Section: Research Paper

A Review on1, 3, 4-Oxadiazole Its Chemical Synthesis and Pharmacological Properties

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ABSTRACT:-

In the last year, analogues and derivatives of heterocyclic compounds have gotten a lot of attention since they have beneficial biological and pharmacological features. Oxadiazole derivatives perform important roles in biology, such as killing bacteria, viruses, and tuberculosis, reducing inflammation, and stopping seizures.

Keywords: 1,3,4-oxadiazole; synthesis methods; pharmacological activity; review.

1.INTRODUCTION:-

1,3,4-Oxadiazole (1, see Figure 1) is a heterocyclic molecule with a five-membered ring that has one oxygen atom and two nitrogen atoms. It is made by replacing two methylene groups (=CH) with two nitrogens of the pyridine type (-N=) [1,2]. There are three isomers: 1,2,4-oxadiazole (2), 1,2,3-oxadiazole (3), and 1,2,5-oxadiazole (4). (Figure1). But 1,3,4-oxadiazole and 1,2,4-

oxadiazole are better recognised and more frequently investigated by scientists since they have numerous essential chemical and biological features.(1).

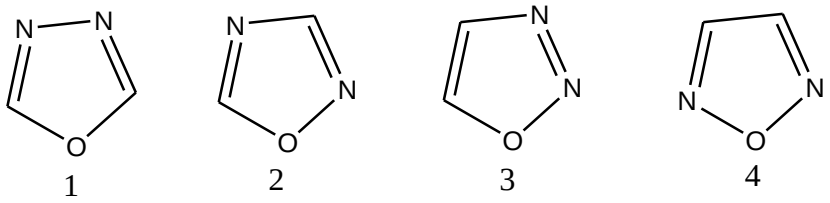


Figure no.1:- Isomers of Oxadiazole

Heterocyclic small molecule peptidomimetics, such 1,3,4-oxadiazoles, are tiny five-membered heterocycles that might be perfect for making universal peptidomimetics. (Ko, E et al., 2011). When a dependable way of putting 1,3,4-oxadiazole into peptides is found, it may be used to make a lot of short peptide segments that can be studied for their biological and therapeutic effects. Also, 1,3,4-oxadiazoles are often used as bioisosteric substitutes for amide bonds that are resistant to hydrolysis (Ahn et al., 2002). This makes these heterocycles an essential structural motif in the pharmaceutical business.(1).

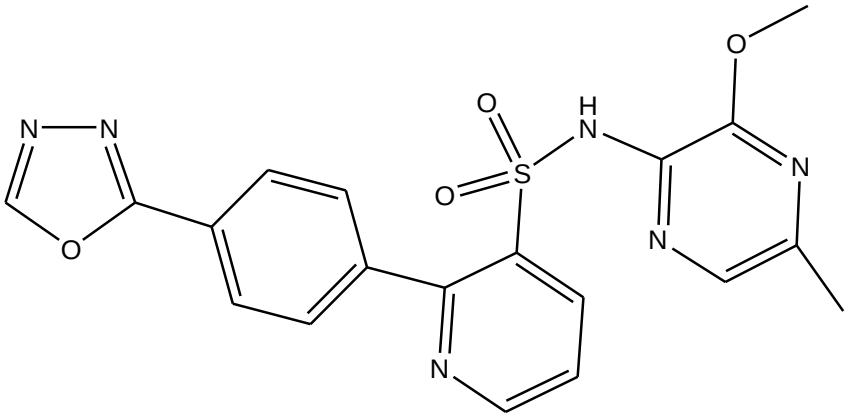
Antibacterial, anti-tuberculous, anti-inflammatory, anticonvulsant, hypnotic, and anaesthetic effects were found in 1,3,4-oxadiazoles. These antibacterial capabilities were comparable to those of well-known sulphonamide medicines. The oxadiazole nucleus with an N=C-S linkage has several pharmacological properties. Sulfone derivatives with a heterocyclic moiety are recognised for their unique antifungal bioactivities, which have drawn a lot of attention in pesticide and drug development.(2).

Here, the rings of type (2) are called azoximes, whereas the rings of type (4) are called furoxans. Oxadiazole is thought to be made by replacing two methane groups (CH=) with two pyridine-type nitrogen groups (-N=), which are termed furadiazoles.(3).

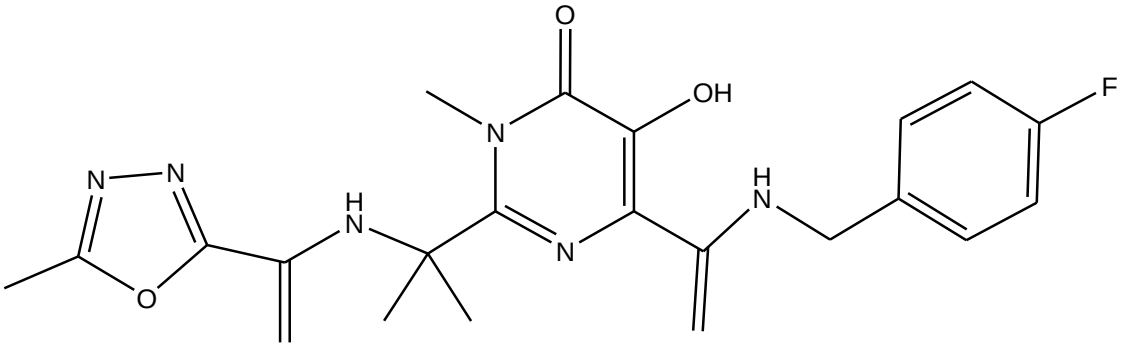
There have been a lot of oxadiazole derivatives made, and several of them have showed antibacterial activity throughout a broad range. Some oxadiazoles with different substituents at different places on the heterocyclic ring produced fungicides and antibiotics with variable levels of effectiveness. Because of what the additional heteroatom does, oxadiazole is an extremely weak base. When two -CH= groups in a furan are replaced by two -N= groups from a pyridine, the aromaticity of the resultant oxadiazole ring is lowered to the point where it acts like a conjugated diene. Electrophilic replacements in the oxadiazole ring are very hard to do at the carbon atom. This is because the pyridine-type nitrogen atom pulls electrons away from the carbon atom, making it less dense with electrons. Electrophiles, on the other hand, attack at the nitrogen if electron-releasing groups are added to the oxadiazole ring. Most nucleophiles can't get into the oxadiazole ring. Halogen-substituted oxadiazole, on the other hand, goes by nucleophilic substitution, where nucleophiles replace the halogen atom. The nucleophilic substitution that happens at an aliphatic sp2 carbon atom also happens at an oxadiazole carbon atom.

Most of the time, diacylhydrazines are cyclized in order to make oxadiazole. The cyclization reaction is affected by several different circumstances of the reaction. Usually, heat and anhydrous reagents such thionyl chloride, phosphorus oxychloride, phosphorous pentoxide, triphenylphosphine, and triflic anhydride are used to speed up the process.(4).

In pharmaceutical chemistry, 1,3,4-oxadiazoles are used to stand in for carboxylic acids, esters, and carboxamides. Oxadiazoles have a unique structure that gives them a lot of biological potential. This makes them significant for designing molecules. HIV-integrase inhibitor Raltegravir, which is an antiretroviral medication, is one of a number of chemicals used in clinical medicine that have therapeutic effects. Zibotentan is an anticancer drug, furamizole is an antimicrobial nitrofuran, and tiodazosin and nesapidil treat high blood pressure.(5).



Zibotentan



Raltegravir

Figure no.2:- Zibotentan and Raltegravir

1.1Properties of Oxadiazole ring:-

1.1.1 Physical properties-

The heterocyclic molecule 1,3,4-oxadiazole has two carbon atoms, two nitrogen atoms, one oxygen atom, and two double bonds. 1955 saw the first reports of monosubstituted 1,3,4-Oxadiazoles from two different labs. Since 1955, several people have made this reaction go much farther. 1,3,4-Oxadiazole boils at 150°C.

Table no.1-Percentage of C, H, N present in 1,3,4-oxadiazole.

	Calculated%	**Found%**
C	34.29	34.56
H	2.88	3.19
N	40.00	39.71

Table no.2-Bond angle

Bond/Angle	**Bond angle()**	**Bond length(pm)**
A	105.6	139.7
B	113.4	129.9
C	102.0	134.8
D	113.4	134.8
E	105.6	19.7

1.1.2: The oxadiazole ring has certain chemical properties:

Oxadiazole is a heterocyclic aromatic chemical compound with the formula C2H2N2 O. It has a five-member ring with one oxygen and two nitrogen atoms. The 1,2,3-isomer is out of whack, thus it goes back to becoming the diazoketone tautomer. Name for oxadiazole ring such as 'Azoxime' (1,2,4-oxadiazole), 'Furazan' (1,2,5-oxadiazole), 'Furazans'(1,2,5-oxadiazole) and 'Biazole, oxybiazole' (1,3,4- oxadiazole)(5).

1.2Infrared spectroscopy:-

- Bonds at 1640-1560 cm-1 (C=N) and 1030-1020 cm-1 (C=O) make up most of the spectrum.
- The C=N stretching band may be used to tell the difference between 2 amino-1,3,4-oxadiazole(1640-1610cm-1).
- The base peak in the spectra of 1,3,4-oxadiazole and 2-amino-5-phenyl-1,3,4-oxadiazole is the molecular ion.
- In the spectrum of 2-amino-5-phenyl-1,3,4-oxadiazole, the loss of HNCO is a big deal.(6).

