Section A-Research paper
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An insight to the synthetic and medicinal aspects of thiadiazole scaffold

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ABSTRACT:

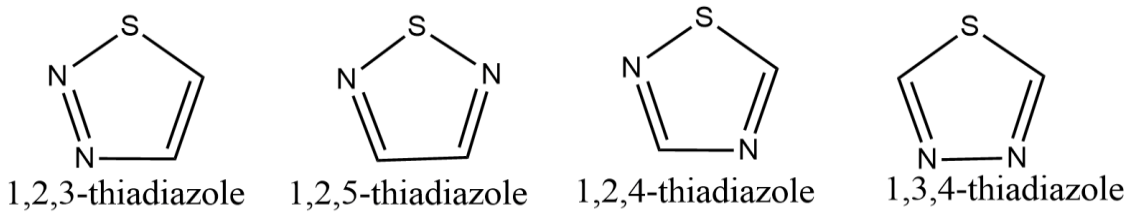
A great deal of research has been done on thiadiazole and its derivatives because of the wide range of biological activities they display. These medications work well as antibacterial, antimalarial, antiviral, anti-inflammatory, anti-cancer, and anti-anthelminthic agents. Antiviral capabilities have been connected to a variety of biological processes, including 1,3,4-thiadiazole's antibacterial and anti-inflammatory components. In the current study, an effort is undertaken to evaluate the structural alterations in this nucleus utilizing results from recent studies. A variety of thiadiazole compounds for various medicinal purposes. The recent synthesis of a thiadiazole with significant biological activity is the subject of the current review.

KEY WORDS: Thiadiazole, microwave assisted synthesis**,** medicinal

INTRODUCTION:

Thiadiazoles are heterocyclic five-membered aromatic compounds composed of two carbon atoms, two nitrogen atoms, and a sulfur atom that is, substituting the oxygen atom in oxadiazole with a sulfur atom

results in thiadiazole derivatives(1). A major concern on a global scale is the resistance to medicines that are currently available. One of the most crucial areas of study nowadays is the requirement to create novel chemicals to combat this resistance. Thiadiazole is a versatile moiety that presents broad several biological processes(2). The thiadiazole moiety functions as a "two-electron donor system" and a "hydrogen binding domain." Additionally, it serves as a restricted pharmacophore. There are several medications on the market that include the thiadiazole nucleus, including acetazolamide, methazolamide, sulfamethazole, etc(3). Researchers have examined these compounds and given importance to their creation since a number of compensators (4,3,1-thiaadiazole) have an applicable biological efficacy and an evident value in the medicinal and industrial domains(4). Figure 1 illustrates the several structural forms of thiadiazoles that result from the placement of heterogeneous atoms inside the five-member ring.



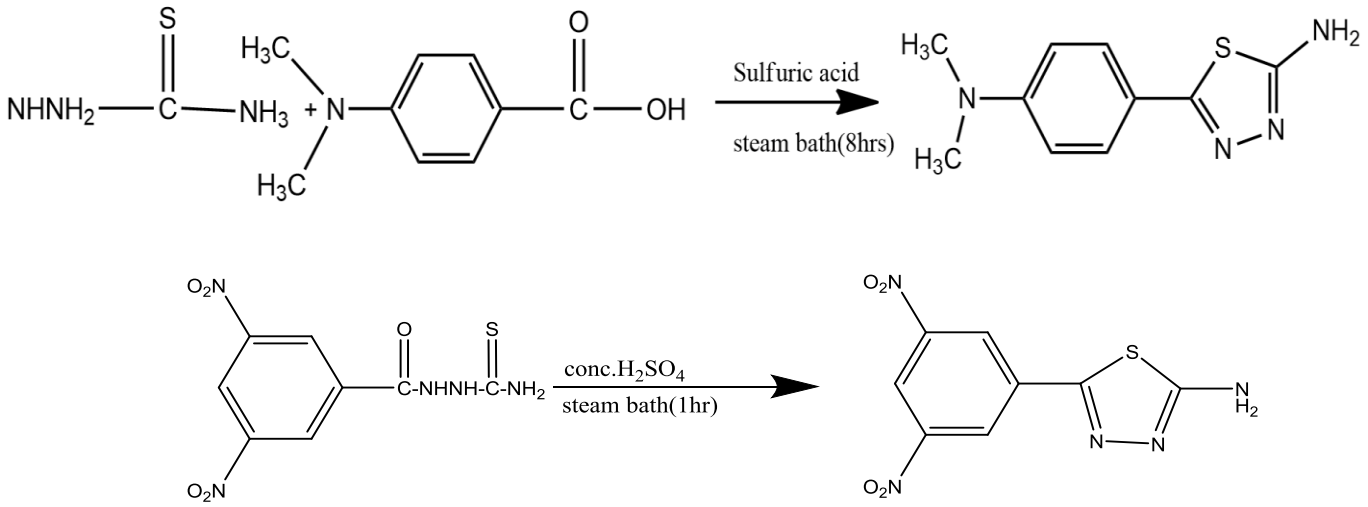
Different types of Thiadiazoles

Approaches for the preparation of Thiadiazoles:

Despite the fact that the compounds are poorly manufactured and of no particular use, pharmacology frequently encounters compounds with them as a structural theme. There are numerous methods for producing thiadiazole derivatives.

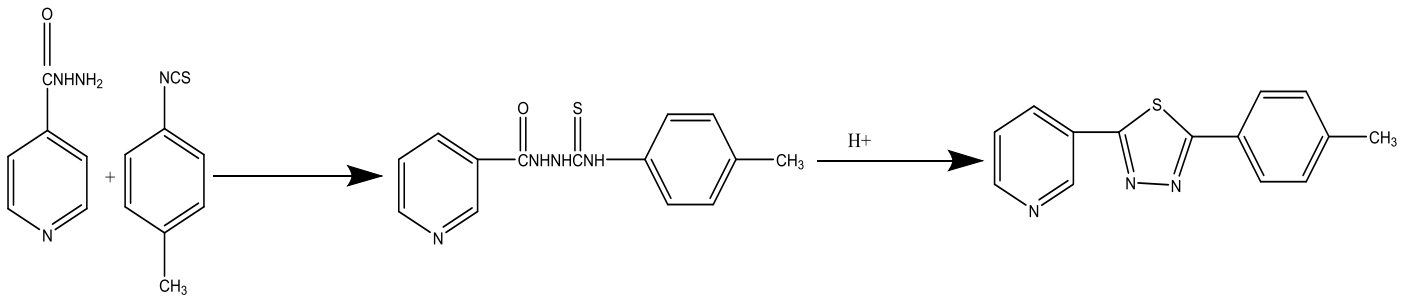
1. From condensation reaction:

In the presence of sulfuric acid, thiosemicarbazide condenses with carbonyl groups such as (carboxylic acid, ester, aldehyde), and then cycles with carboxyl groups (COOH) in an acid medium to produce thiadiazole derivatives as shown below.[2].

