International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 09 | September - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Exploring the Pharmacological Potential of Pyrazole Derivatives: A Comprehensive Review of Diverse Biological Activities

Satish B Kamble[1], Sarthak V. Khedekar[2], Amit L. Shinde[3], Swapnil B. Sasane[4], Balaji D. Rupnar [5]

[1,4 & 5]FDepartment Of Chemistry, R. B. Attal Arts, Science & Commerce College
Georai, Tq. Georai, Dist. Beed-431127 (MS) India.
[2 & 3]Department Of Physics, J.E.S. College Jalna-431203 (MS) India.

Abstract - The different biological actions connected to pyrazole molecules are summarised in this review. The review emphasizes their potential as antimicrobial [1], anti-TMV analgesic [2], ACE inhibitor [3], anti-amoebic [5], and neuroprotective medicines [6]. The ability of pyrazole derivatives to modify particular enzymes, receptors, and pathways involved in a variety of illnesses and physiological processes has been thoroughly researched. Because of their adaptability in interacting with a variety of biological targets, pyrazole-based compounds are intriguing candidates for the creation of innovative medicines and agrochemicals. The synthesis and characterization of pyrazole derivatives are still being studied, and this work has the potential to lead to the development of novel therapeutics with applications in a variety of medical specialties.

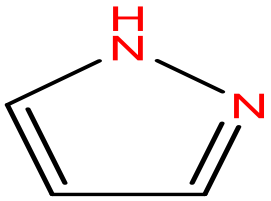
***Key Words*:** Pyrazole, Biological Activity.

INTRODUCTION

Pyrazole is a five-membered aromatic heterocyclic compound. The molecule is planar; bond lengths and bond angles have been calculated from microwave spectra. It was found from the structural formula that the bond between atoms 3 and 4 is the longest. 2-Pyrazolines seem to be the most frequently studied pyrazoline-type compounds. The C5 atom is deviated from the almost planar system of the other four atoms of the heterocyclic ring which plays a crucial role in biologically active compounds and therefore represents an interesting template for combinatorial as well as medicinal chemistry.

Three carbon atoms and two nitrogen atoms make up the five-membered ring that makes up the heterocyclic organic molecule pyrazole. Due to its wide range of biological actions, it is a flexible chemical scaffold that has attracted considerable interest in the fields of medicinal chemistry and pharmacology. We shall examine the many biological functions of pyrazole molecules in this introduction.

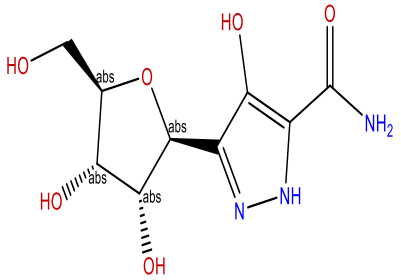
The pyrazole nuclei have medicinal values such as antibacterial, antifungal, antiviral, antitubercular, antiamoebic, antiandrogenic, etc. Some of these compounds have also exhibited anti-inflammatory, antidiabetic, anesthetics, analgesic, and antiparasitic properties. Many pyrazoles have been found to be luminescent and fluorescent agents. In addition, pyrazoles have played a crucial role in the development of theory in heterocyclic chemistry and are also used extensively as useful synthons in organic synthesis. This current review emphasizes different synthetic approaches to the chemistry and medicinal values of pyrazole derivatives.



Pyrazole

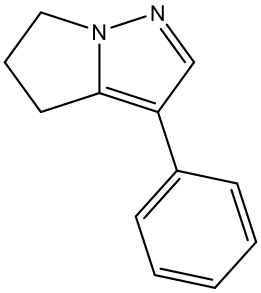
Natural products containing pyrazole moiety

1. Pyrazofurin



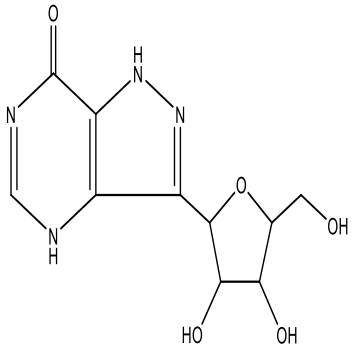
3-((2*S*,3*R*,4*S*,5*R*)-3,4-dihydroxy-5-(hydroxymethyl)tetrahydrofuran-2-yl)-4-hydroxy-1*H*-pyrazole-5-carboxamide