2. METHOD OF SYNTHESIS:-

2.1. How 5-substituted 2-amino-1,3,4-oxadiazoles are made.

Scheme 1: Making 5-Aryl-2-amino-1,3,4-oxadiazole from acylhydrazides and cyanogen bromide.

Using the method Retrosynthetic analysis of 5-substituted-2-amino-1,3,4-oxadiazole, Patel and Patel made 5-aryl-2-amino-1,3,4-oxadiazole compounds5 with yields of 62 to 70%. These chemicals were utilised as building blocks to make novel derivatives of quinazolinone. Kerimov and his team created a novel series of 2-amino-1,3,4-oxadiazoles with a benzimidazole moiety with a 33%–60% yield from the reaction between 2-(2-(4-substituted-phenyl)-1H-benzo[d]imidazol-1-yl)acetohydrazide 6 and cyanogen bromide.

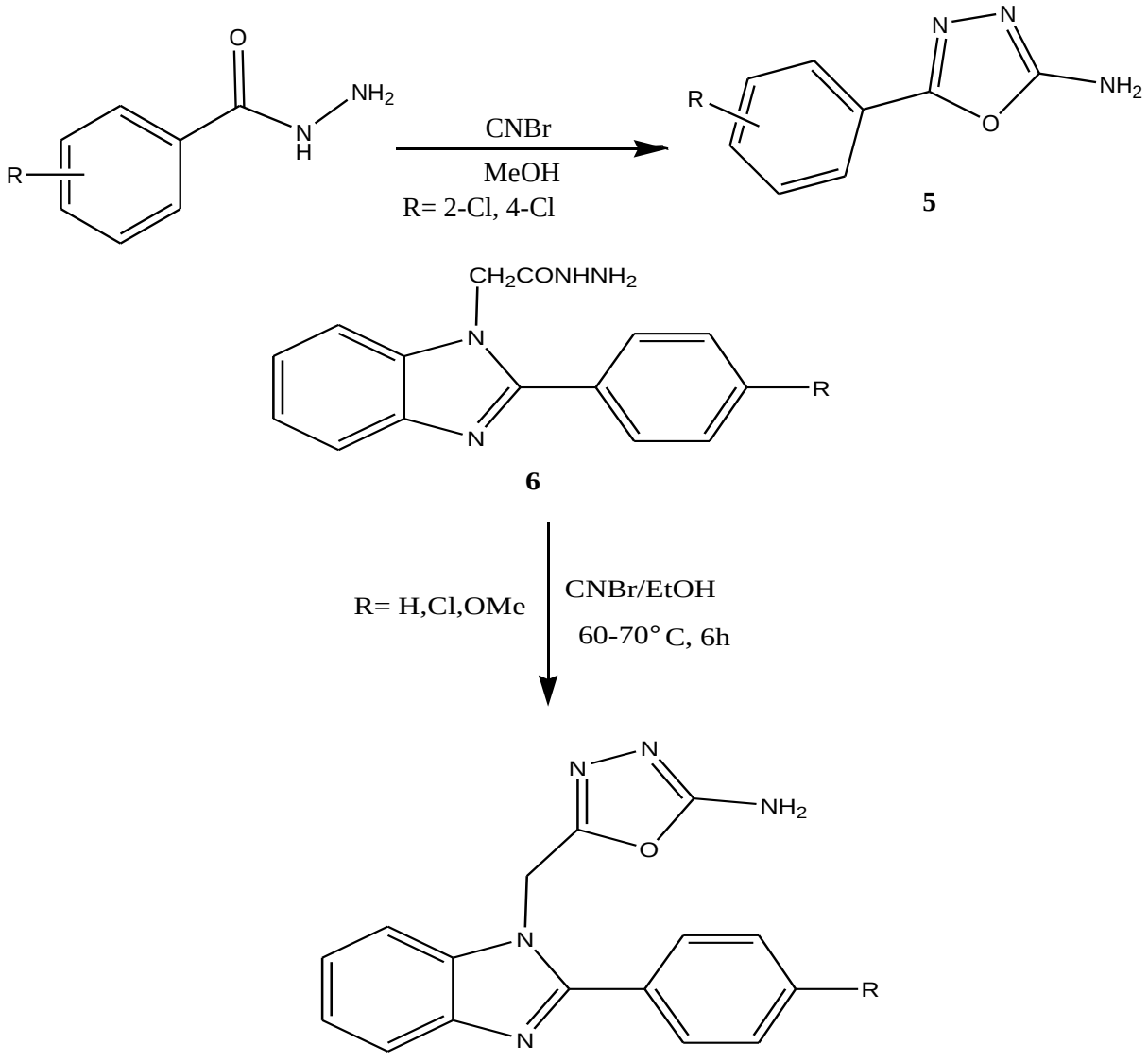


Figure no 3:- 5-Aryl-2-amino-1,3,4-oxadiazole obtained from acylhydrazides and cyanogen bromide.

Scheme 2- 5-Aryl-2-amino-1,3,4-oxadiazole derived from acylhydrazides and di (benzotriazol-1-yl) methanimine.

Katritzky and his colleagues have made high yields of 5-aryl-2-amino-1,3,4-oxadiazole compounds from the reaction of di(benzotriazol-1-yl)methanimine with arylhydrazides, as shown in Scheme 1.

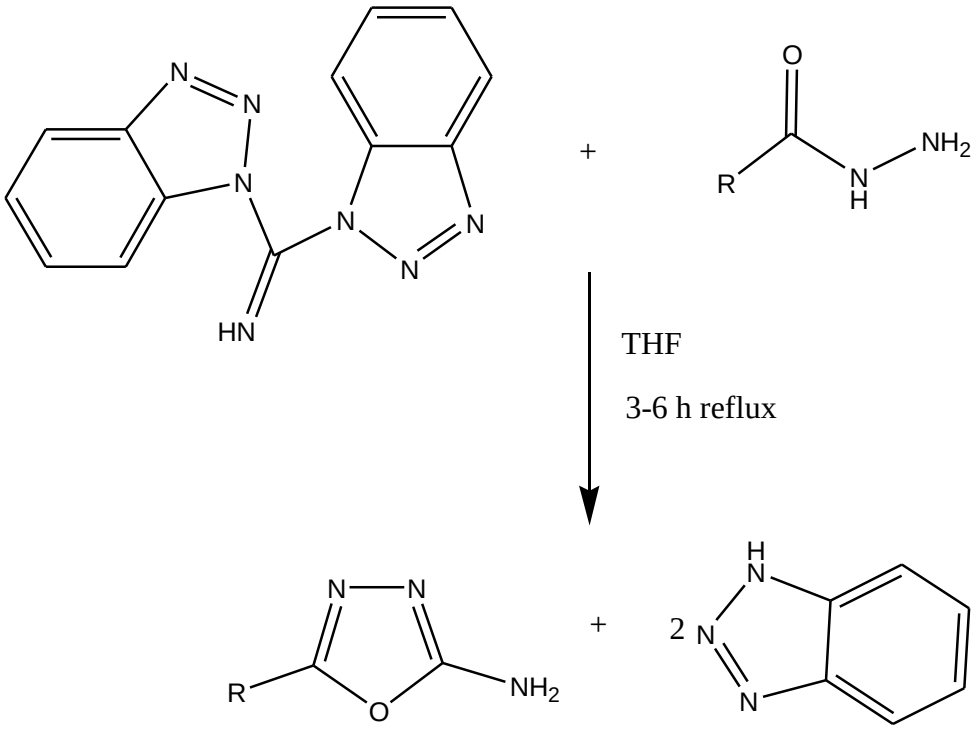


Figure no4:- 5-Aryl-2-amino-1,3,4-oxadiazole obtained from acylhydrazides and di(benzotriazol-1-yl)methanimine.

2.2. How 5-Substituted-1,3,4-oxadiazole-2-thiols are made.

Scheme 3: Making 5-modified 1,3,4-oxadiazole-2-thiols.

The principal way to make 5-substituted-1,3,4-oxadiazole-2-thiol(thione) is for an acylhydrazide and carbon disulfide to combine in a basic alcohol solution, and then the reaction mixture is made more acidic. Compounds are known to have thiol-thione tautomerism, and one of the two forms generally takes over.(1).

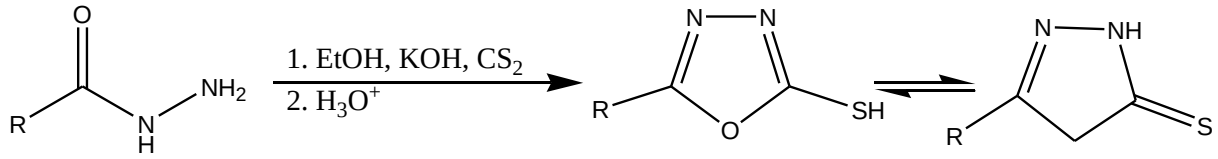


Figure no5:- Synthesis of 5-substituted-1,3,4-oxadiazole-2-thiols.

2.3. Different ways to make 1,3,4-oxadiazole.

Scheme 4: XtalFluor-E has been used to convert 1,2-diacylhydrazines into useful products.