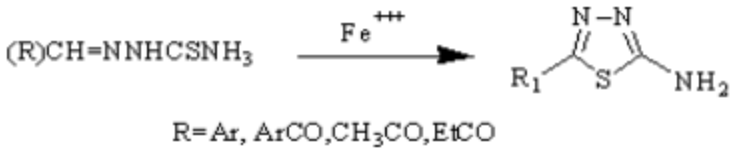


2. From condensation of hydrazo derivatives with thiocynate compounds:

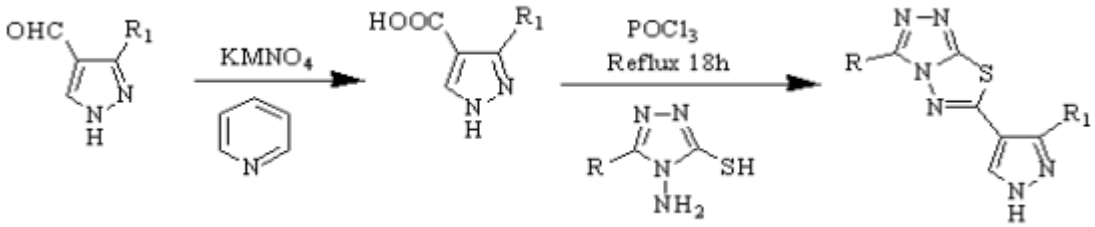
By using specific conditions and closure agents for this reaction, thiadiazole compounds are prepared when hydrazo-derivatives are condensed with thiocynate compounds in an acidic medium.



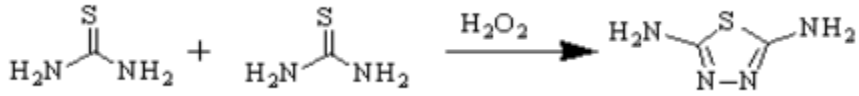
3. From Thiosemicarbazone [5]



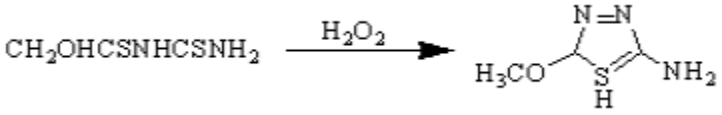
4. By using phosphorous oxychloride [6]



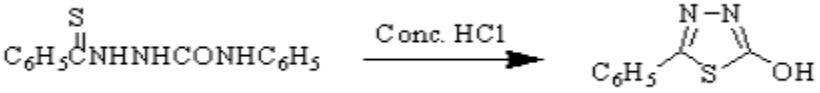
5. From bithioureas [7]



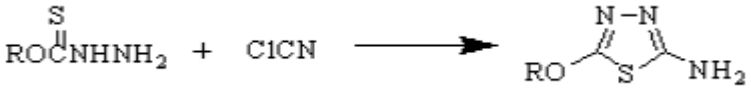
6..From Hydrazines [8]



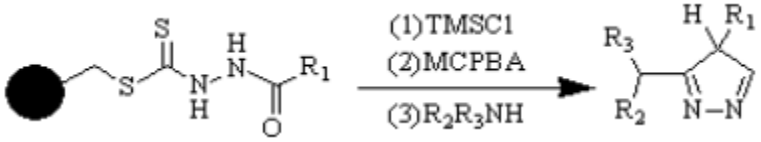
7. From semicarbazide [9]



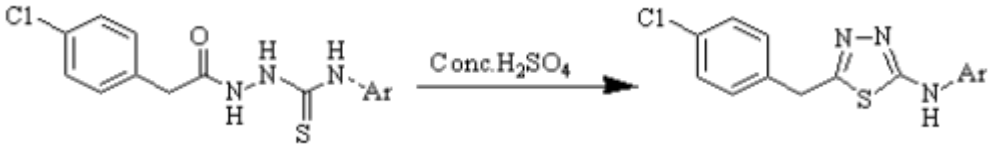
8. From thiosemicarbazate [10]



9. From Resin [11]



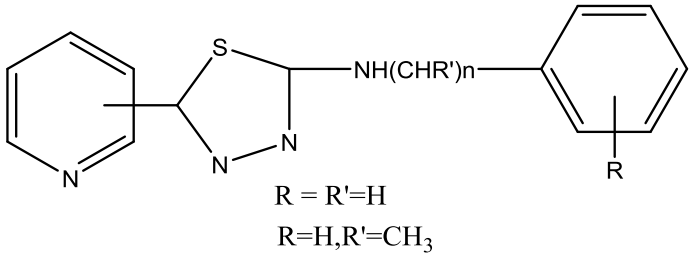
10. From thiosemicarbazide [12]



- **Various biological activities of thiadiazol & its derivatives:**

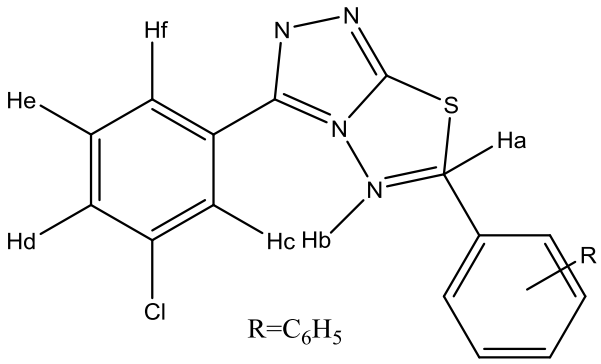
- **ANTIMICROBIAL ACTIVITY:**

Zamani *et al*. discovered that cyclization of matching thiosemicarbazides under acidic circumstances yielded many novel 2,5-disubstituted derivatives of 1,3,4-thiadiazoles (compound 1) possessing isomeric pyridyl(13). At less than 3.6 mg/ml, the majority of the produced compounds were shown to be efficacious against both gram-positive and gram-negative bacteria(14). The chemical is most effective against all seventeen bacteria tested (gram-positive and gram-negative).(15)



(1)

Purohit *et al*. reported the reaction of 4-amino-5-(3 chlorophenyl)-4H-1,2,4-triazole-3-thiol produced the required fused ring system 3-(3-chlorophenyl)-6-aryl-5,6-dihydro[1,2,4] triazolo[3,4-b][1,3,4]thiadiazoles (compound 2). The antibacterial activity of each of the recently produced compounds was tested. Compared to typical medications, some of the substances significantly inhibited the development of bacteria and fungi.(16)



(2)

According to Zamani *et al*., this molecule was prepared by synthesizing novel 1,2,4-tri and 1,3,4-thiadiazoles (compound 3) with isomeric pyridyl and 1- naphthyl in alkaline and acidic conditions, respectively. Some of

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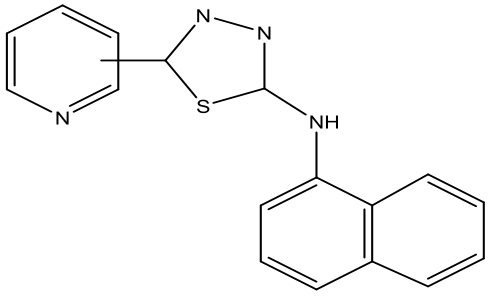
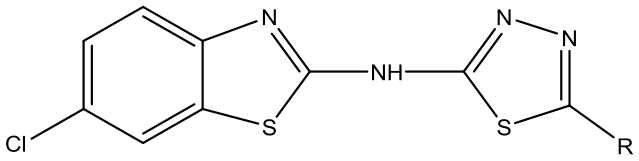
the produced compounds' antibacterial tests against S. E. coli and A. coli as well as their MIC values. None of them have any significant antibacterial properties.(17)