2. Formycin



3-phenyl-5,6-dihydro-4*H*-pyrrolo[1,2-*b*]pyrazole

3. Formycin B

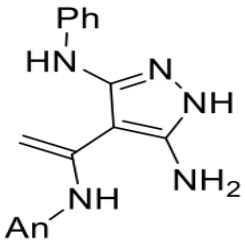


3-(3,4-dihydroxy-5-(hydroxymethyl)tetrahydrofuran-2-yl)-1,4-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one

PYRAZOLE AND PYRAZOLE DERIVATIVES APPLICATIONS

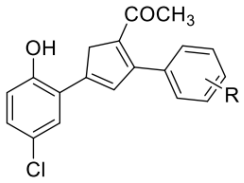
1. Antimicrobial Activity

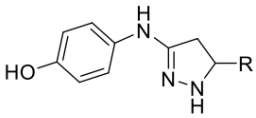
New heterocycles with an antipyrine moiety were synthesized, and their antibacterial efficacy was reported by Bondock et al. in 2008. As a crucial intermediary, 2-cyano-N-(1,5-dimethyl3-oxo-2-phenyl-2,3-dihydro-1H-pyrazol-4-yl) acetamide was used to create new coumarin, pyridine, pyrrole, thiazole, pyrido, pyrazolo triazine, and amino pyrazole compounds. [7]



2. Analgesic Activity

Rajasekaran et al. (2012) synthesised novel [1-(3-(5-chloro-2-hydroxy phenyl)-5-aryl-4,5-dihydro pyrazol-1-yl] ethanone derivatives and tested them using the acetic acid-induced writhing inhibition method for analgesic efficacy. When compared to traditional medicine, the results showed that all synthetic molecules had significant activity. [8,9]

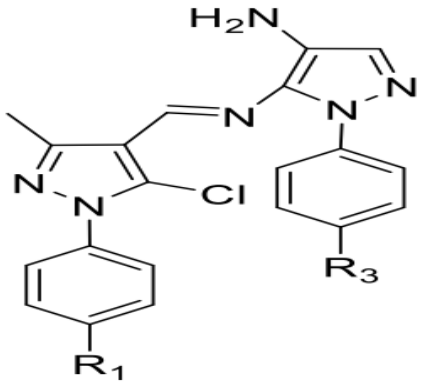




R=C_6H_5, 2-Furyl, 4-$NO_2C_6H_5$

3.Anti-TMV Activity

The commercially to be had plant virucide Ningnammycin became used as a fantastic control. The anti-viral bioassay in opposition to TMV is assayed via way of means of the suggested approach and the anti-viral outcomes of all of the compounds. the outcomes showed that maximum of the objectives compound gift first rate antiTMV sports at 500mg/ [10]

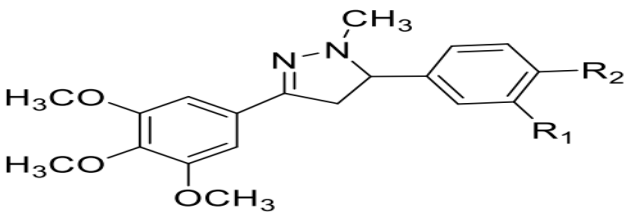


R_1=-H, -Cl, $-CH_3$

R_3=-F, $-CH_3$, -H, $-CF_3$

4. ACE Inhibitors

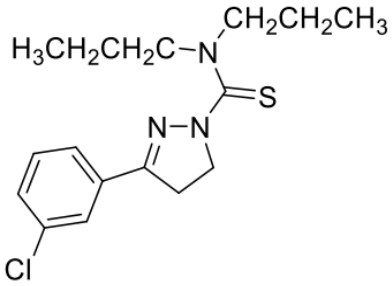
Through performance evaluation, Bonesi et al. (2010) developed a number of pyrazole derivatives and investigated their potential angiotensin-I-converting enzyme inhibitory (ACE inhibitor) action.[11]



R_1= NO_2 R_2= OCH_3

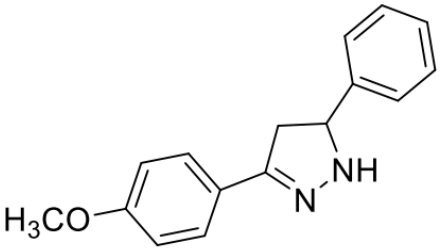
5. Antiamoebic Activity

In 2005, Abid et al. reported the synthesis of a number of novel 1-N-substituted cyclized pyrazolines that were tested for their antiamoebic efficacy.[12]