In recent years, multicomponent reactions (MCRs) have become key tools in current preparative synthetic chemistry. This is because MCRs combine numerous operational stages without isolating intermediates or changing the conditions, which makes them more efficient. For example, the 1:1 iminium intermediate that is formed when a secondary amine is added to an aromatic bis-aldehyde is trapped by the Nisocyaniminotriphenylphosphorane in the presence of an aromatic carboxylic acid derivative. This leads to the creation of a matching iminophosphorane intermediate. Then, the iminophosphorane intermediates go through an aza-Wittig reaction within the molecule, which makes the disubstituted 1,3,4-oxadiazole derivatives. The reactions were completed in neutral circumstances at room temperature, and good yields of the appropriate disubstituted 1,3,4-oxadiazole derivatives were produced. Using XtalFluor-E ([Et2NSF2]BF4) as a cyclodehydration reagent, 1,2-diacylhydrazines were turned into different functionalized 1,3,4-oxadiazoles. In most cases, the yields were higher when acetic acid was added to the process.

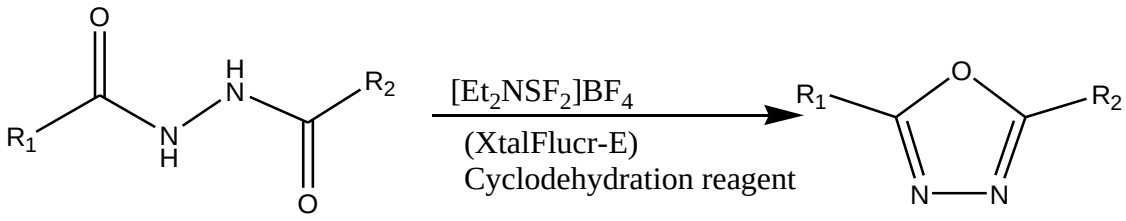


Figure no 6

Scheme 4: How a secondary amine and cinnamaldehyde react with one other.

The reaction between a secondary amine and cinnamaldehyde made an iminium intermediate, which was then reacted with Nisocyanimino-triphenylphosphorane in the presence of benzoic acid derivatives to make an iminophosphorane intermediate. The iminophosphorane intermediate then underwent an intramolecular aza-Wittig reaction, which led to disubstituted 1,3,4-oxadiazole derivatives. The synthesis was done in neutral circumstances at room temperature, and the results were quite good. Solid phase organic synthesis (SPOS) has recently been thought of as a good way to do organic synthesis. cyclodesulfurization processes of acyldithiocarbazate resin are utilised to make 1,3,4-oxadiazoles in a good way using this method.

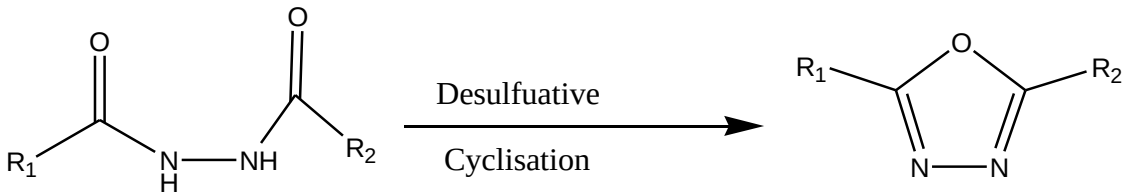


Figure no 7

Scheme 5: Using benzaldehydes that have been changed in glacial acetic acid.

By mixing 2-methyl-3-(5-phenyl-1,3,4-oxadiazole-2-yl)-quinazoline-4(3H)-one with substituted benzaldehydes in glacial acetic acid, a series of 3-(5-phenyl-1,3,4-oxadiazole-2-yl)-2-(substituted styryl)-quinazoline-4(3H)-ones were made. The 2-methyl-3-(5-phenyl-1,3,4-oxadiazole-2-yl)-quinazoline-4(3H)-one was made by heating the 2-amino-5-phenyl-1,3,4-oxadiazole with the 2-methylbenzoxazin-4(3H)-one in a reflux. In the presence of glacial acetic acid, benzaldehyde semicarbazone and bromine were used to make 2-amino-5-phenyl-1,3,4-oxadiazole. On oxidative cyclization of aromatic aldehyde semicarbazides with bromine in acetic acid in the presence of sodium acetate, 2,5-disubstituted 1,3,4-oxadiazoles were said to be made.(3).

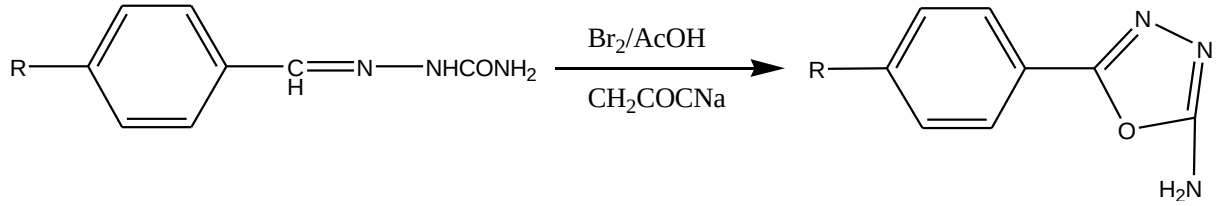


Figure no 8

Plan 6: Starting with isothiazole

Kiselyov et. al. (2010) said that oxadiazole may be made by letting an isothiazole derivative boil with pure hydrazine hydrate for 4 hours. The hydrazide may then be reacted with isothiocynates, and the intermediate thiosemicarbazides can be cyclized in place with DCC to make the crucial molecules.

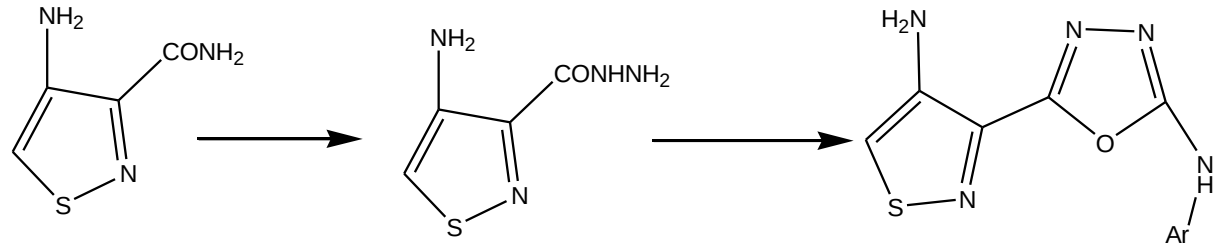


Figure no 8

Scheme 7: Starting with Thiosemicarbazide

Barbuceanu et. al. (2010) revealed that N1-[4-(4-bromophenylsulfonyl)benzoyl]-N4-(4-fluorophenyl)-thiosemicarbazide and mercuric chloride may be used to make oxadiazole.

Oxide (HgO) in an ethanol solution I2/KI in a NaOH solution.

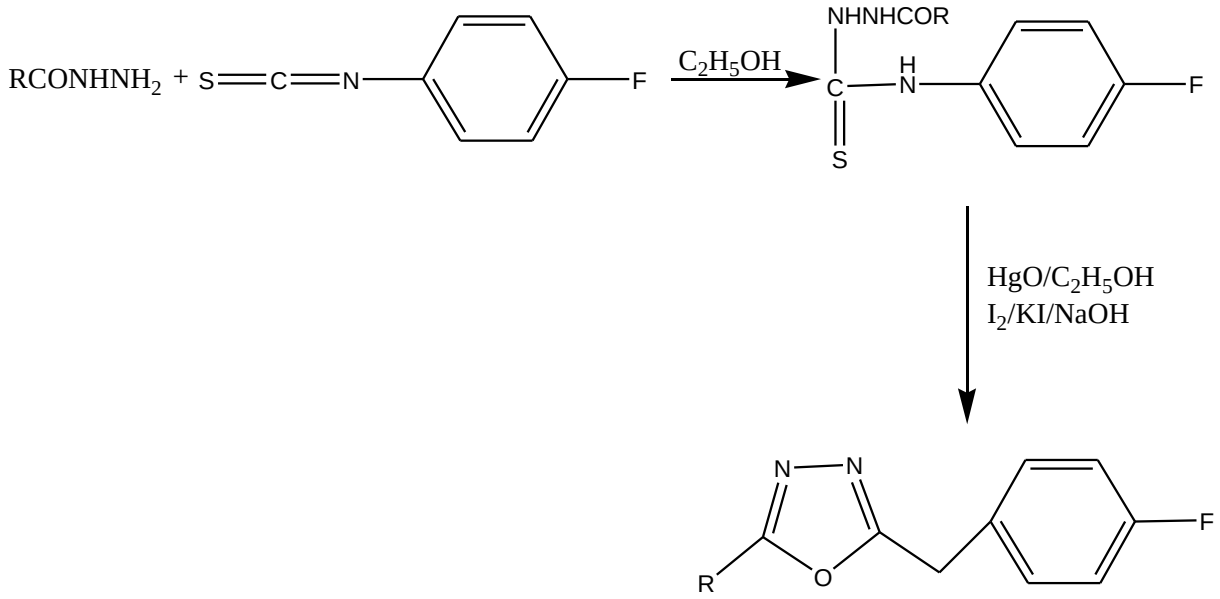


Figure no 9

Scheme 8- From N-acyl hydrazones

Prakash et. al. revealed in 2010 that a series of new 2,5-disubstituted 1,3,4-oxadiazoles may be made by oxidative cyclization of pyrazolylaldehyde N-acyl hydrazones under moderate circumstances.