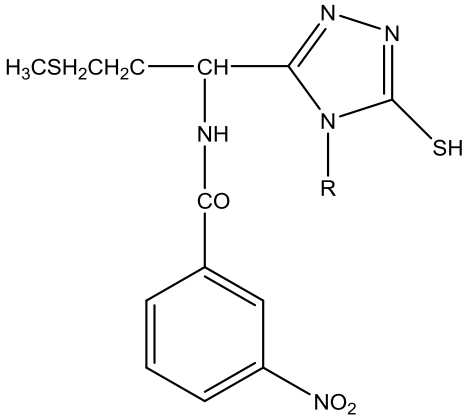
(3)

When cyclized with a different carboxylic acid in POCL3 and substituted azlactones in pyridine, the 6-chloro-2-aminobenzotiazole thiosemicardazide produces the corresponding 1,3,4-thiadiazoles of 2-aryl-5-(6chloro-1,3benzothiazole-2-yl-amino) (compound 4) Amir *et al*. reported it. All of the substances have been tested in vitro for their antibacterial effects on various microorganisms and have proven to be effective.(18)



(4)

Otilia Pintilie *et al*. reported the New synthesis of 1,3,4-thiadiazole(compound 5) and 1,2,4-triazolecompounds with a D,L-methionine moiety, which were produced by intramolecular cyclization of 1,4-disubstituted thiosemicarbazides in acid and alkaline conditions, respectively.(18)



(5) R = CH_3, C_6H_5, C_6H_4- CH_3

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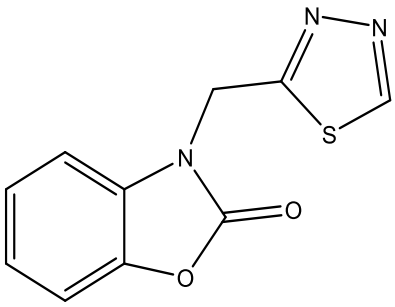
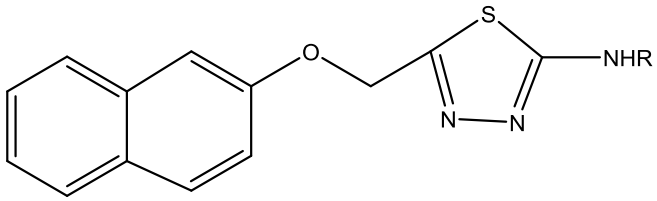
- **ANTI INFLAMATORY ACTIVITY:**



(6)

Salgin-Goksen *et al*.(compound 6) produced a number of condensed 2-benzoxazolinones and modified thiadiazoles and tested them for anti-inflammatory activity.The most efficient and consistent anti-inflammatory action was found in the compound with phenyl substituent. Change in the alkyl chain for a phenyl ring shown increase in the anti-inflammatory action.(18,19)

Erhan *et al*. (compound 7) developed a series of 2-(2-naphthyloxymethyl)-5-substitutedamino-1,3,4-thiadiazole and tested their ability to reduce inflammation using a hind-paw edoema model. All the substances were discovered to have meagre anti-inflammatory effects.(20)



(7)

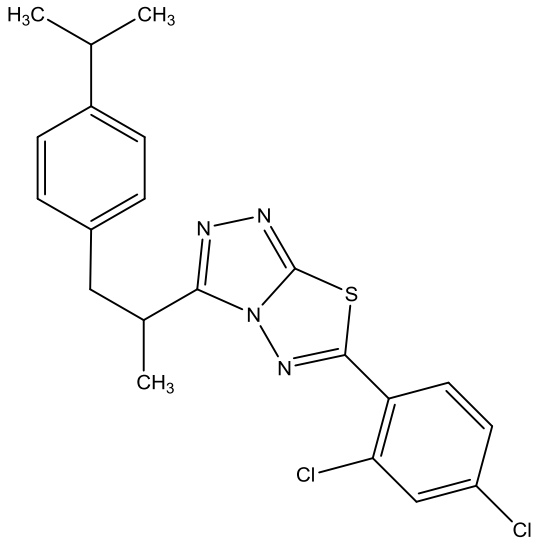
R= -CH_3, C_2H_5, -CH_2CH= CH_2, -C_6H_5

By Mathew *et al*.[11], various 3,6-disubstituted 1,2,4-triazolo [3,4-b]- 1,3,4-thiadiazole and their dihydro derivatives were screened for anti-inflammatory efficacy. Results showed that compounds with an indole ring at position 6 of the triazolothiadiazole system displayed the greatest anti-inflammatory effect.(21)

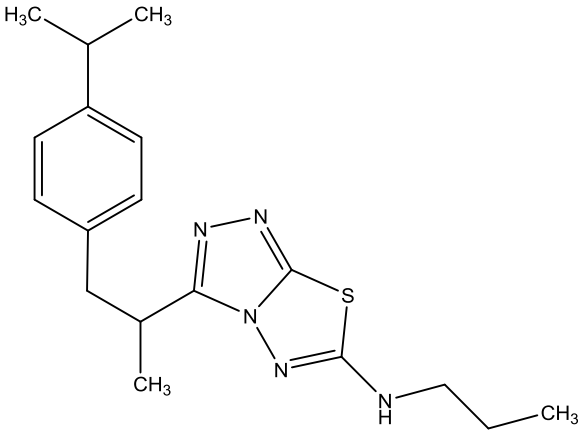
Nesrin *et al*.performed the synthesis and assessment of the analgesic-anti-inflammatory activity of 1,3,4-thiadiazoles containing the 5-methyl-2-benzoxazolinone moiety (compound 8a-c). Aspirin and morphine

both had less analgesic activity than (compound 8a), which was greater. The anti-inflammatory efficacy of each chemical was excellent.(22)

Biphenyl-4-yloxy acetic acid and 1,2,4-triazolo [3,4-b][1,3,4]thiadiazole derivatives of ibuprofen were synthesized and tested for their ability to reduce inflammation. Compounds (10 and 10b) with 2,4-dichlorophenyl and N-butyl amino groups, respectively, were found to have the highest concentrations, being somewhat less potent than ibuprofen but equivalent to flurbiprofen, according to Amir *et al*. High anti-inflammatory action was generally produced by the inclusion of 2,4-dichlorophenyl, 4-chloroprene, n-butyl amino, and 4-aminophenyl groups at C-6 of the triazolo-thiadiazole ring.(23)



