

A REVIEW ON PHARMACOLOGICAL ACTIVITY OF OXAZOLE DERIVATIVES

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ABSTRACT

Heterocycles showed important role in medicinal chemistry and responsible for therapeutic activity. Oxazole is heterocyclic compound containing oxygen and nitrogen atoms. It is weak basic substance which derived from replacement of methane group by azomethine nitrogen. Oxazole exhibits broad part of pharmacological activities like antimicrobial, anticancer, anti-inflammatory, antifungal, antibacterial etc. Thus, oxazole nucleus is important template for recent development and potential biological applications. In this review article we discussed properties and pharmacological activities of oxazole for approach to synthesized new drugs.

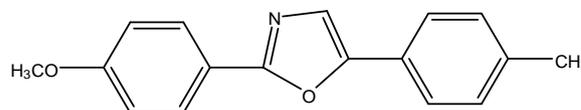
KEYWORDS: Oxazole, anticancer activity, antimicrobial activity, anti-inflammatory activity.

INTRODUCTION

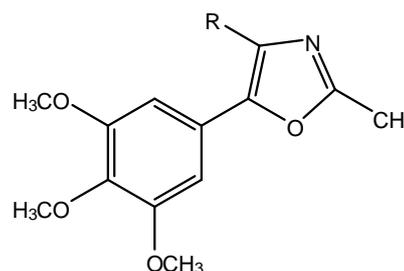
Biochemistry is very useful branch in progress of medicinal chemistry. The medicinal agents are heterocyclic compounds, synthesized from the different naturally or synthetic compounds which are related to the biochemistry. Heterocyclic compounds having oxygen and nitrogen are useful in field in biological activities. Oxazole is heterocyclic compound and its chemistry was started about in 1876 by synthesis of methyloxazole. It is five member nucleus with nitrogen and oxygen atoms. Oxazole gives essential and helpful information in field of medicine and industrial area because it possesses biological activity such as anticancer^[1-3], antimicrobial^[4-9], antiviral^[10], antifungal^[11-16], antibacterial^[17-20], pesticide^[21], anti-inflammatory^[22-24], analgesic^[25-26], anticonvulsant^[27-29], and antiprotozoal activities etc. In the past year various oxazole moiety showed pharmacological potential. From the literature it is observed that broad range in therapeutic potential of oxazole derivative is related to the interaction of oxazole nucleus with various proteins.

BIOLOGICAL ASPECTS OF OXAZOLE DERIVATIVES

Tomi et al^[31] have synthesized oxazole derivatives. They were used nutrient agar medium for screening of test compounds against bacteria *E. coli*, *S. aureus*, *P. aeruginosa* and dextrose agar medium for fungi *A. niger*, *C. albicans*. These test compounds were compared with ofloxacin and ketoconazole for bacteria and fungi respectively.

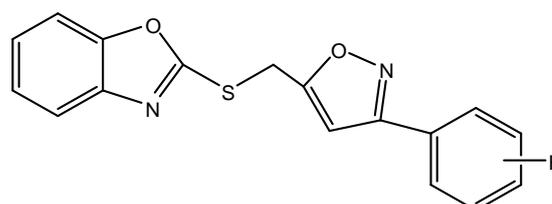


Romagnoli et al^[32] have reported that 2-methyl-4,5-disubstituted oxazoles exhibited anticancer activity and they found 4i & 4g showed potent anticancer agents.



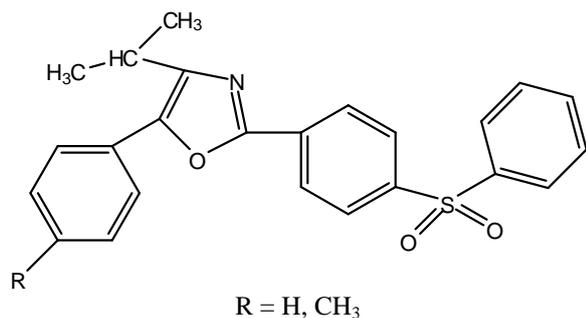
R = naphtha-2-yl, 4-FC₆H₄, 4-ClC₆H₄, 4-MeC₆H₄, 4-OMeC₆H₄, OEtC₆H₄

Benzo[d] oxazole 2-thiol/ oxazolo[4,5 b] pyridine 2-thioles have been synthesized by Gour et al^[33] and investigated these drugs for antimicrobial activity by using various bacteria and fungi.

