Synthesis of New Compounds Containing 1,3,4-Thiadiazole Ring and Study of Biological Activity

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Abstract
This work employed closure, binding, Schiff base, and azetidine synthesis processes to produce novel 1,3,4-thiadiazole compounds.First, chloroacetyl chloride and 1,4-phenylenediamine were combined with triethylamine. AM was formed.The second phase involves thiosemicarbazide, para-hydroxybenzoic acid, $POCl_3$, KOH, and BM.Third, AM and BM were reacted with potassium hydroxide and 100% ethanol to form CM.Fourth step: CM reacts with aromatic aldehydes in ethanol and glacial acetic acid to form Schiff base compounds (DM1-10)Fifth, dissolve DM in dioxane, add TEA, and produce beta-lactam molecules (EM1–10).FT IR analysed all chemicals. Melting points and $^{-1}$HNMR and ^{13}C-NMR spectra were used to diagnose and quantify substances. Some of the produced compounds were also tested with three species of bacteria.
Keywords: B-lactam, compounds, biological activity

1. Introduction

They're cyclic organic compounds with many different atom kinds. Common atoms include nitrogen, sulphur, oxygen, hydrogen, and carbon. Silicon (1), arsenic, phosphorus, boron, antimony, and germanium are rare in rings (2). These organic compounds are used in medicine and business. These compounds' ring structures include O, N, and S atoms. Compounds containing five or six rings are essential. These molecules include pyridine, pyrrole, furan, and thiophene (3). Based on their chemical structure, heterocyclic compounds may be aromatic, like oxazole thiadiazoles, or aliphatic, like pyrrolidine and 4-tetrahydrofuran. 1,3,4-thiadiazole, pyrrolidine, tetrahydrofuran) (4). Figure (1-1)

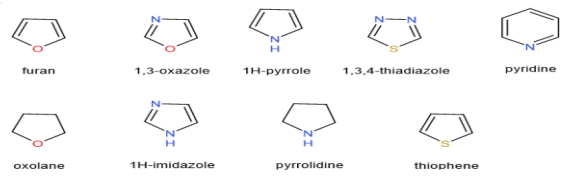

Figure (1-1) Some heterogeneous rings

In 1882, Emil Fischer discovered thiadiazole-1,3,4. Most 1,3,4 It's a thermally stable isomer whose stability is governed by the electron density in C2 and C5, which relies on G-compensators (5). Alkyl and aryl modifications increase 4,3,1-thiadiazole stability. Both hydroxy-1,3,4-thiadiazole, 2-mercapto-1,3,4-thiadiazole-2, and aminothiadiazole-2 have two tautomeric forms, and each is typically found in the keto form (I). The thiol/hydroxyl function is always removed by chemical processes (6),

Experimental

Were obtained from BDH, Aldric and, Fluka, Merck all starting chemical Spectra of FT-IR were obtained in KBr pellets from (FT-IR 8300) Shimadzu spectrophotometer in the range 4000-400 (cm^{-1}) region. All the reactions were followed by the TLC using silica plates and visualising by Ultraviolet at 254 (nm), potassium permanganate chamber was used for staining.

2. Results and Discussion

Preparation and characterisation of compound [7,8] AM.

1,4-Phenylenediamine in DMF with TEA and chloroacetyl. 3-hours later, N,N-(1,4-phenylene) bis(2chloroacetamide) was made. The compounds (AM) were characterised using FT-IR spectroscopy by the presence of bands at (3263) cm -1 related to N-H, (3170-3093) cm-1 related to C-H aromatic rings, and (2947-2891) cm-1 linked to C-H aliphatic group asymmetric and symmetric stretching vibrations. At 1674 cm-1, acetamide's carbonyl groups (C=O) emerged. (C-N) groups occurred at 1589 cm-1, and (C=C) aromatics at 1511-1410 cm-1.