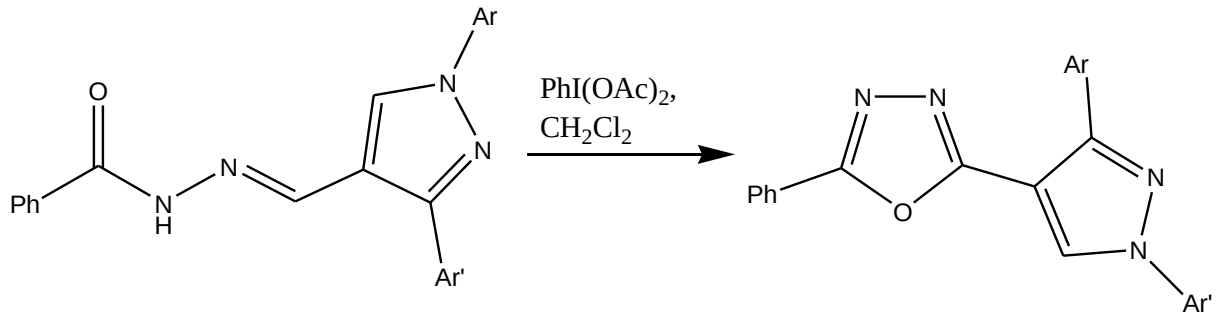


Figure no 10

Scheme 9: Starting with acid hydrazides

Husain et. al. (2010) revealed that 1,3,4-Oxadiazole may be made by mixing 4 oxo-4(biphenyl-4-yl)butanoic acid (fenbufen) with aryl acid hydrazides in phosphorous oxychloride. (8).

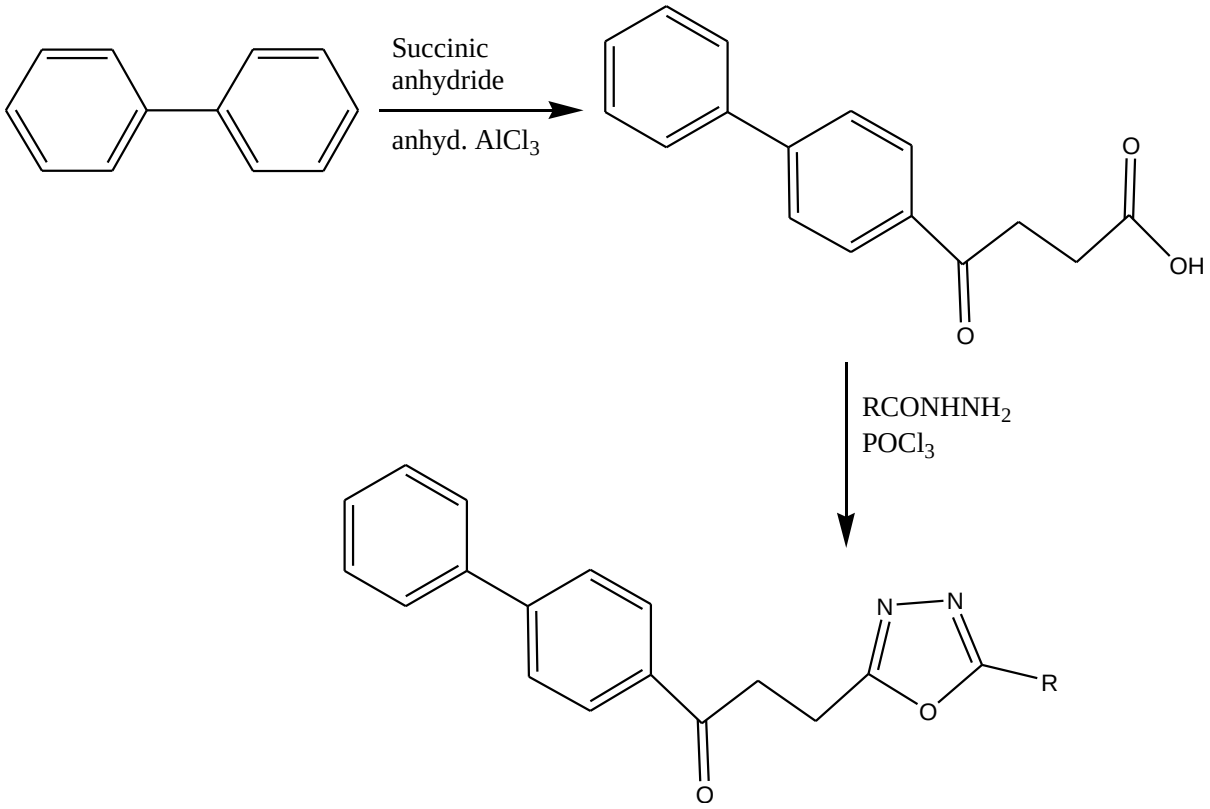


Figure no. 11

Scheme 10: Using a cyclization procedure to make 1,3,4-oxadiazol-2-amines

Iodine is added to acylthiosemicarbazides.

The cyclization reaction of acylthiosemicarbazides with iodine as the oxidising agent is the way to make 5-substituted-2-amino-1,3,4-oxadiazoles. El-Sayed and his colleagues made 5-((naphthalen-2-yloxy)methyl)-N-phenyl-1,3,4-oxadiazol-2-amine with a 62% yield by heating compound 3 in ethanol with sodium hydroxide and iodine in potassium iodide.

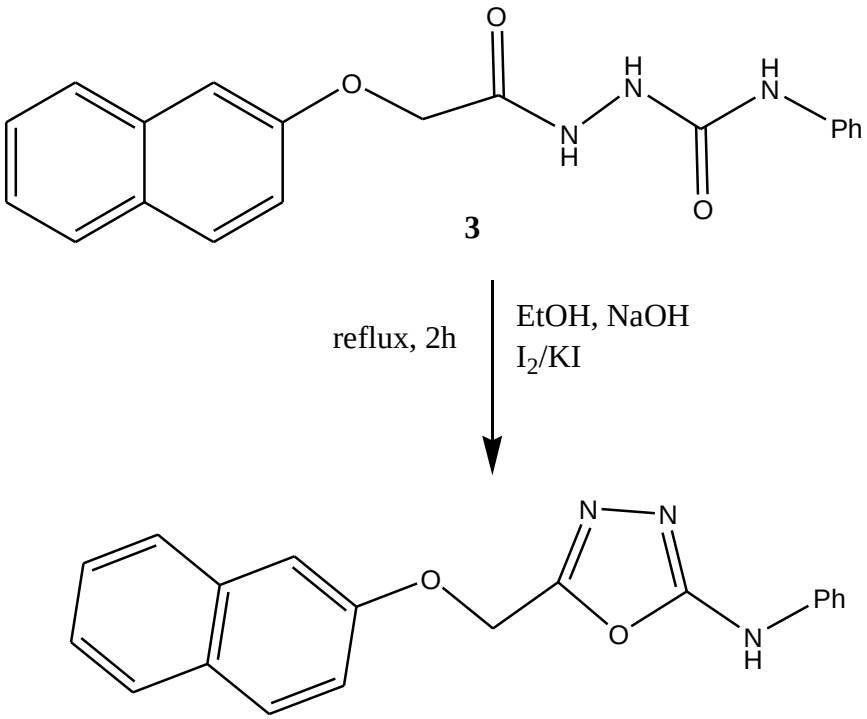
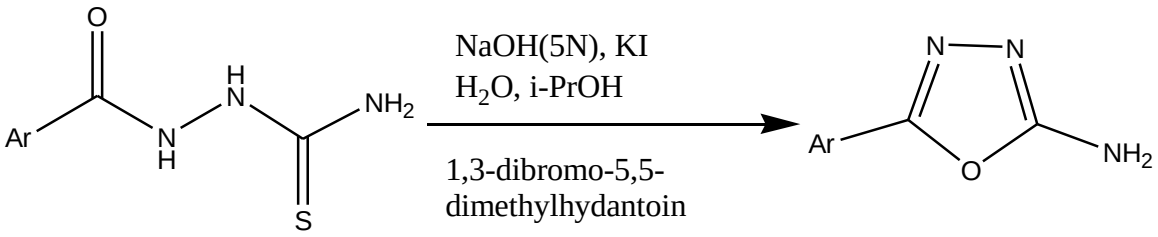


Figure no. 11

Scheme 11: Using acylthiosemicarbazide and 1,3-dibromo-5,5-dimethylhydantoin to make 5-aryl-2-amino-1,3,4-oxadiazole.

Rivera and his colleagues found that 1,3-dibromo-5,5-dimethylhydantoin works well as an oxidising agent for acylthiosemicarbazide cyclization processes. Compounds were rearranged in a way that produced 5-aryl-2-amino-1,3,4-oxadiazoles in high yield. The key benefit of this approach is that the reagents can be bought cheaply and are safe to use. Also, it may be employed when other oxidising agents can't be used in large-scale synthesis.



Ar = Ph, 4-ClC_6H_4, 4-$MeOC_6H_4$

Figure no. 12

Scheme 12: Making 1,3,4-oxadiazole derivatives of ibuprofen that are 2,5-dissubstituted.

The 5-(2,4-dichloro-5-flurophenyl)-2-(aryl)-1,3,4-oxadiazole compounds that didn't fit together well were Zheng and his colleagues said that the equivalent diacylhydrazines were made by refluxing them with phosphorus oxychloride in two phases. If you don't want to separate out the intermediate diacylhydrazine, a carboxylic acid, an acylhydrazide, and POCl3 as a dehydrating

agent are usually employed in a one-pot synthesis. In a similar way, Amir and Kumar reported making new 2,5-disubstituted-1,3,4-oxadiazole derivatives by starting with ibuprofen, which is an anti-inflammatory medication. In the reaction of acylhydrazide with substituted aromatic carboxylic acids, phosphorus oxychloride (POCl3) was utilised to get rid of the water.