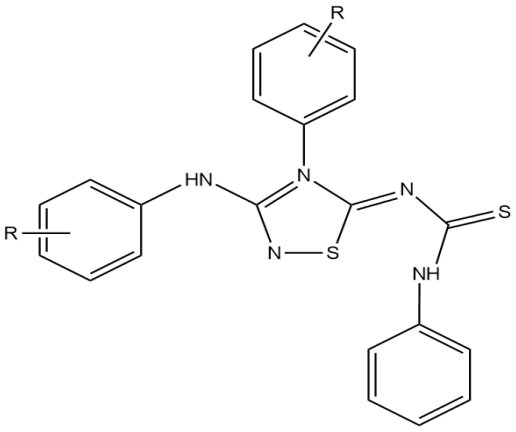
8 a



8 b

- **ANTI-CONVULSANT ACTIVITY**

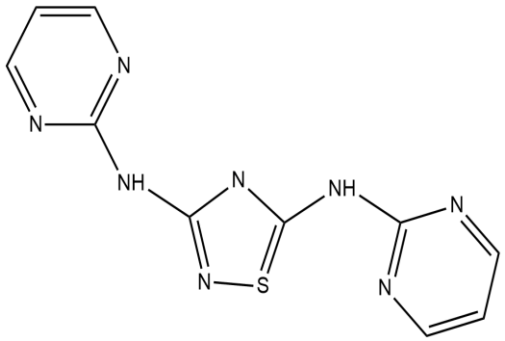
Siddiqui *et al*. synthesised and assessed for anticonvulsant action a series of 1,2,4-thiadiazoles (compounds 10 a-e). While other compounds in the series were less active, the molecule with the para-chloro substitution had the highest level of activity in the MES test and partially prevented strychnine seizures.(24)



(10)

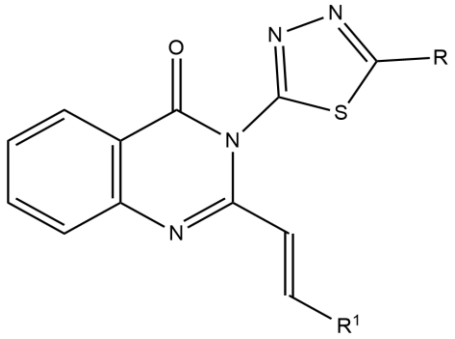
R= 2-Cl, 4-Cl, 4-NO_2, 2-CH_3

Gupta *et al*. synthesised and tested a number of novel substituted 1,2,4-thiadiazoles for their anticonvulsant properties. At 0.5 hours, all drugs, with the exception of (compound 10), demonstrated protection against the MES (maximal electroshock induced seizures) screen. It may be inferred that the synthetic compounds were less powerful as sedative-hypnotic agents than ScPTZ and were more effective against MES-induced seizures, which is favourable.(25)



(11)

Sushil *et al*. discovered New 3- [5-substituted phenyl-1,3,4-thiadiazole-2-yl] compounds and synthesised -2-styryl quinazoline-4(3H)-ones, which were tested in mouse models of seizures brought on by subcutaneous pentylenetetrazole (scPTZ) and maximum electroshock (MES). Only compounds 13a, 13b, and 13c out of 18 exhibited anticonvulsant action in at least one test animal(26).

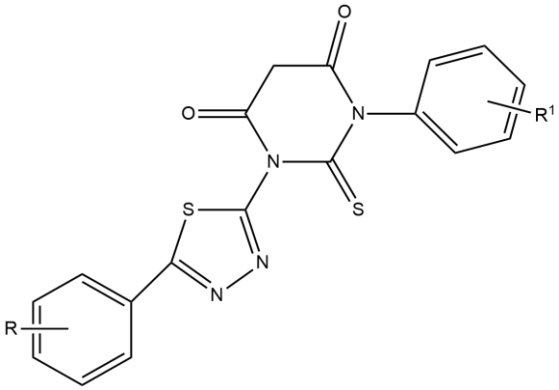


(12)

R= -C_6H_5; R^1 = p-$ClC_6H_4$22b: R= m-ClC_6H_4; R^1 = p-ClC_6H_4 22c: R= p-ClC_6H_4; R^1 = 4-pyridinyl

An array of 1 (substituted phenyl) 3,4,6-trimethyl-1,3,4-thiadiazol-2-yl-3- [(5-substituted phenyl)] Thioxodihydropyrimidine, 2, -4,6(1H,5H) Siddiqui *et al*. (compound13) developed, synthesised, and characterised the -diones 13(a-w). The substanceS anticonvulsant potential was examined. The compounds

(13d, 13f, 13l, 13m, 13n, 13o, 13t, and 13v) were more effective than phenytoin in the MES test while being less neurotoxic.(27)

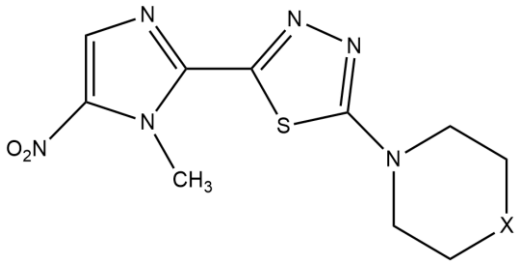


(13) (a-w)
R= 2-Cl, 3-NO_2, 4-F R^1= H, 2-Cl, 2-CH_3 , 3-Cl, 3-CH_3 , 4-Cl, 4-CH_3

- **ANTI-LEISHMANIAL ACTIVITY:**

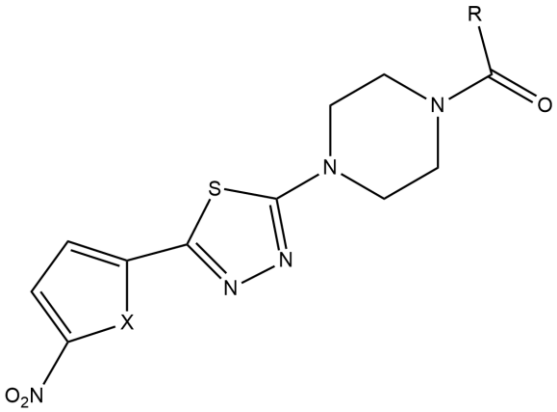
Foroumadi *et al*. developed and tested a variety of 2-(1-methyl-5-nitroimidazol-2-yl)-5-(1-piperazinyl, 1-piperidinyl, and 1-morpholinyl)-1,3,4-thiadiazoles for their in-vitro leishmanicidal activity against Leishmania major promastigotes(14). According to the leishmanicidal data, compounds 14(a-g) demonstrated substantially more leishmanicidal action than the standard treatment pentostam. The most active substance was compound (14c) (a piperazine analogue; IC50 = 0.19 M). These novel nitroimidazolyl-1,3,4-thiadiazole compounds' antileishmanial action may be attributed to the single-electron transfer ArNO2/reduction ArNO2's potential(28).

