to formamide by elimination of the Sulphur atom and an adjoining hydrogen atom is a useful procedure for degradation and synthesis. The Hofmann exhaustive methylation method has been used most often to bring about change, but other methods as the thermal decomposition of amine oxides and the pyrolysis of amine phosphates or acetyl or benzoyl derivative have often been employed<sup>3</sup>. Formamidines are an important class of compounds which are of interest in synthetic chemistry and have been used extensively as pesticides (viz., amitraz, chlordimeform, formetanate), the current value of which are found in the control of carbamate-resistant pests and as pharmacological agents. The reported biochemical targets of formamidines include adrenergic, histamine, neurochemical receptors; monoamine oxidase and prostaglandin E<sub>2</sub> synthesis<sup>4</sup>. Their use as ligands in transition metal complexes has also been noted<sup>5</sup>. The uses of formamidines in organic synthesis have been quite diversified, including such roles as auxiliaries in asymmetric synthesis, protecting groups for primary amines, electrophiles and support linkers in solid phase synthesis<sup>6</sup>. Beside these, formamidines have been used as Antimalarial, anti-cancer & antitumor agents, antifungal agents, anti-inflammatory, anti-edema, anti-hypersensitive,

UV light absorbers, and in many other ways<sup>7</sup>. Reductive desulfurization is an important step in organic synthesis for the removal of sulfur so as to manipulate the structure of the substrate<sup>8</sup>. A variety of reagents have been used for the desulfurization of different classes of organic compounds<sup>9</sup>. Desulfurization of thioureas with reagents such as MeSO<sub>2</sub>Cl–Et<sub>3</sub>N/DMAP, NBS, thionyl chloride, di (2-pyridyl) sulfite and di-2-pyridylthionocarbonate–DMAP is reported to give mono- and diarylcarbodimides<sup>10</sup>. Raney nickel has also been reported as a dethiating agent for thioureas; it has been reported as dethiating agents for 2-thiobarbiturates, the yields range from high to moderate<sup>11</sup>. Raney Nickel has distinct advantage over other desulphurating reagents. The aromatic rings, acids, nitriles, esters etc. are found mostly undisturbed while the related sulphur compounds are desulphurate<sup>12</sup>.

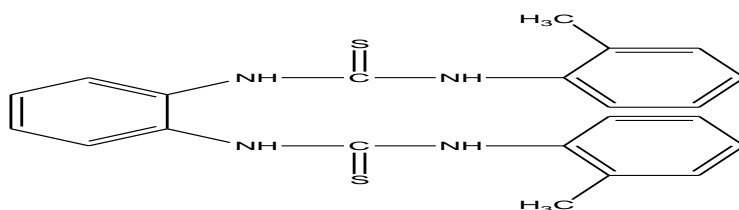
**Experimental : Materials and Reagents -  
Preparation of Substituted Ph-NCS :**

In a 500 ml RBF Take 2:1 pure conc. Ammonia and add pure Carbon disulfide and add in a slot of 1 ml substituted aniline with continuous shaking at 4<sup>o</sup> c to 5<sup>o</sup> c till the solid ppt is formed. Filter the mixture through buckner funnel and dry it 2 Hrs. After drying a carbamate weigh it. take a 1:2 ratio lead nitrate ( dissolved in distilled water ) in a 500 ml RBF take dried carbamate and lead nitrate add distilled water if

necessary, assemble the distillation assembly and distilled the solution and collect the oily droplets in conical flask containing distilled water and 2-4 drops of cons.  $H_2SO_4$ . Store the substituted Ph-NCS in a ambered color bottle containing fused Calcium Chloride. *N*-Substituted Thiocarbamide was to be synthesized by taking 1:2 ratio substituted amine and Ph-NCS boil the mixture with Toluene as a solvent in RBF at about 2 hrs. reaction monitored by TLC. *N*-Substituted Formamidine was to be synthesized by taking *N*-Substituted Thiocarbamide and reflux it hot magnetic stirrer with Raney-Nickel, reductive desulfurization takes place and *N*-Substituted Formamidine is formed.

**Preparation of 1-Isothiocyano-2-methylbenzene :** Equip a 500-ml three-necked flask with a powerful mechanical stirrer and a separatory funnel; leave the third neck open or loosely stoppered. Introduce, while the flask is

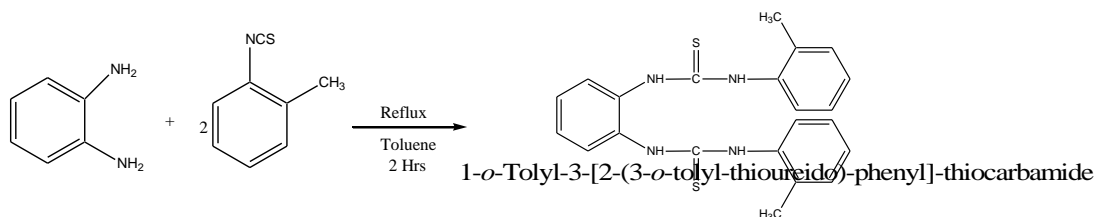
cooled in a freezing mixture of ice and salt, 90 ml of concentrated ammonia solution (d 0.88) and 54g (43 ml, 0.71mol) of pure carbon disulphide . Stir the mixture and run in 56 g 55ml, 0.60 mol) of *o*-Tolylamine from the separatory funnel during about 20 minutes stir for a further 30 minutes, and allow to stand for another 30 minutes. A heavy precipitate of ammonium phenyldithiocarbamate separates. Transfer the salt to round bottomed flask by four extractions with 200 ml portions of water. Add to the resulting solution, with constant stirring a solution of 200 g (0.605 mol) of lead nitrate in 400 ml of water, lead sulphide precipitates. Steam distilled the mixture into a receiver containing 10 ml of conc. 0.5M sulphuric acid as long as organic material passes over. Separate the oil, dry it over anhydrous calcium chloride or magnesium sulphate and stored in air amber colored bottle.