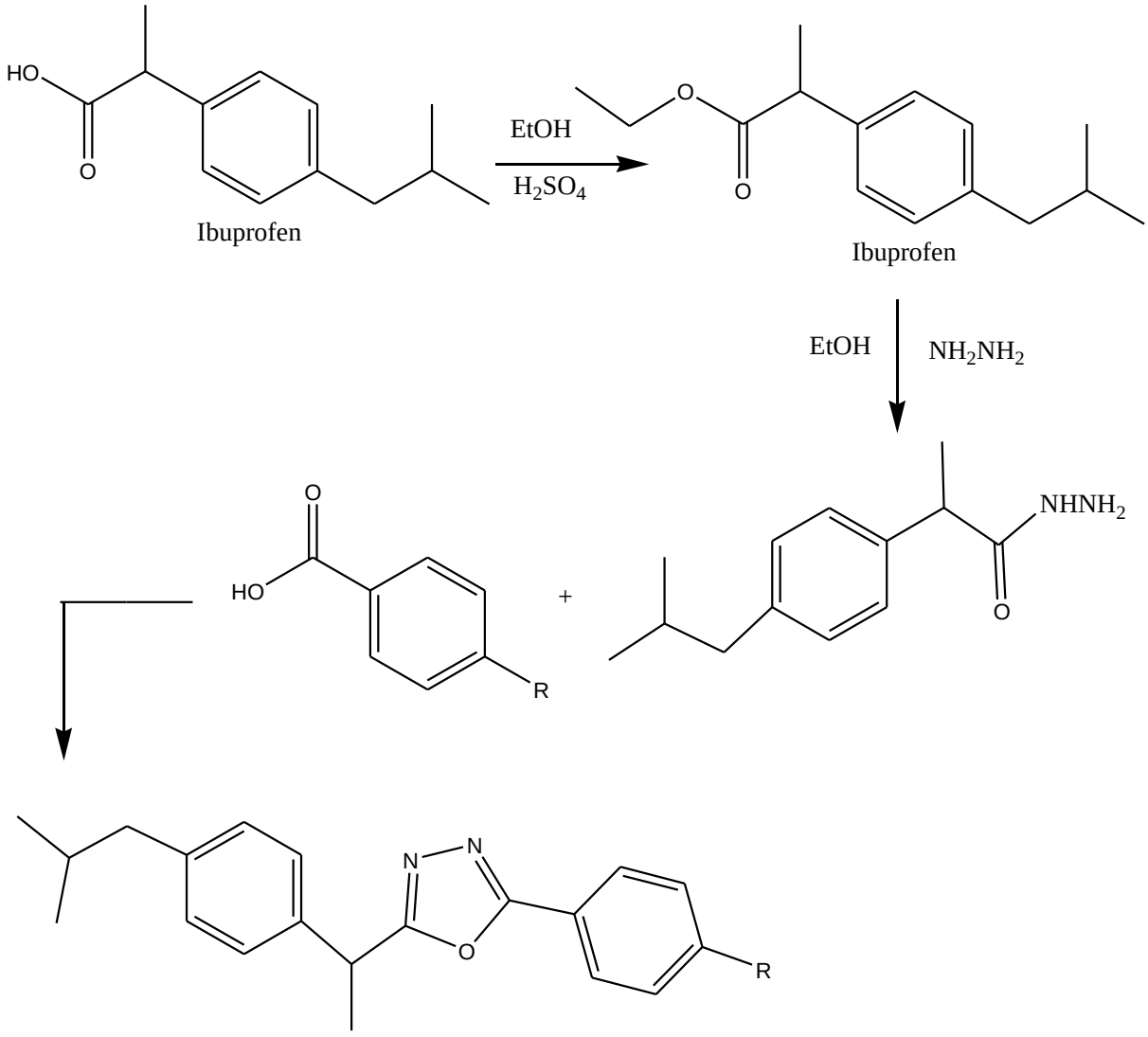


Figure no. 13

Scheme 13: Using 1,2-diacylhydrazines and zirconium(IV) chloride to make 2,5-disubstituted 1,3,4-oxadiazoles.

Sharma and his colleagues came up with a straightforward, generic approach for making 1,3,4-oxadiazoles from diacylhydrazines by employing the cheap catalyst ZrCl4. Advantages over the current approaches include greater yields, quicker reaction times, and a straightforward experimental process.(1).

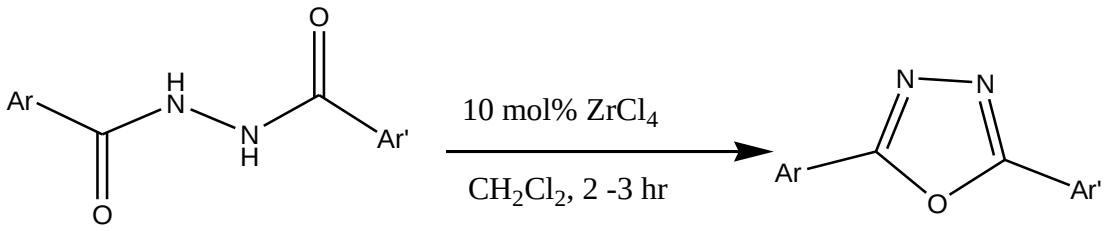


Figure no. 14

3. 1,3,4-Oxadiazoles Have the Following Pharmacological Effects:

3.1 Antimicrobial activity

The recent rise of medication resistance in treating infectious illnesses has shown how important it is to find new antimicrobial medicines that are safer and work better. Compounds with a 1,3,4-oxadiazole core have been shown by several studies to be very good at killing bacteria.

Oliveira and his colleagues reported the production and antistaphylococcal activity of 1,3,4-oxadiazolines 7 against methicillin- and aminoglycoside-resistant isolates of Staphylococcus aureus. glycosides (MARSA) and those code for efflux proteins (multidrug drugs resistant—MDR). in 4 to 32 g/mL, compounds 7 were effective in killing staphylococci. This made all of the compounds 2–8 times more effective than the conventional medication chloramphenicol.

A series of novel derivatives of 5-(1-/2-naphthyloxymethyl)-1,3,4-oxadiazol-2(3H)-thione (R=SH), 5-(1-/2-naphthyloxymethyl)-1,3,4-oxadiazole-2-amino (R=NH2), and 5-(1-/2-naphthyloxymethyl)-1,3,4-oxadiazol-2(3H)-ones (R=OH) 8 were synthesised and tested for their antibacterial activity. All of them worked against S. aureus, E. coli, P. aeruginosa, C. albicans and Candida sp. At least 64–256 mg/mL is needed to treat parapsilosis.

Patel and Patel tested the antibacterial activity of a series of derivatives with the 1,3,4-oxadiazole nucleus against Gram-positive (S. aureus MTCC 96 and S. pyogenes MTCC 442) and Gram-negative (E. coli MTCC 443 and P. aeruginosa MTCC 1688) microorganisms using ampicillin as the pharmacological standard. The chemicals 4-[5-(2-chlorophenyl)-1,3,4-oxadiazol-2-yl]benzenamine (9).

And the antibacterial and antifungal effects of 2-(5-amino-1,3,4-oxadiazol-2-yl)-4-bromophenol (10) and 5-(3,5-dibromophenyl)-1,3,4-oxadiazol-2-amine (11) were tested on Streptococcus aureus, Bacillus subtilis, Klebsiella pneumoniae, Escherichia coli, and Aspergillus Niger. Pannical. The testing indicated that streptomycin and griseofulvin were about as effective as the usual medications used to treat the disease.(1).

