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Short Communication

Eco-Friendly Synthesize and Biological Evaluation of 2-Amino-5-substituted-1,3,4-thiadiazoles

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Abstract

In the present work, we synthesized the 2-amino-5-substituted-1,3,4-thiadiazole moiety and its different derivatives. The preparation of above 1,3,4-thiadiazole involves cyclisation of aromatic acid with thiosemicarbazide in presence of few drops of $POCl_3$ as dehydrating agent. The derivatives, mostly Schiff' bases, were synthesized using 'Green Chemistry' approach. The reactions are simple one step reactions.The purity of derivatives confirmed by Thin Layer Chromatography. IR spectra was recorded on FT-IR SHIMADAZU, and X-ray Diffraction by RIGAKUMINIFLEXII. The synthesized compounds were tested for their antimicrobial activity against three microorganisms namely E-coli, S. Aureus and P. Seudomonas, and the minimum inhibitory concentrations (MICs) of the tested compounds were determined by the dilution method using Ampicillin, Chloramphenicol, Tetrecyclin.

Keywords: 1, 3, 4-thiadiazole, Synthesis, Antibacterial, Antifungal activities.

Introduction

Heterocyclic[1] are very important in biological activity and in industries[2]. One such important heterocyclic ring is 1, 3, 4-thiadiazole ring. It is a 5-membered heterocyclic ring in which nitrogen are at 3rd and 4th position and the sulphur is at 1st position.

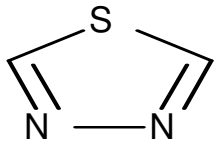


Figure-1
General structure of 1,3,4,-thiadiazole

1, 3, 4-thiadiazole and its derivatives are widely applied in medicine[3] and agriculture[4] as pesticides[5].

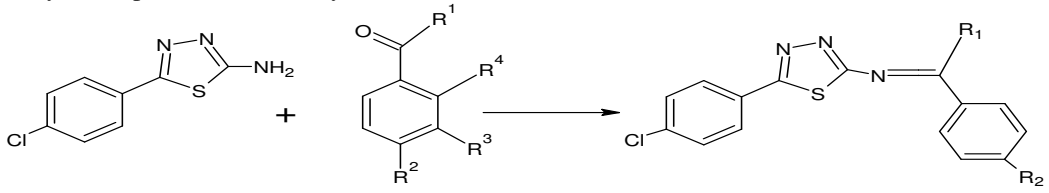
Nowadays, the research field dealing with Schiff base coordinationchemistry has expanded enormously[6].

Schiff bases resulted from aromatic aldehydes. Schiff bases have been reported in their biological properties, such as, antibacterial[7], antifungal activities[8-10].

Experimental data: In experimental study the melting point were taken in capillary tube at a room temperature which are incorrected. All derivatives are pure by crystallization process and the purity of derivatives confirmed by TLC. Using solvent system of Glacial acetic acid and Ethylacetate 1:1 ratio using iodine as a visualizing agent. FT-IR (SHIMADAZU), X-ray Diffraction- RIGAKUMINIFLEXII,

Methodology

General method for synthesis of Schiff bases from Mas131 to Mas135: A mixture of substituted thiadiazole and substituted aromatic aldehyde in glacial acetic acid was refluxed for two hours, cooled and poured cold water with stirring till precipitation was complete.



Where R^1 = H, CH_3 R^2 = Cl , -$N(CH_3)_2$, H R^3 = NO_2,H R^4 = OH,H

Scheme-1
General method for synthesis of Schiff bases

Results and Discussion

The data of physical properties of synthesized Schiff bases are given in Table-1. All compounds are studied by IR, NMR, Mass spectrometry, X-ray diffraction.

Characterization- FT-IR Spectra in cm^{-1}: Mas 131-1662.64(C=N bond), 1595.13(N-H bend), 1438.90(C-H bend), 812.03(para substitution), 729.09(C-Cl bond). Mas 132 - 3736.12 (-OH bond), 3088.03(C-H stretch), 831.32 (meta substitution-OH), 669.30(C-Cl stretch). Mas 134 - 3282.84(N-H stretch), 1508.33(Ar C=C stretch), 775.38(C-Cl stretch)

H^1NMR (DMSO, 400MH),: 7.3 (d. 1H, J=7.31), 7.5 (d, 1H, J=7.48), 7.9 (d,1H, J=7.93) 6.8 (s, J=6.83).