Preparation and characterisation of compound[9] BM

2-Amino-5-(substituted phenyl)-1,3,4-thiadiazole is produced. Dropwise phosphorus oxychloride was introduced to ice-cold para hydroxybenzoic acid derivatives and thiosemicarbazide while stirring. Characterizing BM.Using F.T-IR spectroscopy to identify NH2 asymmetric and symmetric stretching vibrations. C-H aromatic rings are at 2989 cm-1. The (C=N) cyclic and (C=C) aromatic emerged at 1620 cm-1. (1527) -1 cm

synthesis and characterisation[10] CM

AM was dissolved in 100% ethanol. After cooling, 2-Amino-5-(substituted phenyl)-1,3,4-thiadiazole is added (BM). Mixture was stirred and refluxed in an ice bath. Characterized by a band at (3261-3178) cm-1 associated to NH2 asymmetric and symmetric stretching vibrations. C-H aromatic rings cause the 3086 cm-1 band. (C=N) cyclic groups emerged at (1597) cm, (C=O) groups at (1674) cm, and (C=C)

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aromatic groups at (1519) cm.

Table 1 : FT-IR for (DM1-10)					
Comp. No.	Characteristic stretching bands of FT-IR (cm^{-1}, KBr disc)				
	N-H	Ar.C-H	C=O	C=N	Ar.C=C
DM1	3260,3170	30876	1666	1589	1512
DM2	3254,3164	30965	1676	1586	1510
DM3	3248,3158	30904	1656	1565	1518
DM4	3242,3152	30898	1674	1576	1520
DM5	3245,3155	30874	1671	1569	1511
DM	3253,3163	30955	1669	1574	1518
DM7	3254,3164	30909	1643	1585	1507
DM8	3262,3172	30959	1680	1580	1519
DM9	3248,3154	30984	1698	1583	1503
DM10	3255,3162	30921	1679	1579	1514

Compound synthesis/characterization (EM1–10).(24)

synthesising beta-lactam (EM1-10) Schiff bases, D.M 1-10, and triethylamine were dissolved in 1,4-Dioxin, and chloroacetyl chloride was added dropwise. The compound (EM1) infrared spectrum showed absorption packs at (3260) cm-1 belonging to the (NH) symmetrical and asymmetric stretch, an absorption pack at (3089 cm-1) belonging to the C-H aromatic band stretch, the (N=C-H) showed absorption packs at(3270 cm-1) while the frequency of the (C-N)appears at (1389 cm-1) and two absorption packs belong to the (C=C)aromatic beam at As shown in Table(1-2), 1H-NMR analyses of compound (EM1) showed a peak at(4.66) belonging to (2H OF O-CH, a peak at (9.85) belonging to the N-H group, a peak at (5.08) belonging to the C-H group.in beta-lactam, and several peaks between (6.95-7.90) belonging to (18 H Aromatic) Table(1-3). 13C-NMR indicated that aromatic carbons at (160–170 ppm). Beta-carbonyl lactam's group is at (175.78–172.87 ppm). The carbonyl group of acetamide was between 169.03 and 165.56 ppm, the 1,3,4-thiadiazole ring was between 162.02 and 158.73 ppm, and the CH2 group was between 163.02 and 158.73 ppm (43.30-42.52 ppm). Figures (3-35), (3-36), and (3-37) show the 13C-NMR spectra for C1, C2, and C3 (337). Table(1-4)

Table 2: CNMR spectra						
Comp. No.	Characteristic stretching bands of 1H-CMR (cm^{-1}, KBr disc)					
	G-Ar-H	O-C-H	Ar.C-H	C-H beta	O-H	N-H
EM1	7.85\7.17	4.96	7.03\7.77.57	5.08\5.44	-	9.96
EM2	7.48	4.66	7.03\7.77.57	5.08\5.44	-	9.96
EM3	6.71\7.05	4.66	7.03\7.77.57	5.08\5.44	9.06	9.96
EM4	6.92\6.82\7	4.66	7.03\7.77.57	5.08\5.44	9.29	9.96
EM5	8.18\7.58	4.66	7.03\7.77.57	5.08\5.44	-	9.96
EM	8.53\6.5\6.39	4.66	7.03\7.77.57	5.08\5.44	9.45	9.96
EM7	7.44\7.52\7.11	4.66	10.36\7.03\7.77.57	5.08\5.44	9.68	9.96
EM8	6.48\373	4.66	7.03\7.77.57	5.08\5.44	8.73	9.96
EM9	6.68	4.66	7.03\7.77.57	5.08\5.44	8.7	5.27\9.96
EM10	7\8.5	4.66	7.03\7.77.57	5.08\5.44	6	9.96