1-*o*-Tolyl-3-[2-(3-

### Synthesis of *o*-tolyl-thioureido)-phenyl]-thiocarbamide :

1-*o*-Tolyl-3-[2-(3-*o*-tolyl-thioureido)-phenyl]-thiocarbamide was to be synthesized by interaction of *o*-Tolylphenyl Isothiocyanate and Benzene-1,2-diamine in toluene medium was

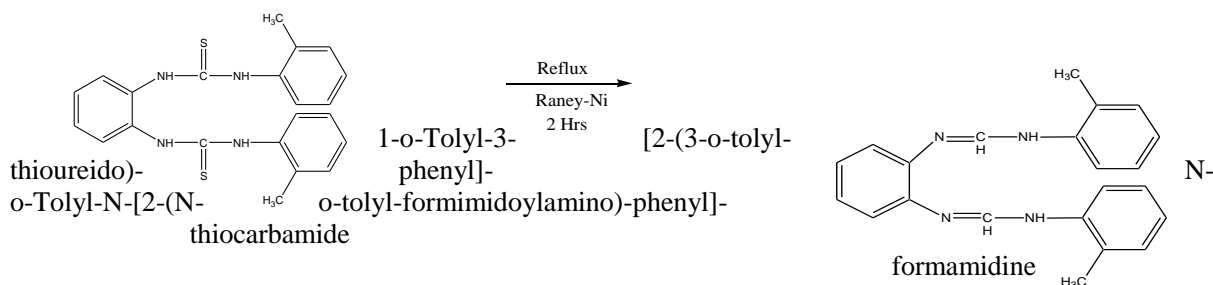
refluxed for 2 hrs to get the solid product, the reaction monitored by TLC. toluene was distilled off. Product was crystallize by ethanol.



### Synthesis of *N*-*o*-Tolyl-*N*'-[2-(*N*'-*o*-tolyl-formimidoylamino)-phenyl] formamidine :

*N*-*o*-Tolyl-*N*'-[2-(*N*'-*o*-tolyl-formimidoylamino)-phenyl]formamidine was synthesized by carried out reductive desulfurization of 1-Isothiocyano-2-methylbenzene by activated Raney-Nickel in toluene

medium, which was refluxed for 2 hrs, the reaction was monitored by TLC. toluene was distilled off to get the solid product which was crystallize by ethanol.



**Examination of the product :**

1.Melting point: Melting points of newly synthesized compounds have been studied by using digital melting point apparatus. The compound has m. p. 95-96<sup>0</sup>C.

2.Molecular formula: The elemental analysis assigned the molecular formula: C<sub>22</sub>H<sub>22</sub>N<sub>4</sub>.

3.Molecular weight: 342.43

4.Solubility: The solubility of the compounds was checked in alcohol, acetone, toluene, benzene, chloroform, carbon tetrachloride and ethyl acetate.

5.Action of alkaline plumbite solution: It was non desulfurisable when boiled with alkaline plumbite solution.

6.TLC: The purity of the product was checked by TLC. TLC studies indicate R<sub>f</sub> Value 0.87 in acetone as eluent.

7.The compound is yellowish coloured crystalline solid.

8.IR: [ IR plate no.-1 ] 3050 cm<sup>-1</sup> aromatic, 2360 cm<sup>-1</sup> N-C str, 1701 cm<sup>-1</sup> Ar-C str, 1595 cm<sup>-1</sup> C=N str.

9. PMR : [ PMR plate no.-1 ] δ 7.44 -7.87 m; 1H aromatic; δ 3.42s, 2H CH<sub>2</sub> proton; δ 2.19 s, 3H CH<sub>3</sub> proton

**Result and Discussion :**

It was demonstrated that the reductive desulfurization of thiocarbamides successful due to immediate reclosure the original structure as evidenced by the fact that both the isothiocyanate and thiocarbamide are literally reactive. Formamidines are prepared by condensation of isothiocyanate and substituted amine obtain thiocarbamide which on reductive desulfurize by Raney-Ni to give the formamidines compounds and identified by melting point, IR, NMR and mass spectrum. Urea, thiourea and thiocarbamides derivatives play a vital role in the field of medicinal chemistry by regulating various pharmacological activities. Literature survey reveals that urea and thiourea derivatives showed broad spectrum of biological activities anti-HIV, antiviral, antibacterial, analgesic properties and also act as corrosion inhibitor and antioxidant and also they are polymer component.

**Conclusion :**

In conclusion, a synthetic route for the synthesis of *N*-*o*-Tolyl-N'-[2-(N'-*o*-tolyl-formimidoylamino)-phenyl] formamidines has been successfully presented. The synthesized compound were evaluated on the basis of <sup>1</sup>H NMR and IR spectral and elemental analysis. Thus, the adopted methodology in the present investigation is simple, efficient and inexpensive

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and has useful application in the synthesis of pharmacologically important molecules.

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