The creation of nitroheteroaryl-1,3,4-thiadiazole-based compounds, such as 1-[5-(5-nitrofuran-2-yl)-1,3,4-thiadiazol-2-yl], and their anti-leishmanial activity -1 [5-(5-nitrothiophen-2-yl)-1,3,4-thiadiazol-2-yl] and -4-aroylpiperazines Fardmoghadam *et al*. described -4-aroylpiperazines(29). At non-cytotoxic doses, the majority of the synthesised compounds displayed significant antileishmanial activity against both promastigote and amastigote forms of Leishmania major. The related 5-nitrophene analogues were often less active than 5-nitrofuran derivatives (15a) (15b)(30). Nitro radical anion combines with oxygen in an aerobic environment to produce superoxide anion and hydroxy radical(31). The resultant free radical would cause harm to the enzyme, DNA, or significant cell structures, leading to cytotoxicity. The radical anion can change into its equivalent nitroso-derivative when anaerobic circumstances are present. This nitroso form has been proposed as an effective thiol scavenger in the cell.(32)



(14)

14a = X = CH2 , 14b = X = O, 14c = X = NH, 14d = X = NMe,14e = X = NPh, 14f = NCOMe 14g = NCOPh

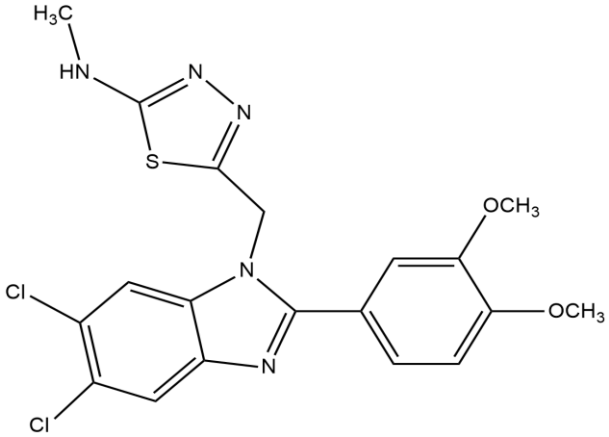


(15)

15b = R = -SCH2CH$_3$, -CH2CH$_3$; R' = -SOH, -PO(OH)$_2$

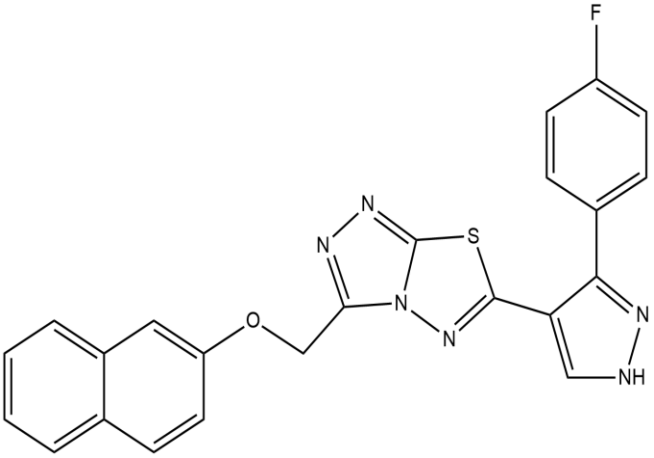
- **ANTIOXIDANT ACTIVITY**

There are several new 5- [(2-(substituted phenyl)-1H-benzimidazole-1-yl)methyl] compounds. Kus *et al* (33) produced —methyl-1,3,4-thiadiazole-2-amines and examined their antioxidant capacity utilising a variety of in vitro systems. At a dose of 10-3 M, (compound 16), the most active derivative, modestly prevented lipid peroxidation.(34)

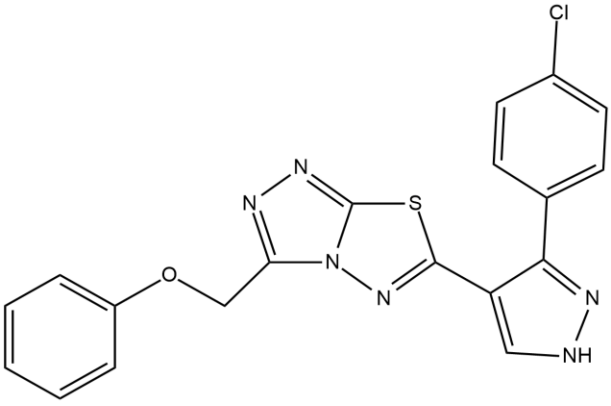


(16)

In vitro antioxidant properties of two triazolothiadiazoles, 6-[3-(4-fluorophenyl)-1H-pyrazol-4-yl], were examined by Dhanya Sunil and his group. -3-[(2-naphthyloxy) methyl] Triazolo [1,2,4], [3,4-b] Two compounds are 6-[3-(4-chlororophenyl)-1H-pyrazol-4-yl] and -[1,3,4] thiadiazole (FPNT) (compound 17a). -3-[(phenyloxy)methyl] Triazolo [1,2,4], [3,4-] Spectrophotometric DPPH and ABTS radical scavenging techniques, as well as an assay for lipid peroxide, were used to measure [1,3,4]thiadiazole (CPPT) (compound 17b). In vitro lipid peroxidation experiments, DPPH free radical scavenging, and ABTS free radical scavenging assays all clearly demonstrate the substantial antioxidant activity of FPNT with low IC50 values when compared to standard. The in vitro lipid peroxidation experiment further demonstrated FPNT's superior antioxidant capabilities.(34)

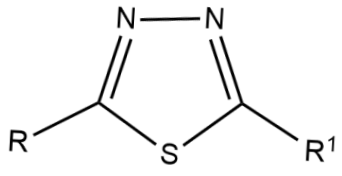


(17 a)



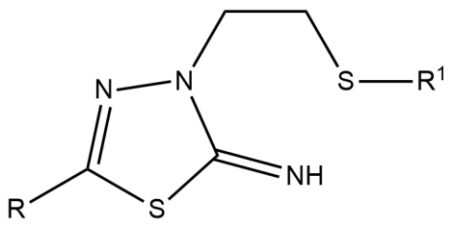
(17 b)

The thiol, thiosulfonic acid, and phosphorothioate derivatives of thiadiazoles (compound 18a-b) display apparent antioxidant activity, according to Cressier *et al* evaluation of antioxidant activity(35). The strong activity of thiol derivatives supports the idea that an aromatic ring and thiol function are directly related. When the radical is captured by the thiol, it can then be trapped by the aromatic ring. Moreover, the thiadiazole aminothiol derivative has improved action.(36,37)



(18a)

R= -SCH_2CH_3, -CH_2CH_3 R^1 = -SO_3H, -$PO(OH)_2$



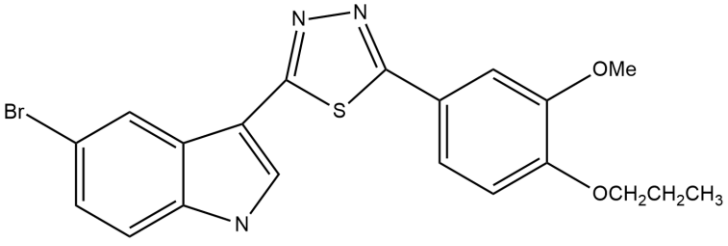
(18b)