Table-1
Characterization

Sr no.	Molecular formula	M. Pt. ^{0}C	R1	R2	R3	R4	Yield (%)	Mol.wtgm/mole
S1	$C_8H_6N_3SCl$	128						221.5
Mas131	$C_{17}H_{14}N_4SCl$	90	H	$N(CH3)_2$	H	H	25	341.5
Mas132	$C_{15}H_9N_3SClO$	219	H	H	H	OH	20	314.5
Mas133	$C_{15}H_8N_3SCl_2$	160	H	Cl	H	H	30	333
Mas134	$C_{15}H_8N_4SClO_2$	110	H	H	NO_2	H	20	333
Mas135	$C_{16}H_{12}N_3SClO$	180	CH_3	H	H	OH	35	343.5

Table-2
Crystal data and structure refinement for SA1 Molecule

Empirical formula	C6H8NCl
Temperature	293K
Formula weight	179.2
Crystal system	Centro symmetric
Unit cell dimensions	a = 9.3, b = 7.25A˚, 91.5^0,c = 11.0A˚

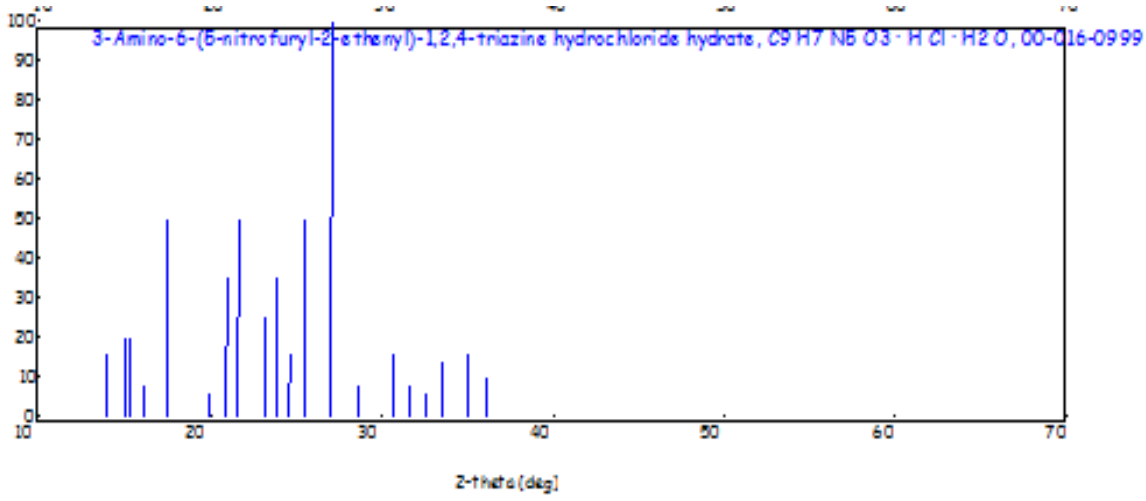


Figure-2
Characterization of X-ray diffraction

Table-3
Biological assay: Antibacterial study of Schiff base

Sr.No.	*S.aureus*	*P.Seudomonas*	*E. coli*
S1	15	17	15
Mas1	19	16	19
Mas2	15	16	19
Mas3	17	13	20

Conclusion

An environmental benign method was adopted to synthesize thiadiazole and its derivatives. The method is economical and very efficient[9]. The yield is quite high with good purity of the molecules. The molecules have good anti-microbial activity[10].

In the present work, various derivatives of 1,3,4-thiadiazole were synthesized by using aromatic carboxylic acid as starting material with moderate to good yield. The method is atom economic, easy and efficient and eco –friendly. The method has advantages of cheaper chemicals and safely too. The method has additional advantage of easy work up and the compounds are obtained in high purity without any tedious separation. Thus, the method has good number of advantages. The Rf values, determined for two molecules viz. compound number 1 and its derivatives, are close to 0.5. The structure confirmed by the FT-IR spectroscopy and X-ray diffraction studies gives the crystalline nature of the compounds.

The biological assay indicates high antimicrobial activity against *E. coli*, *S. Aureus* and *P. Seudomonas*[5]. For some compounds the activity is better than the reference drugs. This indicates that the molecules are good candidates for lead optimization.

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