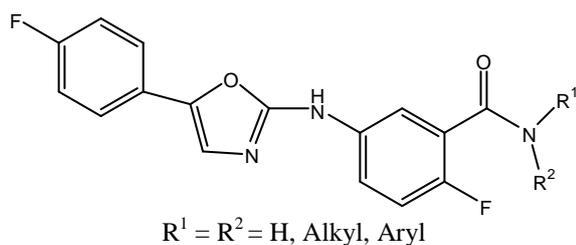


R = 3NO₂, 4CH₃, 3,4,5-OCH₃, 4Cl, 2Cl

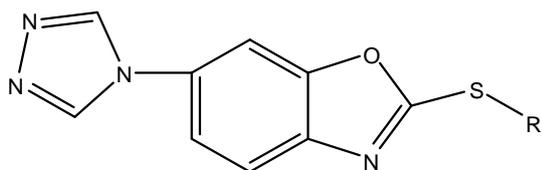
Apostol et al^[34] have prepared acyl alpha amino ketones and 1,3-oxazoles. These drugs were tested for antimicrobial activity.



Udhayasurian et al^[35] have synthesized 1,3-oxazole moiety. They exhibited biological activity of these drugs.

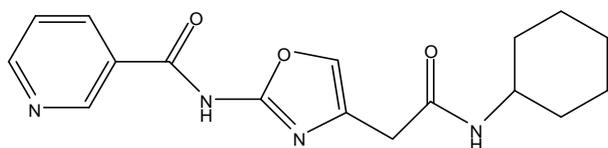


Oxazole nucleus has been prepared by Song et al.^[36] The new drugs are reported for their antidepressant and anticonvulsant activity.



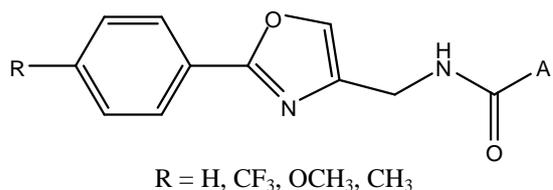
R = C₃H₇, C₄H₉, C₅H₁₁, C₆H₁₃, C₇H₁₅, C₈H₁₇, CH₂C₆H₅, CH₂C₆H₄(ortho-F), CH₂C₆H₄ (meta-F), CH₂C₆H₄(para-F), CH₂C₆H₄(ortho-Cl), CH₂C₆H₄(meta-Cl), CH₂C₆H₄(para-Cl), CH₂C₆H₃(2,4-diCl), CH₂C₆H₄(para-CH₃), CH₂C₆H₄(para-OCH₃)

Venkatasubramanian and Easwaramoorthy^[37] have reported preparation of novel oxazole nicotinamide derivatives. They have shown antimicrobial activity by taking various bacteria like *S. aureus* (ATCC9144), *S. epidermidis* (ATCC155), *E. coli* (ATCC25922), *K. pneumoniae* (ATCC11298) and fungi such as *C. albicans* (ATCC9029). For the screening antibacterial activity of new drugs they used nutrient agar medium and dextrose agar medium was used for antifungal activity.

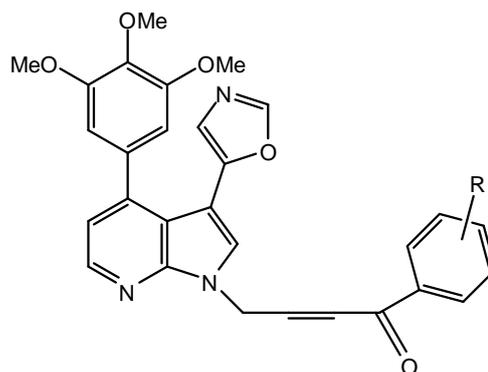


((2 phenyloxazol- 4yl) methyl) pyrimidine carboxamides have been prepared by Huang et al.^[38] These new

synthesized drugs exhibited potential fungal activities against various fungi.