R= -SCH_2CH_3, -CH_2CH_3 R^1= -SH, -$NHCH_2CH_2SH$

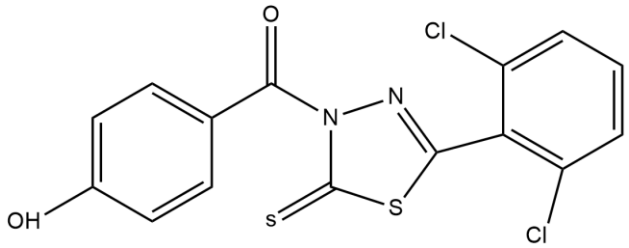
- **ANTI-CANCER ACTIVITY**

5-(3-indolyl)-1,3,4-thiadiazoles were synthesised and tested for anticancer activity by Kumar *et al*. Between 100 nM and 1 mM in concentration, first screening was carried out. In 24 and 48 hours, changes in cell shape and number were seen in 96-well plates(38). For the secondary confirmation experiments, compounds that showed toxicity to cancer cell lines but not to normal cells were chosen. Compounds were tested in triplicate using the same concentration as in the primary screening for the secondary screening. As a consequence, eight substances were recognised as powerful catalysts for cytoselective toxicity. It was discovered that the 1,3,4-thiadiazole ring's C-2 position substitution is crucial for delivering the cytotoxic action to the compound(39).

The antiproliferative activity was increased by replacing the phenyl ring at the C-2 position with benzyl, 4-(dimethylamino)phenyl, 3,4-dimethoxyphenyl, and 4-benzyloxy group, whereas the biological activity was decreased by replacing the phenyl group with p-chlorophenyl and adding the third methoxy group(40). The most effective molecule in the series was discovered to be 2-(4-(Benzyloxy)-5-(5-bromo-3-indolyl)- 3-methoxyphenyl)-1,3,4-thiadiazole (compound 19). This compound contains 4-benzyloxy-3-methoxyphenyl at the C-2 position and 5-bromoindole at the C-5 position. (4-hydroxyphenyl) [5-(2,6-dichloro)-2-thioxo-1,3,4-thiadiazol-3-yl] is a compound(41)(42). Methanone (compound 20) shown outstanding cytotoxic effect against non-small cell lung cancer (HOP 92) with a log GI50 value of -6.49, colon cancer (HCC-2998) with a GI50 value of 5.31, and prostate cancer (PC-3) with a GI50 value of substantial cytotoxic efficacy against human tumour cells. value 5.48. The electron withdrawing group of the thiadiazole at position C-5 was beneficial for activity, according to a SAR analysis.(43)



(19)

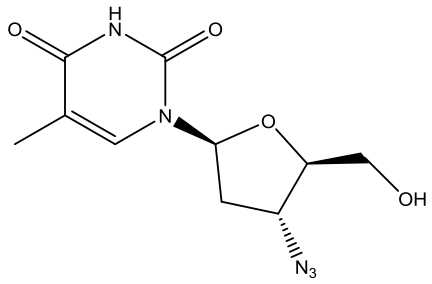


(20)

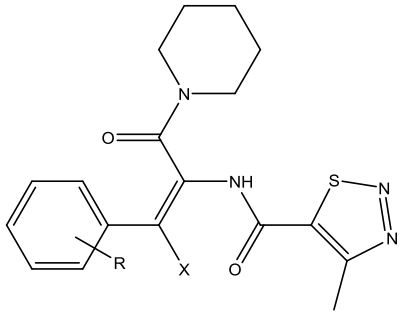
- **ANTI VIRAL ACTIVITY:**

It is remarkable that viruses, including those that cause the flu, AIDS, hepatitis B, and measles, to name a few, are responsible for 50% of the occurrence of human disease. Given that thiadiazole derivatives are

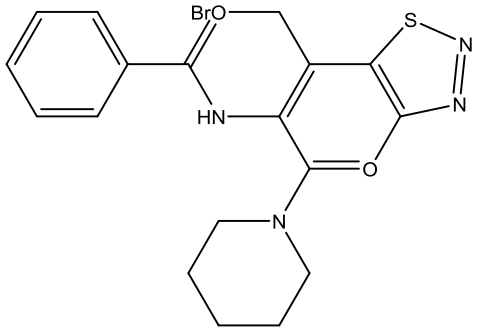
bioisosteres of pyrimidine, a nucleobase scaffold found in nucleosides, and that zidovudine (compound 21), an antiviral discovered in 1987 against the human immunodeficiency virus (HIV), the virus that causes AIDS, is a nucleoside analogue, it follows that thiadiazole derivatives should also have antiviral properties. This is actually the case, as several thiadiazoles exhibit superb antiviral properties. (Compounds 22-24) produced by Dong *et al*. shown effective suppression of the replication of hepatitis B virus (HBV) DNA, with IC50 values lower than the well-known HBV medication lamivudine (IC50 (mgmL1))=10.4, 3.59, 9.00, 24, and 14.8 for lamivudine). Moreover, compound 25 dramatically reduced HBV extracellular antigen HBeAg production (IC50=12.26 mgmL1) Derivatives of thiadiazole that are antiviral have also been discovered for less frequent viral infections. Compound 88 demonstrated the most powerful activity against the Sindbis virus, the causal agent of Sinbus fever, at 9.6 mgmL1, among the compounds described by Kkgzel *et al*. in 2007.(44)



(21)

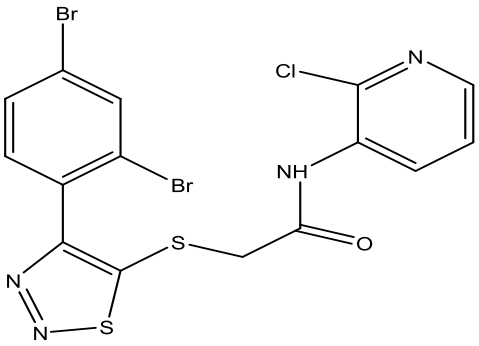


(22 X=Br,R=2-Cl) (23 X=Br,R=4-Cl)(24 X=Cl,R=H)



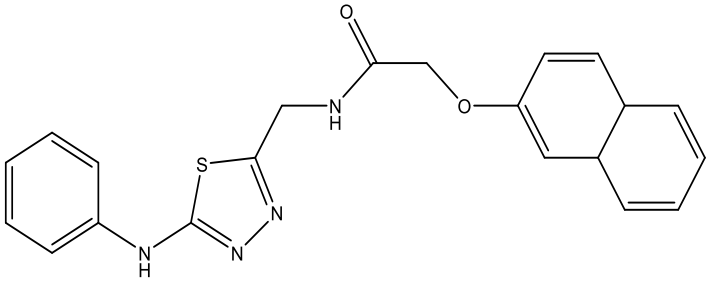
(25)

A novel synthesis method and assessment of the anti-HIV activity of a new series of 2-(4-(2,4-dibromophenyl)-1,2,3-thiadiazol-5-ylthio) acetamide derivatives were developed by Zhan P and Co-workers. cryesst res. (compound 26) demonstrated the strongest anti-HIV-1 action, suppressing HIV-1 replication in MT-4 cells seven times more efficiently than NVP and DLV (EC50 = 36.4 nM) (by eightfold)