Table 3: FT_IR spectra					
Comp.No.	Characteristic stretching bands of FT-IR (cm^{-1}, KBr disc)				
	N-H	Ar.C-H	C=O	C=N	Ar.C=C
EM_1	**3260,3170**	**30876**	**1812**	**1589**	**1512**
EM_2	**3254,3164**	**30965**	**1801**	**1586**	**1510**
EM_3	**3248,3158**	**30904**	**1789**	**1565**	**1518**
EM4	3242,3152	30898	1723	1576	1520
EM5	3245,3155	30874	1803	1569	1511
EM6	3253,3163	30955	1787	1574	1518
EM7	3254,3164	30909	1821	1585	1507
EM8	3262,3172	30959	1800	1580	1519
EM9	3248,3154	30984	1832	1583	1503
EM10	3255,3162	30921	1797	1579	1514

Table 4: Biological activity								
Comp. No.	Characteristic stretching bands of 13C-NMR(cm^{-1}, KBr disc)							
	G-CAr	C amide	C-N Bta	C-CL Bta	N-C=N thio	C=N thio	N-C=O	Ar-C
EM1	**121-145**	**162**	**160-174**	**62**	**163**	**174**	**167**	**114-158**
EM2	**132-145**	**162**	**160-174**	**62**	**163**	**174**	**167**	**114-158**
EM3	**156-115**	**162**	**163-174**	**62**	**163**	**174**	**167**	**114-158**
EM4	**156-112**	**162**	**163-174**	**62**	**163**	**174**	**167**	**114-158**
EM5	**120-150**	**162**	**163-174**	**62**	**163**	**174**	**167**	**114-158**
EM	**100-165**	**162**	**163-174**	**62**	**163**	**174**	**167**	**114-158**
EM7	**120-155**	**162**	**163-174**	**62**	**163**	**174**	**167**	**114-158**
EM8	**100-149**	**162**	**163-174**	**56**	**163**	**174**	**167**	**114-158**
EM9	**115-140**	**162**	**163-174**	**56**	**163**	**174**	**167**	**114-158**
EM10	**115-158**	**162**	**163-174**	**56**	**163**	**174**	**167**	**114-158**

	S. aureus		*S. pneumonia*		*E. coli*		*K. pneumonia*	
Con.	50	100	50	100	50	100	50	100
E5	22 mm	24 mm	R	R	R	R	R	15 mm
SMX	R	R	R	R	R	R	R	R
SMX	25 mm	25 mm	R	R	R	15 mm	R	15mm
E1	22 mm	24 mm	R	R	R	R	R	14 mm
E2	23 mm	23 mm	R	11 mm	R	R	R	14 mm
E7	20 mm	23 mm	R	11 mm	R	12 mm	R	14 mm
E10	23 mm	23 mm	R	11 mm	R	14 mm	R	14 mm
R= resist. *S. aureus*								

synthesis/characterization Compound [11] (DM1-10)

CM reacts with aromatic aldehydes to form Schiff base compounds (DM1-10). Infrared spectrum (DM1). Absorption packs at (3260) cm-1 belong to the symmetrical and asymmetric stretch of the (NH group), whereas absorption packs at (3089 cm-1) belong to the C-H aromatic band stretch. (1589 cm 1) and two absorption packs. (C=C) aromatic beam (1512, cm 1) Table (1)

When the bioactivities of some prepared compounds were tested in 100 and 50, it was clear that compounds E5, E1, E2, E7, and E10 were very good at killing this type of bacteria. Different effects could be caused by the type and location of the compensated grubs as well as the chemical structure of the compound.