Krishna et al^[39] have reported about arylketo alkyne derivatives of oxazole moiety and investigated anticancer activity. They had found that 10b, 10c, 10d, 10f & 10g compounds give more potent anticancer activity.



R = H, 3,4,5-trimethoxy, 4OCH₃, 4Cl, 4Br, 4NO₂, 3,5,diNO₂, 4-cyano, 4-methyl, 4-chloro & 3-nitro

CONCLUSION

Oxazole is useful heterocyclic compound because it is essential constituent for large number of drugs. This review give the importance of oxazole in field of pharmacological activities such as anti-inflammatory, anticonvulsant, antibacterial, antifungal, anticancer, analgesic activities etc. The potential power of oxazole can be modified by possessing of possible substituent and synthesized potent new drugs to improve future commitment.

REFERENCES

1. Pragathi YJ; Veronica D; Basaveswara Rao MV; Raju RR. Design, synthesis and anticancer activity of 1,3,4-oxadiazole Incorporated 5-(pyrimidin-5-yl) benzo[d] oxazole derivatives. Russian Journal of General Chemistry, 2022; 90: 2371-2375.
2. Kini DD; Mathews JE. Synthesis and biological evaluation of novel 6-(substituted benzylidene)-2-methylthiazolo[2,3-6]oxazol-5-(6H)one as potential anticancer agents. International Journal of Pharmaceutical Sciences and Research, 2020; 11(5): 2199-2205.
3. Pilyo SG; Kozachenko O P; Zhirnov VV; Kachaeva MV; Kobzar OL; Vovk AI; Brovarets VS. Synthesis and anticancer activity of 5-sulfonyl derivatives of 1,3-oxazole-4-carboxylates. Ukrainica Bioorganica Acta., 2020; 15(2): 13-20.
4. Raddy AB; Hymavathi RV; Swamy GN. A new class of multisubstituted oxazole derivatives:

- synthesis and antimicrobial activity. *Journal of Chemical Science*, 2013; 125(3): 495-509.
- Rawat BS; Shukla SK. Synthesis and evaluation of some new thiazole/oxazole derivatives for their biological activities. *World Journal of Pharmacy and Pharmaceutical Sciences*, 2016; 5(8): 1473-1482. (micro).
 - Eliwi AG; Dadoash SA-H; Ali ZZ; Atia AJK; Mohammed IR; Hussein. Antimicrobial activity and characterization of some oxazole, thiazole and quinoline. *Indian Journal of Forensic Medicine & Toxicology*, 2020; 14(1): 1222-1228.
 - Naganagowda G; Petsom A. Synthesis and antimicrobial activity of oxazolone, imidazolone and triazine derivatives containing benzothiophene. *Bull. Korean Chem. Soc.*, 2011; 32(11): doi.org/10.5012.
 - Patel B; Shaikh AR. Synthesis of new 1,3-oxazolyl-7-chloroquinazolin-4(3H)ones and evaluation of their antimicrobial activities. *Acta Poloniae Pharmaceutica-Drug Research*, 2011; 68(2): 223-230.
 - Al-Joubory AKJ; Abdullah LW; Mohammed AJ. Synthesis, characterization and biological activity evaluation of some pyrazoles, thiazole and oxazole derived from 2-mercapto aniline. *Baghdad Science Journal*, 2021; 18(1): doi.org/10.21123.(microbi)
 - Sochacka-Cwikla A; Regiec, A; Zimecki M; Artym J; Zaczynska E. Synthesis and biological activity of new 7-amino-oxazolo[5,4-d] pyrimidine derivatives. *Molecules*, 2020; 25(15): doi.org/10.3390. (viral)
 - Ryu CK; Lee RY; Kim NY; Kim YH; Song AL. Synthesis and antifungal activity of benzo[d]oxazole-4,7-diones. *Bioorganic & Medicinal Chemistry Letters*, 2009; 19(20): 5924-5926.
 - Malik D; Yadav P; Kumar S; Malik V. Synthesis characterization and fungicidal activity of 2-amino-4-(p-ethoxy phenyl) oxazole complexes of transition metal (II) ions. *Research Journal of Chemical Sciences*, 2014; 4(5): 48-51.
 - Xu H-L; Wei Y; Hao S. 4-Methylumbelliferone fused oxazole thioether derivatives: synthesis, characterization and antifungal activities. *Formerly Natural Product Letters*, 2020; 36(3): 707-713.
 - Wei Y; L S-Q; Hao S-H. New angular oxazole-fused coumarin derivatives: synthesis and biological activities. *Natural Product Research*, 2018; 32(15): 1824-1831. (fungi)
 - Jyothi S; Madhusekhar M; Sravya C; Zyryanov GV; Padmaja. Synthesis and antifungal activity of diamido methane linked oxazolyl/thiazolyl/imidazolyl isoxazoles. *AIP Conference Proceeding*, 2022; 2390: doi.org/10.1063.
 - Singh WM; Dash BC. Synthesis of some new Schiff bases containing thiazole and oxazole nuclei and their fungicidal activity. *Life, Earth & Health Sciences*, 1988; 22(11): 33-37.
 - Phalke PL. Synthesis of different alpha, beta unsaturated oxazolone derivatives. *Journal of Drug Delivery & Therapeutics*, 2019; 9(1): doi.org/10.22270. (bactrei)
 - Kaspady M; Narayanaswamy VK; Raju; Rao GK. Synthesis, antibacterial activity of 2,4-disubstituted oxazole and thiazole as bioisosteres *Letters in Drug Design & Discovery*, 2009; 6(1): 21-28.
 - Akram MAW; Lakshmi S; Shankar B; Gouda TS. Synthesis, characterization and biological evaluation of oxazolone derivatives. *International Journal for Pharmaceutical Research Scholars*, 2014; 3(2): 775-779. (bacteria)
 - Hashim ZB; Atia AJK; Al-Bayti RI; Al-Marjani MF; Salih RH. Synthesis of new 1,3-thiazole and 1,3-oxazole from 3-chlorobenzothiofene and evaluation of anti-bacterial activity. *Journal of Pharmaceutical Sciences and Research*, 2018; 10(6): 1629-1634.
 - Liu S; Ling Y; Li H; Xu D; Yang X. Design, synthesis and biological activity of novel substituted phenyl oxazole based compounds. *Chemical Journal of Chinese Universities*, 2014; 35(2): 281-285. {pesticide}
 - Kumar G; Singh NP. Synthesis, anti-inflammatory and analgesic evaluation of thiazole/oxazole substituted benzothiazole derivatives. *Bioorganic Chemistry*, 2021; 107: doi.10.1016.
 - Shakya AK; Kaur A; Al-Najjar BO; Naik RR. Molecular modeling, synthesis, characterization and pharmacological anti-inflammatory agents. *Saudi Pharm. J.*, 2016; 24(5): 616-624.
 - Crank G; Foulis MJ. Derivatives of 2-aminooxazoles showing anti-inflammatory activity. *Journal of Medicinal Chemistry*, 1971; 14(11): 1075-1077.
 - Marabathuni VJ; Mariyamma K; Sravani K; Ravindra P; Srihari R. Synthesis, characterization, anti microbial, analgesic activities of 3-(3-chlorophenyl) -5- phenyl-4,5- dihydro- 1,2-oxazole derivatives. *Asian Journal of Pharmaceutical Research*, 2017; 7(3): doi: 10.5958.
 - Sarkate AP; Shinbe DB. Synthesis and docking studies of 2- (nitrooxy) ethyl-2- (substituted-2, 5-diphenyl- oxazole)- acetate as anti-inflammatory agents with analgesis and nitric oxide releasing properties. *International Journal of Pharmacy and Pharmaceutical Sciences*, 2015; 7(10).
 - Trapani G; Franco M; Latrofa A; Carotti A; Cellamare S; Serra M; Ghiani CA; Tuligi G; Biggio G; Liso G. Synthesis and anticonvulsant activity of some 1,2,3,3a-tetrahydro pyrrolo[2,1-b] benzothiazol, thiazol- or - oxazol- 1-ones in rodents. *Journal of Pharmacy and Pharmacology*, 1996; 48(8): 834-840.
 - Yuede T; Xiaoyan H; Baoqi R; Binbin C; Mingxia S; Xianqing D. Synthesis and evaluation of the anticonvulsant activities of triazole containing benzo[d]oxazoles. *Chinese Journal of Organic Chemistry*, 2016; 36(10): 2449-2455.
 - Garg N; Chandra T; Kumar A. Synthesis and anticonvulsant activity of substituted quinoline