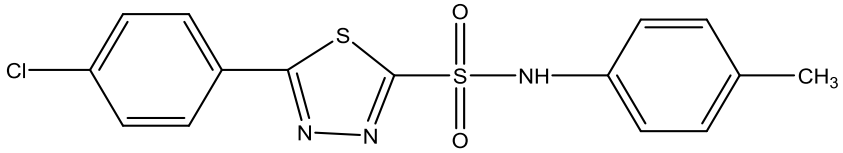
(26)

Using the MTT assay, Hamad N.S. and Co-workers prepared the compound 2-(naphthalen-2-yloxy)-N-((5-(phenylamino)- 1,3,4-thiadiazol-2-yl)methyl)acetamide (compound 27) and investigated its in vitro anti-HIV-1 (strain IIIB) and anti-HIV-2 (strain ROD) efficacy by inhibiting the virus's growth With the exception of compound (a), which had an EC50 value of 0.96 g/mL, all the compounds were found to be inactive.



(27)

Chen Z and Co-workers prepared 5-(4-chlorophenyl)-1,3,4-thiadiazole sulfonamides and tested their effectiveness against the tobacco mosaic virus. Some of the sulfonamide-containing compounds were discovered to be efficient tobacco mosaic virus inhibitors with minimal cytotoxicity. The inhibitory activity of 5-(4-chlorophenyl)-N-p-tolyl-1,3,4-thiadiazole-2-sulfinamide (compound 28) was around 42%.



(28)

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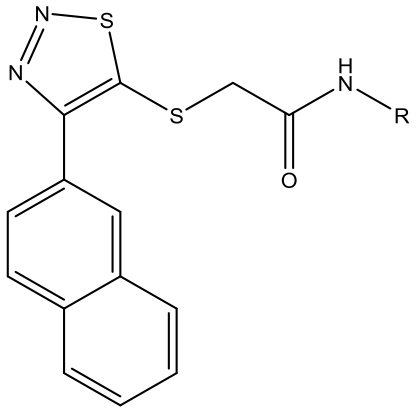

(29)
a R=2-chloropyrin-3-yl
b R=4-acetyl-2-bromophenyl
c R=2-nitrophenyl

Many 2-(4-(naphthalen-2-yl)-1,2,3-thiadiazol-5-ylthio) acetamide (TTA) compounds were prepared by Zhan P and colleagues and tested for their potency as HIV-1 inhibitors. The three tested drugs with the highest EC50 values for inhibiting HIV-1 replication were a, b, and c (EC50=0.170.02, 0.360.19, and 0.390.05 mM, respectively).

- **MICROWAVE ASSISTED SYNTHESIS**

  Scientists have studied the process of microwave dielectric heating and determined the benefits of the approach for chemical synthesis because microwave has been used to speed up chemical reactions in laboratories. Microwaves have recently been a popular non-conventional energy source for performing organic synthesis and have been widely used for carrying out chemical processes. As a result of the wide availability of specialised and dependable microwave equipment, there have been a lot of publications in recent years, especially in 2003, relating to the application of microwaves.

  The aqueous emulsion polymerization of butyl acrylate, acrylic acid, and methacrylic acid using pulsed electromagnetic radiation is the first known use of microwave energy in organic synthesis**.**

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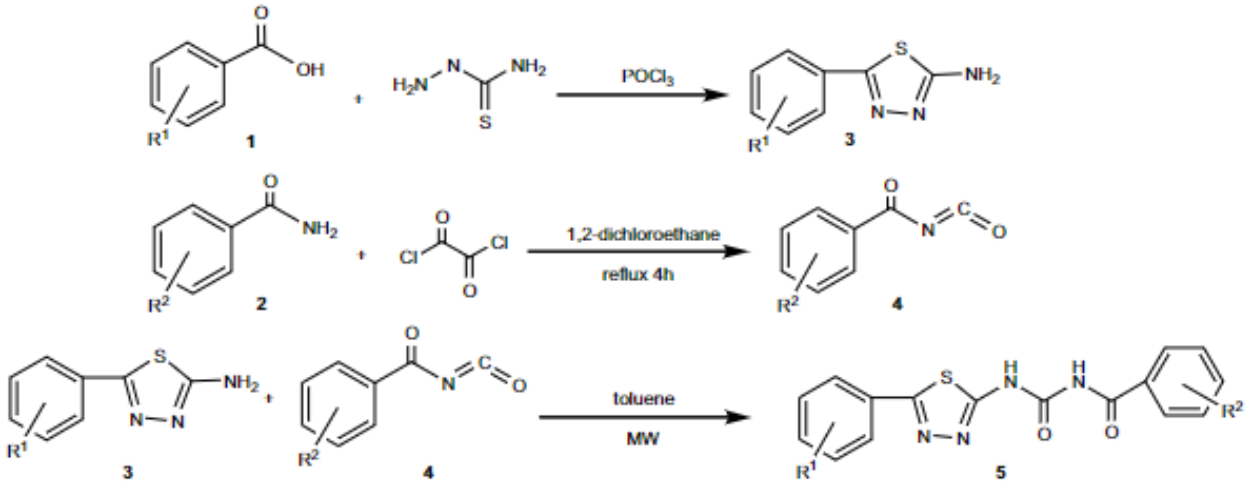
availability of specialised and dependable microwave equipment, there have been a lot of publications in recent years, especially in 2003, relating to the application of microwaves.