S. pneumonia

In the bacteria, the bioactivities of some prepared compounds were tested in 50. All the compounds were resisted, but 100, E5, and E1 were good at killing this type of bacteria Depending on the type and location of the compensated grubs and the chemical structure of the compound, it could have different effects.

E. coli

When the bioactivities of some prepared compounds were tested in 100, it was clear that compounds E7, and E10 were good at killing this type of bacteria. and in other concentrations showed weak to non-effectiveness, Different effects could be caused by the type and location of the compensated grubs as well as the chemical structure of the compound.

K. pneumonia

In the bacteria, the bioactivities of some prepared compounds were tested in 50. All the compounds were resisted, but in 100, E5, E1, E2, E7 and E10 were good at killing this type of bacteria Depending on the type and location of the compensated grubs and the chemical structure of the compound, it could have different effects.

Referecnes

ALjama & N. Heterocyclic Compounds. (J. Plast. Polym. Technol, 2015).

Quin & A., J. FQuin, & A., J. (2010). Fundamentals of heterocyclic chemistry: importance in nature and in the synthesis of pharmaceuticals. John Wiley Sons.undamentals of heterocyclic chemistry: importance in nature and in the synthesis of pharmaceuticals. (John Wiley Sons, 2010).

Kunied, T. & H. Mutsanga. The chemistry of heterocyclic compounds. 175 (Palmer, 2002).

Li & J, J. Heterocyclic chemistry in drug discovery. (John Wiley Sons, 2013)

Babu, Selvakumar, I. and & S. Synthesis and spectral characterization of some 2-((1-((substituted phenylamino) methyl)-1-benzoimidazol-2 yl) alkyl) isoindoline-1,3-diones for in-vitro anthelmintic screening. Der. Pharma. Chem. 198-206. (2013).

Jain, A. K., Sharma, S., Vaidya, A., Ravichandran, V. & Agrawal, R. K. 1,3,4-thiadiazole and its derivatives: A review on recent progress in biological activities. Chemical Biology and Drug Design vol. 81 557 576 (2013).

Ibraheem, T. K., Karam, N. H., & Al-Dujaili, A. H. (2020). Synthesis and characterization of symmetrical liquid crystalline compounds based on oxazole and thaizole rings. Molecular Crystals and Liquid Crystals, 710(1), 1-12.

Ibraheem, T. K., Al-azawi, S. T. A., & Mohammed, A. (2019). Synthesis and anti-microbial screening of some substituted 1, 2, 3-triazole derivatives. Journal of Pharmaceutical Sciences and Research, 11(8), 2797-2801.

Tomi, I. H. R., Al-Daraji, A. H. R., Al-Qaysi, R. R. T., Hasson, M. M., & Al-Dulaimy, K. H. D. (2014). Synthesis, characterization and biological activities of some azo derivatives of aminothiadiazole derived from nicotinic and isonicotinic acids. Arabian Journal of Chemistry, 7(5), 687-694.

Mauf, R. M., Sultan, A. H., & Farag, A. (2014). Synthesis of Some new 2-(4-Aryliminophenoxy) N-Arylacetamide Via p-hydroxy benzaldehyde. Baghdad Science Journal, 11(2), 486-490.

Abdulridha, A. A., Allah, M. A. A. H., Makki, S. Q., Sert, Y., Salman, H. E., & Balakit, A. A. (2020). Corrosion inhibition of carbon steel in 1 M H2SO4 using new Azo Schiff compound: Electrochemical, gravimetric,adsorption, surface and DFT studies. Journal of Molecular Liquids, 315, 113690.

Adnan, S., Mohammed, A. J., & Thamer, H. (2015). Synthesis and identification of some derivatives of 1, 3, 4-thiadiazole. J Chem Pharm Res, 7(10), 1000-11.