- derivatives. *International Journal of Pharmacy and Pharmaceutical Science*, 2010; 2(2): 88-92.
30. Carballo RM; Vazquez JP; Castillo DC; Quinones RQ; Espana AH; Moo-Puc RE; Chale-Dzul J; Mena-Rejo GJ. Synthesis and in vitro antiprotozoal activity of some 2-amino-4-phenyloxazole derivatives. *Tropical Journal of Pharmaceutical Research*, 2017; 16(8): 1951-1956.
 31. Tomi, IHR; Tomma, JH; Al-Daraji, AHR. Synthesis, characterization and comparative study the microbial activity of some heterocyclic compounds containing oxazole and benzothiazole moieties. *Journal of Saudi Chemical Society*, 2015; 19(4): 392-398.
 32. Roniagnoli, P; Baraldi PG; Prencipe F; Oliva P; Baraldi S; Salvador MK; Lopezcara LC; Brancale A; Ferla S; Hamel E; Ronca R; Bortolozzi R; Mariotto E; Porcu E; Basso G; Viola G. Synthesis and biological evaluation of 2-methyl-4,5-disubstituted oxazoles as a novel class of highly potent antitubulin agents. *Scientific Reports*, 2017; 7(46356): doi.org/10.1038.
 33. Gour PB; Rajani DP; Deshmukh L. Synthesis and antimicrobial activity of isoxazole tagged benzo[d]oxazole-2-thiol/oxazolo[4,5-b]pyridine-2-thiol derivatives. *International Journal of Research and Analytical Reviews*, 2018; 5(2): 410-417.
 34. Apostol TV; Marutescu LG; Draghici C; Socea LI; Olaru OT; Nitulescu GM; Pahontu EM; Saramet G; Preoteasa CE; Barbuceanu SF. Synthesis and biological evaluation of new N-acyl-alpha-amino ketones and 1,3-oxazoles derivatives. *Molecules*, 2021; 26 (5019): doi.org/10.3390. (micro)
 35. Udhayasurian R; Sivakumar K; Sajith AM; Joy MN. A modified approach for the synthesis of biologically relevant 5-substituted-2-N-aryl-1,3-oxazole derivatives in mild conditions. *Journal of Taibah University for Science*, 2020; 14(1): 807-811.
 36. Song MX; Rao B-Q; Cheng B-B; Yi; Wu; Zeng H; Luo Y-G; Deng X-Q. Design, synthesis and evaluation of the antidepressant and anticonvulsant activities of triazole containing benzo[d]oxazoles. *CNS & Neurological Disorders Drug Targets*, 2017; 16: 187-198.
 37. Venkatasubramanian H; Easwaramoorthy D. Synthesis and antimicrobial activity of novel oxazole nicotinamide derivatives. *International Journal of Pharma Science and Research*, 2019; 10(2): 78-83.
 38. Huang D; Zheng S; Cheng Y-X. Design, synthesis and biological evaluation of N-(2-phenyloxazol-4-yl)methyl)pyrimidine carboxamide derivatives as potential fungicidal agents. *Heterocyclic Communication*, 2020; 26: 185-191.
 39. Krishna AMS; Gandham HB; Valluru KR; Rao NSK; Sridhar G; Battula VR. Design, synthesis and anticancer activity of arylketa alkyne derivatives of 7-azaindole oxazole. *Chemical Data Collectio*, 2021; 34: doi.org/10.1016.