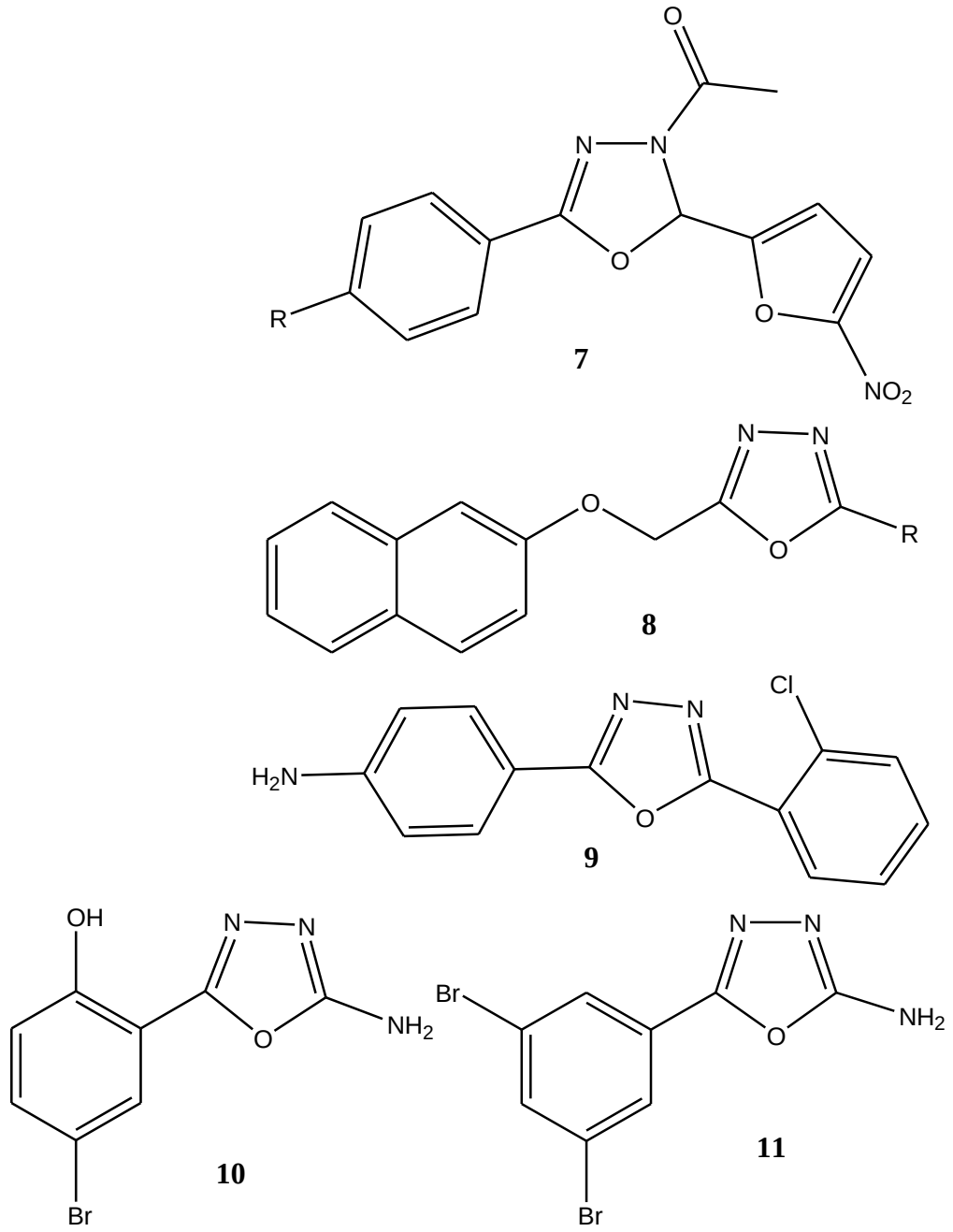


Figure no.15:- Disubstituted-1,3,4-oxadiazoles with antibacterial and antifungal activity.

2-(2-naphthyloxymethyl)-5-phenoxymethyl-1,3,4-oxadiazole (12) has the following properties:

anti-mycobacterial activity at a minimum inhibitory concentration of 6.25 g/Ml. Kumar and his team also looked at the anti-mycobacterial activity of a series of di-substituted oxadiazoles 13 with a thiazole unit against Mycobacterium tuberculosis H37RV. At a minimal inhibitory dose of 4 g/mL, the derivative with the Cl group worked very well. With a MIC50 value of 0.04 0.01 M, Compound 14 was about the same as Isoniazid.

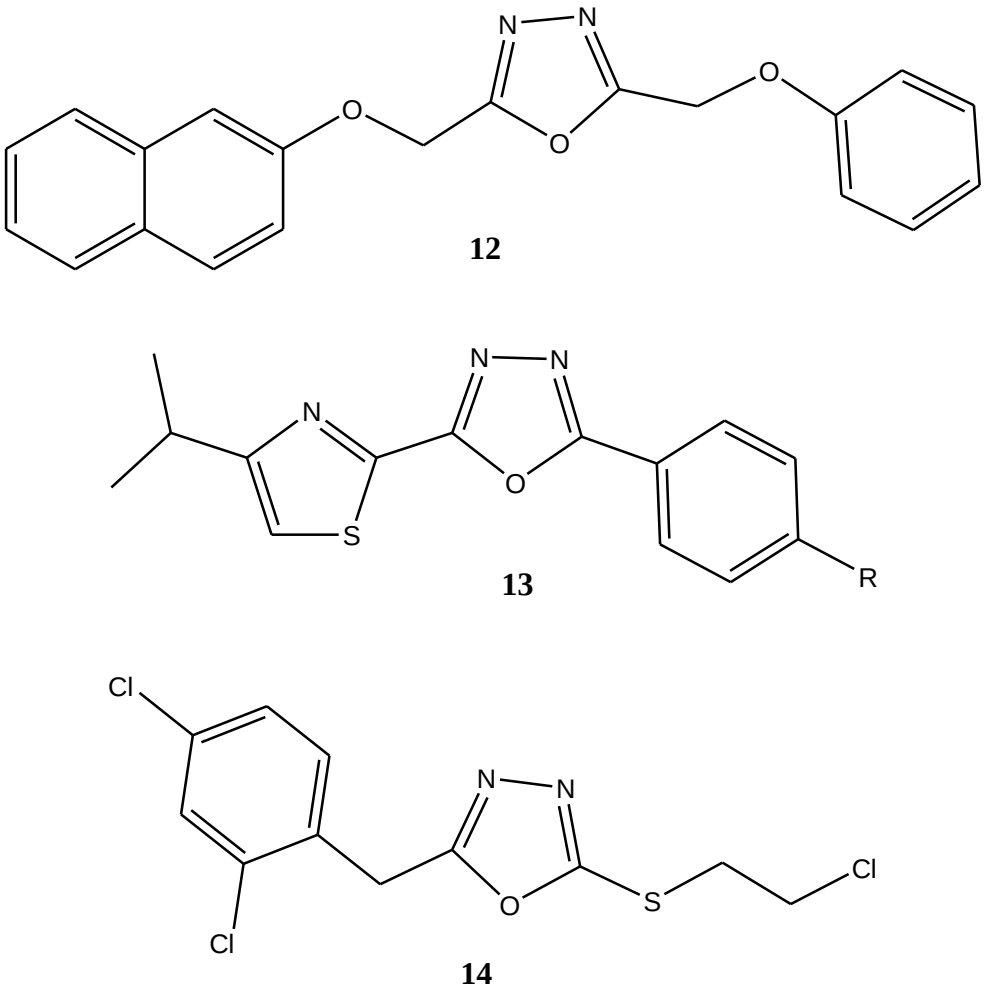
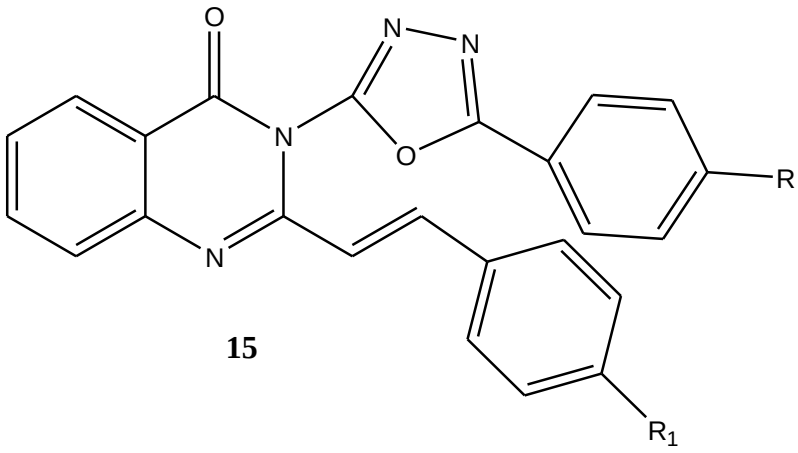


Figure no. 16:- 1,3,4-Oxadiazoles with anti-mycobacterial activity.

3.2. Acts to stop seizures

Kashaw and his colleagues made new 3-[5-(4-substituted)-phenyl-1,3,4-oxadiazole-2-yl]-2-styrylquinazoline-4(3H)-one oxadiazoles 15 and tested them for their ability to stop seizures. As seizure medicines, new 2-substituted-5-(2-benzylthiophenyl)-1,3,4-oxadiazole derivatives 16 were developed and made. The scientists observed that the anticonvulsant action is improved by adding an amino group to position 2 of the 1,3,4-oxadiazole ring and a fluorine replacement to position para of the benzylthio group.



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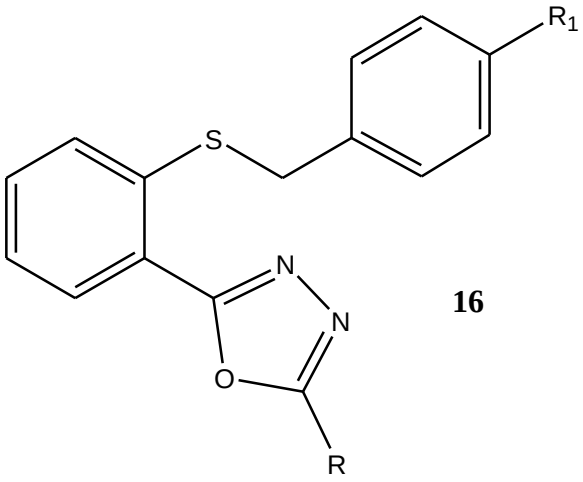

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Figure no. 17

3.3 Actions Against Inflammation

A group of oxadiazole derivatives of ibuprofen that include an arylpiperazine unit at position 17 position 3 of the oxadiazole ring were tested for anti-inflammatory efficacy by Manjunatha and his colleagues. They used paw edoema caused by carrageenan as a test method using salt diclofenac was used as an example. Compounds with 4-Cl, 4-NO2, 4-F, and 3-Cl groups were more active than sodium diclofenac. Compounds with 4-MeO and 2-EtO groups were less active.