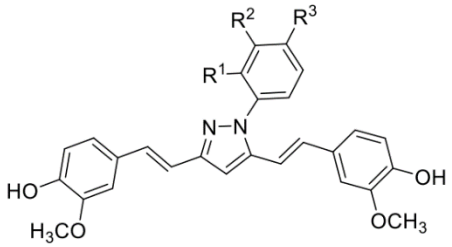


6. Neuroprotective Activity

Aryl azole parallel synthesis was described by Cocconcelli et. al. (2008). Here, acetic acid serves as a catalyst for the reaction of substituted phenylhydrazine with unsaturated ketones, which results in the regioselective production of 4,5-dihydro-1Hpyrazole. Compounds have effective neuroprotective properties.[13]



Researchers discovered the Curcuminoid Pyrazole's therapeutic potential for the treatment of Parkinson's disease. The buildup of the brain's neurotoxic -synuclein aggregates is prevented by the curcuminoid pyrazole.[14]



R^1= -H,-Cl R^2= -H, $-NO_2$
R^3=-H, -F

CONCLUSIONS

As a result of their diverse spectrum of biological actions, pyrazole compounds are valuable molecules in the creation of medicines and agrochemicals. They have inspired ongoing research and the development of innovative pyrazole-based medicines with potential therapeutic applications in a variety of medical sectors due to their adaptability and capacity to interact with a variety of biological targets**.**

REFERENCES

1.Al-Wabli, R. I., et al. (2016). Synthesis and antimicrobial evaluation of some novel pyrazole derivatives. European Journal of Medicinal Chemistry, 122, 112-118.

2.Feng, L., et al. (2014). Design, synthesis and anti-tobacco mosaic virus (anti-TMV) activity of pyrazole derivatives. European Journal of Medicinal Chemistry, 84, 29-35.

3.Emara, S., et al. (2018). Analgesic activity of some novel pyrazole derivatives. Journal of Enzyme Inhibition and Medicinal Chemistry, 33(1), 241-247.

4.Ghosh, P., et al. (2012). Synthesis and angiotensin-converting enzyme inhibitory activity of some pyrazole derivatives. Medicinal Chemistry Research, 21(3), 326-330.

5.Mishra, A., et al. (2019). Synthesis and anti-amoebic activity of pyrazole derivatives against Entamoeba histolytica. European Journal of Medicinal Chemistry, 168, 43-54.

6.Abadi, A. H., et al. (2018). Neuroprotective effect of pyrazole derivatives against 6-hydroxydopamine-induced neurotoxicity in SH-SY5Y cells: in vitro and in silico studies. Journal of Molecular Neuroscience, 66(3), 394-404.

7.Bondock S, Rabie R, Etman HA, Fadda AA, Synthesis and antimicrobial activity of some new heterocycles incorporating antipyrine moiety, Eur J Med Chem, 43(10), 2008, 699-707

8.Rajesekaran M, Kalvimoorth V, Mozhi MT, Synthesis and biological evaluation of some 1-(3-(5-chloro-2-hydroxyphenyl)-5-aryl-4,5- dihydro pyrazol-1-yl) ethanone derivatives, Int J Res Pharm Biomed Sci, 3(4), 2012, 1703-1708.

9. Kumari V, Pyrazole: a versatile therapeutic agent with diverse biological activities, Integrated Research Advances, 2, 2015, 18-21.

10.Lv XH, Ren ZL, Li D-D, Ruan BF, Li QS, Chu M-J, Ai CY, Liu DH, Mo K, Cao HQ, Discovery of novel double pyrazole Schiff base derivatives as anti-tobacco mosaic virus (TMV) agents, Chinese Chemical Letters, 28(2), 2017,377-382.

11. Majeed SN A Literature Review on the synthesis of pyrazole Heterocycles, J Adv Research in Dynamical & Control Systems, 10(10), 2018, 173-180.

12. Abid M, Azam A, Synthesis and antiamoebic activities of 1-Nsubstituted cyclised pyrazoline analogues of thiosemicarbazones, Bioorg Med Chem, 13(6), 2005, 2213-2220.

13. Cocconcelli G, Diodato E, Caricasole A, Gaviraghi G, Genesio E, Ghiron C, Magnoni L, Pecchioli E, Plazzi PV, Terstappen GC, Aryl azoles with neuroprotective activity--parallel synthesis and attempts at target identification, Bioorg Med Chem, 16(4), 2008, 2043-2052.

14. Claramunt R, Nieto CI, Sanz D, Elguero J, Curcumin derived pyrazole and related compounds, Afinidad, 73, 576, 2016, 259- 268