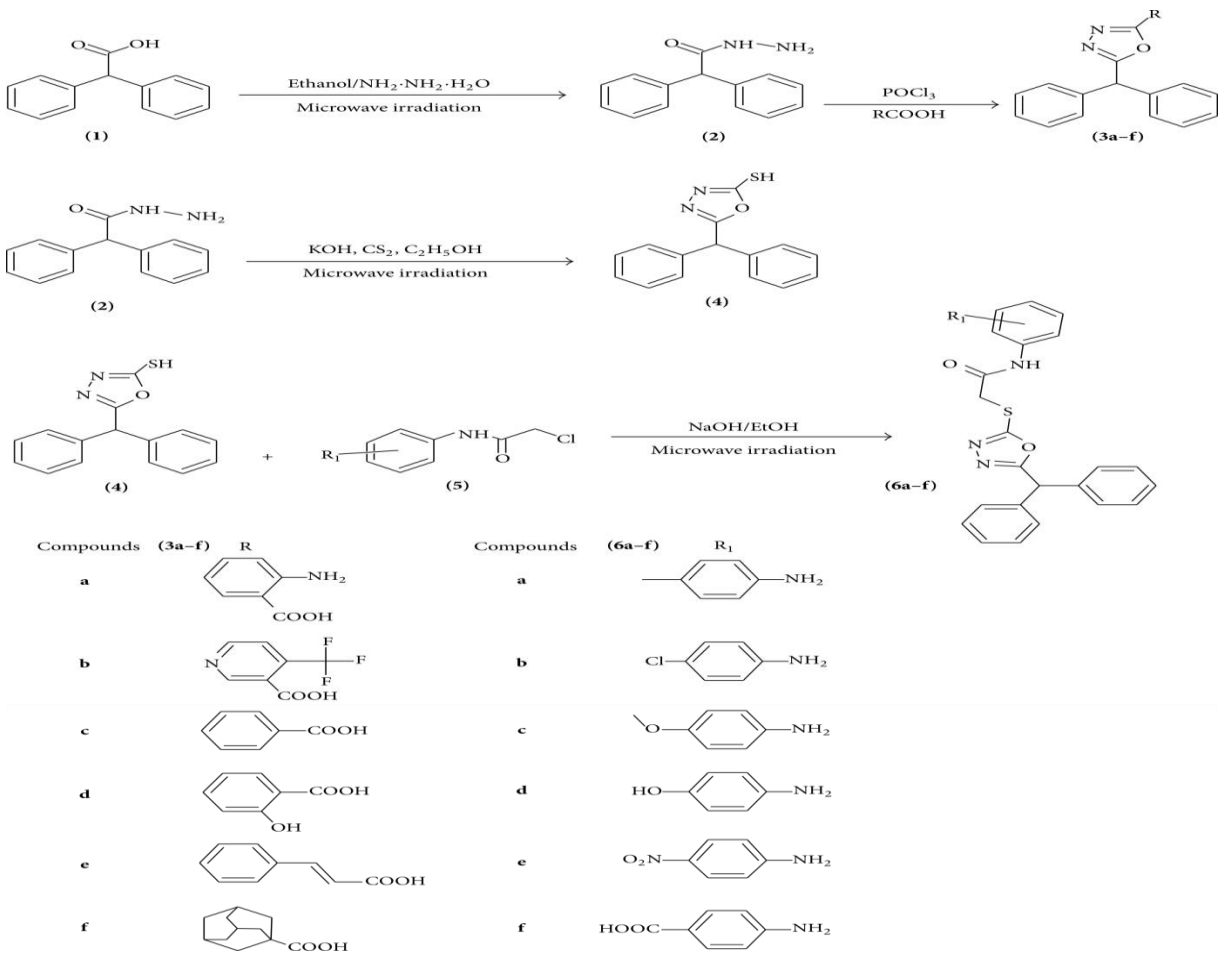
Microwave irradiation gives an alternative to the standard ways, for heating or injecting energy\sinto the system. It makes use of the capacity of conducting ions in solids or mobile electric charges present in liquids to convert electromagnetic energy into heat. Electromagnetic waves are what microwave radiation is. The microwave section of the electromagnetic spectrum lies between radio waves and infrared radiation. Wavelengths of microwaves range from 1 mm to 1 m, or frequencies between 0.3 and 300 GHz. Many of the band frequencies in this area are used by telecommunication and microwave radar equipment. Using some liquids' and solids' capacity to convert electromagnetic radiation into heat, microwave dielectric heating is used to promote chemical processes.

- Feng Han et al., have reported the microwave-assisted synthesis of 1,3,4-thiadiazole aroylurea derivatives. Arapidandefficientmicrowave-assistedsynthesismethodforthepreparationof1-aroyl-3-(5-aryl-1,3,4-thiadiazol-2-yl)ureaisdescribed.These1,3,4-thiadiazolearoylureas(5a–f) were identified by IR,1HNMR,elemental analysis and N-[5-(4-methoxyphenyl)-1,3,4-thiadiazol-2-ylcarbamoyl]-2,6-difluorobenzamide was confirmed by single-crystal X-ray diffraction. The target compounds were prepared under microwave in a shorter reaction time compared with conventional heating methods. (45)



3a R^1=4-methoxy **3b** R^1=3,5-dimethyl **3c** R^1=2,4-dichloro **3d** R^1=3-fluoro
4a R^2=2,6-difluoro **4b** R^2=4-methoxy **4c** R^2=H
5a R^1=4-methoxy R^2=2,6-difluoro **5b** R^1=3,5-dimethyl R^2=2,6-difluoro
5c R^1=2,4-dichloro R^2=4-methoxy **5d** R^1=3,5-dimethyl R^2=4-methoxy
5e R^1=3-fluoro R^2= H **5f** R^1=4-methoxy R^2= H

- Deepak Swarnkar, Rakshit Ameta and Ritu Vyas, reported the synthesis of Microwave-Assisted Synthesis of Some 1,3,4-Oxadiazole Derivatives and Evaluation of Their Antibacterial and Antifungal Activity. A series of substituted 1,3,4-oxadiazole derivatives (3a–f) and (6a–f) have been synthesized from diphenylacetic acid hydrazide under microwave irradiation in various reaction conditions. The structures of the synthesized compounds were assigned on the basis of elemental analysis, IR, and ^{1}H NMR. These targeted compounds have been tested for their antibacterial and antifungal activities compared to ampicillin and griseofulvin as standard drug. Compounds 3a, 3e, 3f, 6c, 6d, 6e, and 6d exhibited the maximum antibacterial activities while 3b, 3c, 3d, 3e, 6a, 6d, and 6e exhibited the maximum antifungal activities. (46)



➢ MICROWAVE VERSUS CONVENTIONAL SYNTHESIS

In conventional synthesis, the walls of the reactors are typically heated by convection or conduction using a furnace or oil bath. The sample's core takes substantially longer to reach the desired temperature. This is a sluggish and ineffective way to move energy into the system that reacts. On the other hand, in microwave aided synthesis, the microwave directly interacts with the substance, penetrating it and creating heat. In comparison to traditional reactions, microwave-assisted synthesis has a number of benefits, including the ability to speed up analogue synthesis and reaction optimization. It also makes challenging compound synthesis possible while using less energy and solvent. Particularly, microwave synthesis could influence medicinal chemistry activities in the drug discovery process includes three main stages: lead generation, hit-to-lead efforts, and lead optimization. Dedicated rotors or microtiter plate systems can be used to perform microwave chemistry very well in a parallel configuration. With multimode microwave equipment, several hundred reactions can be carried out in a single microwave experiment. Researchers have demonstrated the advantages of combining combinatorial chemistry and microwave heating.(47)

• CONCLUSION

This review article highlights that the thiadiazole and its derivatives have produced various analogues with potential for use in medicine. Several substances have demonstrated more pharmacological activity than usual. Research into thiadiazole derivatives, which are a key structural component in a variety of pharmacological categories including antibacterial, anti-inflammatory, analgesic, antiepileptic, antiviral, antineoplastic, and antitubercular medicines, is therefore necessary. Thiadiazole and its derivatives have become pharmacologically significant scaffolds because to their extensive and strong action. In this paper, an effort has been made to review the structural alterations on several thiadiazole derivatives for various pharmacological actions using latest research discoveries on this nucleus. This review shows that 1,3,4-thiadiazoles, 1,2,4-thiadiazoles, and 1,2,4-triazolo thiadiazole derivatives exhibit a broad range of pharmacological actions. The biological characteristics of all these thiadiazole derivatives would serve as a useful matrix for the continued creation of improved pharmaceuticals.

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