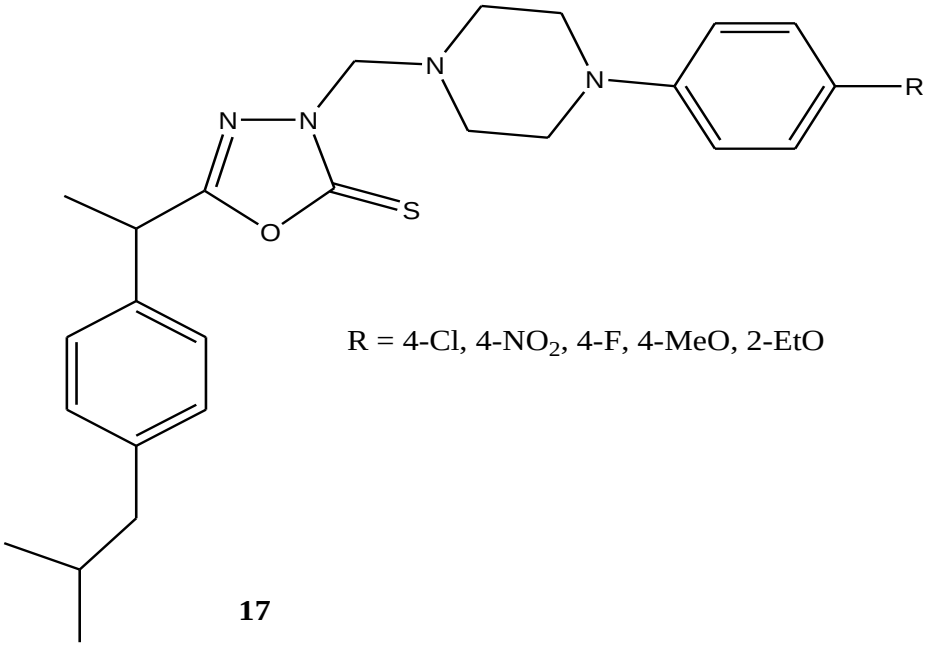

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Figure no. 18

Compound 18 was made from the anti-inflammatory medication fenbufen, and carrageenan-induced paw edoema was used to test it for anti-inflammatory action. Sodium diclofenac and fenbufen were used as standards. The compounds with 4-Cl, 4-NO2, 4-F, and 4-MeO groups were all around the same as fenbufen. The molecule with a 3,4-di-MeO group was stronger than fenbufen and about the same as sodium diclofenac.

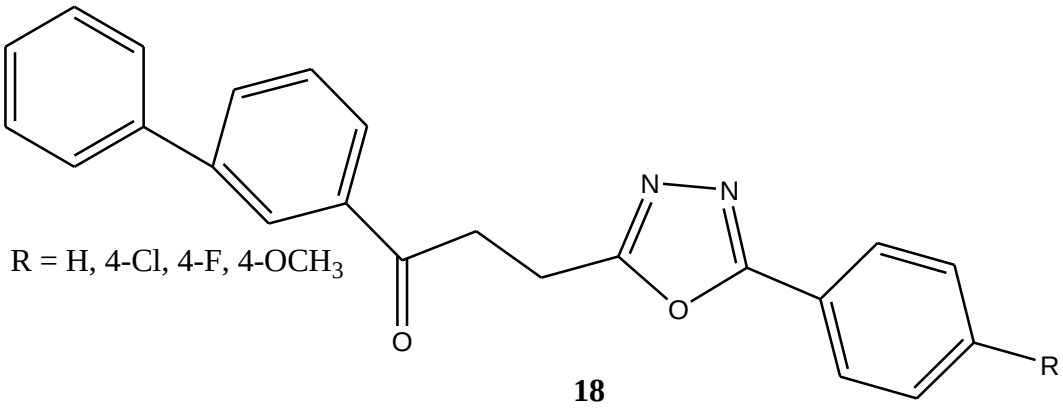

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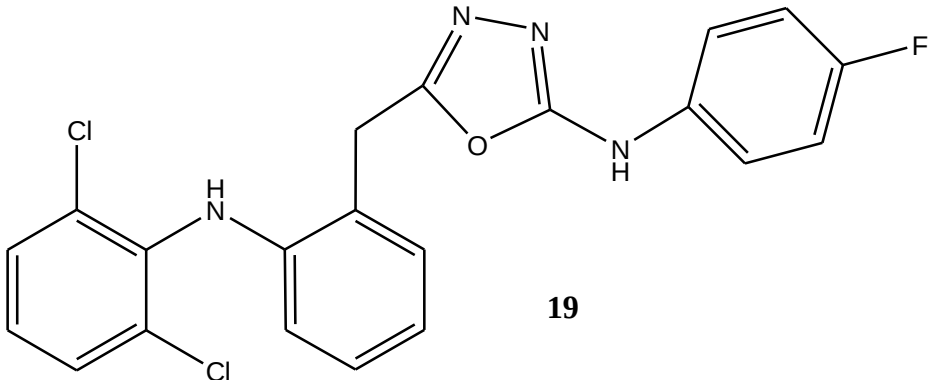
Figure no. 19

3.4. Analgesic Activity

3.4. Actions that reduce pain

5-(2-(2,6-Dichlorophenylamino)benzyl)-N-(4-fluorophenyl)-2-amino-1,3,4-oxadiazole (19) had a maximum analgesic activity of 81.86 percent, which was higher than sodium diclofenac. Compound 20 with the 2,4-dichlorophenyl group in the second position of the oxadiazole ring

had a maximum activity of (70.37 1.67%), which was practically the same as the conventional ibuprofen (73.52 1.00%).



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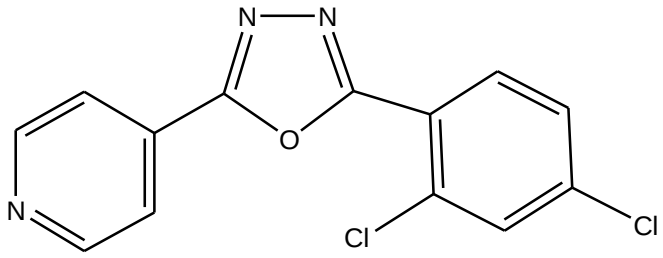

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Figure no. 20

3.5 Activity against cancer

Savariz and his colleagues made novel Mannich bases and tested their ability to kill cancer cells in a lab dish. Liu and his colleagues created a variety of 2-(benzylthio)-5-aryloxadiazole compounds and found that they stopped cells from growing and stopped EGFR from working. The biological activity of Compound 21 was strong (IC50 = 1.09 M for MCF-7 and 1.51 M for EGFR).

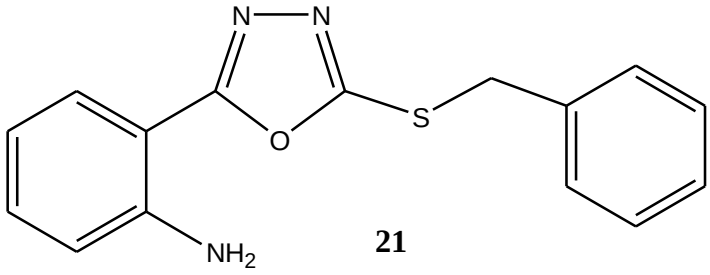

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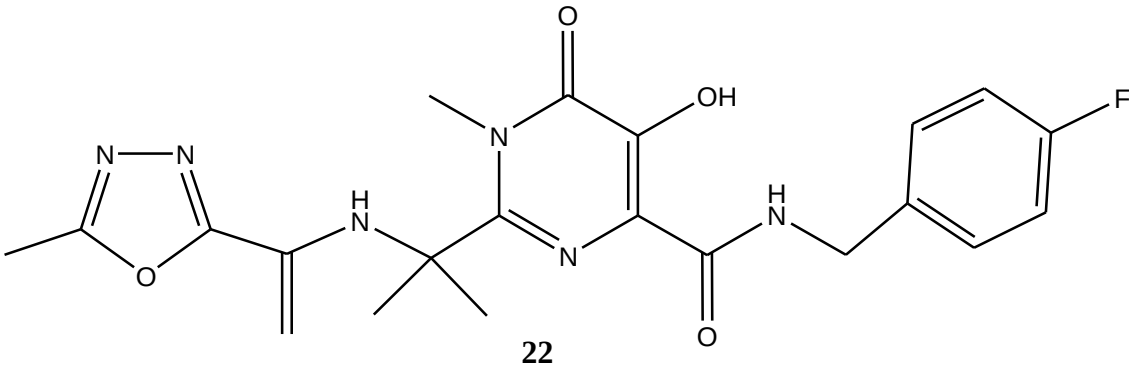
Figure no. 21

3.6. Activity against viruses

On October 16, 2007, the US Food and Drug Administration (FDA) approved raltegravir 22 to treat human immunodeficiency virus (HIV)-1 infection in combination with other antiretroviral agents in treatment-experienced adult patients who have signs of viral replication and HIV-1 strains that are resistant to multiple antiretroviral agents. Integrase inhibitors, which Raltegravir is the first of, are a new kind of antiretroviral medication.

Wang and his colleagues wanted to find more promising molecules than raltegravir, so they changed the 5-hydroxyl group of the pyrimidine ring to make a series of raltegravir derivatives and tested them for their ability to fight HIV. The 5-hydroxyl group added to raltegravir derivatives made them much more active, which shows that the 5-hydroxyl group is not necessary. Compound 23, with a sub-picomol IC50 value, was the most effective anti-HIV agent of all the derivatives made. It was a novel and very effective anti-HIV agent.(1).



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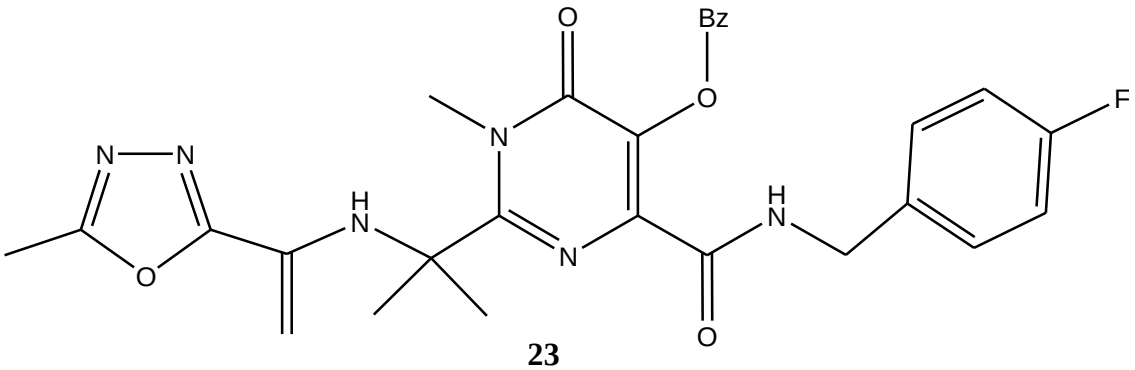


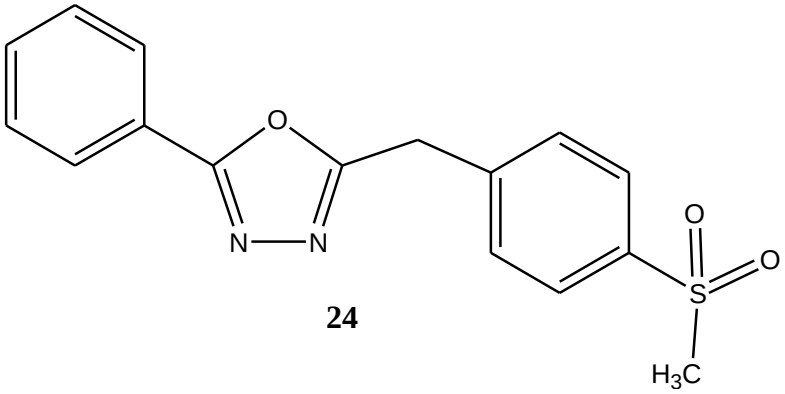
23

Figure no. 22

3.7 Activity of antioxidants

By adding various nucleophiles to arylsulfonylethylsulfonylacetic acid methyl ester and benzylsulfonylethylsulfonylacetic acid methyl ester, several novel disubstituted 1,3,4-oxadiazoles were made. All of the novel compounds were tested to see whether they were good antioxidants.

From 4-(alkylthio) phenyl actetonitrile, a number of novel 2-[4-(alkylsulfonyl)benzyl]-5-substituted-1,3,4-oxadiazoles have been made in a series of steps. All of the chemicals that were made were tested to see whether they were good antioxidants. The antioxidant activity investigation showed that 4-bromophenyl, 4-chlorophenyl, and 3,5-dimethylphenyl at the C-5 position of the oxadiazole ring work better than the conventional medication. (Poojary et al., 2012).



24

Figure no. 23

By reacting aromatic acid hydrazides with carbon disulfide in ethanolic potassium hydroxide, potassium salts of 1,3,4-oxadiazoles were made. This process was repeated eighteen times. The antioxidant properties of the synthesised 1,3,4-oxadiazoles derivatives were investigated, and compound (25), in particular, showed a lot of promise (Mohammed Hanif et al., 2012).(1).

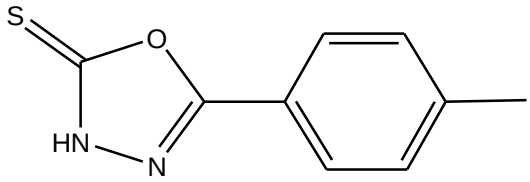


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Figure no. 24

3.8 CALCIUM CHANNELS BLOCKER

In this work, we looked at whether the treatment of endothelial dysfunction depends on the normalisation of high blood pressure by 1,3,4-oxadiazole derivative (NOX-1) in rats with high blood pressure caused by deoxycorticosterone acetate (DOCA-salt) and NG-nitro-l-arginine (L-NNA). The mean systolic blood pressure (MSBB) in DOCA-salt and L-NNA hypertensive rats was 185.34.7mmHg and 170.24.1mmHg, respectively. In hypertensive rats given NOX-1, the MSBB was 127.84.5mmHg and 120.25.1mmHg, respectively.

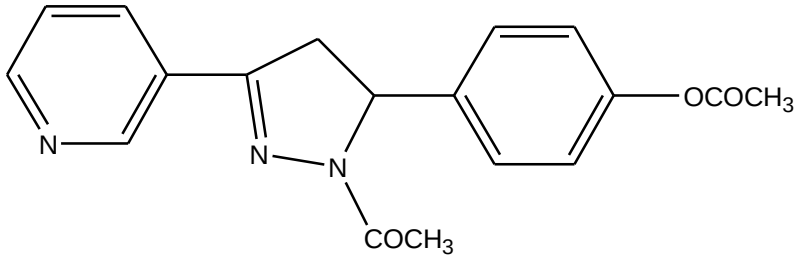

Figure no.25

3.9 ANTI ALZIMER ACTIVITY

Glycogen syntheses kinase-3b (GSK-3b) is linked to abnormally high levels of phosphorylation of tauprotein, and its inhibitors are thought to be good candidates for treating Alzheimer's disease. Here, we talk about the design, synthesis, and structure–activity correlations of a new class of oxadiazole compounds that work as GSK-3b inhibitors. Compound 20x was the most selective and powerful inhibitor of GSK-3b in vitro, and the way it bound to GSK-3b was found by looking at the X-ray structure of 20x and GSK-3b together.

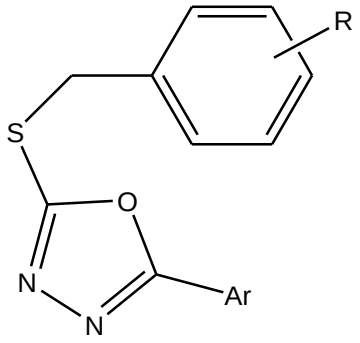

Figure no. 26

A set of 2,5-diphenyl-1,3,4-oxadiazole derivatives that can find b-amyloid plaques in the brains of people with Alzheimer's disease. The affinity for amyloid plaques was tested in a lab using Ab42 aggregates that had already been made. The Ki values for the new set of 1,3,4-DPOD derivatives ranged from 20 to 349 nM. This means that they were attracted to Ab42 aggregates. In an animal model of Alzheimer's disease, the 1,3,4-DPOD derivatives stained the b-amyloid plaques in a way that showed their affinity for Ab42 aggregates. Compared to 3,5-diphenyl-1,2,4-oxadiazole (1,2,4-DPOD) derivatives, they were able to get into the brain well and left the brain quickly when tested on normal mice. The new radioiodinated 1,3,4-DPOD derivatives may be excellent probes for finding b-amyloid plaques in the brain.

Alzheimer's brain.

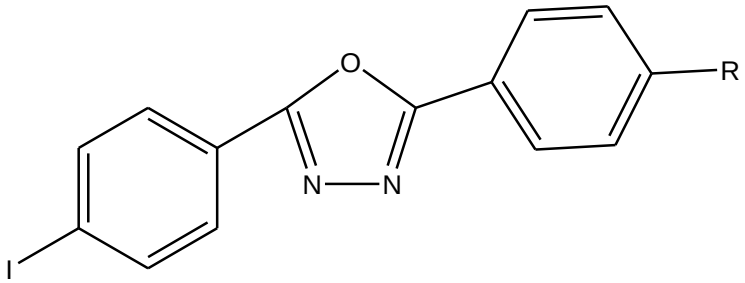

Figure no. 27

3.10 ANTIDIABETIC

In order to find benzimidazole derivatives with a wide range of pharmacological activities, a group of 4-thiazolidinones 5(a–j) and 1,3,4-oxadiazoles with a 2-mercaptobenzimidazole moiety were made and tested for in vivo anticonvulsant activity using the Maximal Electroshock (MES) model and for anti-diabetic activity using the Oral Glucose Tole(2).

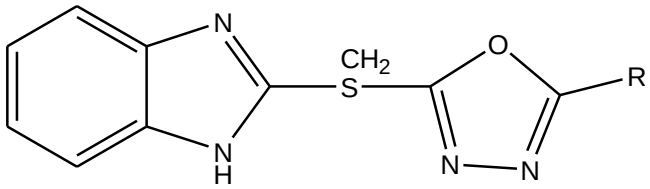

Figure no. 28

4. Conclusion:-

This review contains a summary of the ways to make 1,3,4-oxadiazole derivatives and the biological activities that have been described in the literature over the last several years. Most research organisations still employ similar synthetic techniques, but with new reaction conditions such new cyclization reagents, new catalysts, polymeric supports, and microwave radiation. In recent years, there haven't been many new ways of doing things. Also, the several synthetic processes shown might be used to help plan out novel compounds using the 1,3,4-oxadiazole unit. The many examples given here show that this group of chemicals has a wide range of pharmacological effects. In each article on biological activity, we only included a few examples of molecules with important activities. This is because these molecules might be used as models for making more active copies.

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