Journal of Current Pharma Research
(An Official Publication of Human Journals)
An International Peer Reviewed Journal For Pharmacy, Medical & Biological Science
DOI: 10.25166 CODEN: JCPRD6 NLM ID: 101744065
ISSN: Print: 2230-7834 Online: 2230-7842
SJIF Impact Factor: 6.913

Human Journals
Review Article
April 2022 Vol.:14, Issue:3
© All rights are reserved by Shelar Uttam B.

Review on Antimicrobial Activity of Imidazole

Journal of Current Pharma Research
(An Official Publication of Human Journals)
An International Peer Reviewed Journal For Pharmacy, Medical & Biological Science
DOI: 10.25166 CODEN: JCPRD6 NLM ID: 101744065

Shelar Uttam B. *

Department of Chemistry,
Shri Shiv Chhatrapati College Junnar, Pune,
Maharashtra, India – 410 502.

Submitted: 20 March 2022
Accepted: 26 March 2022
Published: 30 April 2022

Keywords: Imidazole, antimicrobial, heterocycle.

ABSTRACT

Imidazole is two nitrogen-containing heterocycles observed in many natural as well as synthetic compounds. Imidazole has a unique structure that makes it quite abundant in natural compounds like purine, histamine, histamine and nucleic acid. Due to its polar nature Imidazole is quite useful in optimizing the lead structures. Imidazole shows several biological properties including antimicrobial properties. Here we are reporting a review on the antimicrobial property of some Imidazole derivatives.

HUMAN JOURNALS
www.jcpr.humanjournals.com

INTRODUCTION

Imidazole is a five-member heterocycle having polar nature with water and polar solvent solubility. Imidazole exist in two tautomeric forms as hydrogen on the nitrogen atom can exist on any one of nitrogen atom as shown in figure no 1.

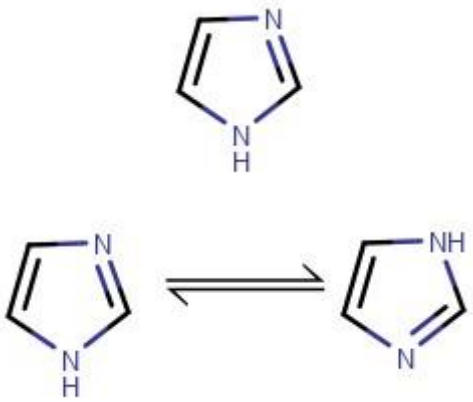
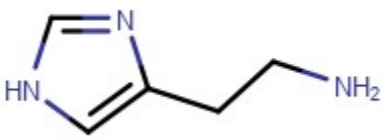


Figure no 1: Imidazole Nucleus

Biological applications of the Imidazole are well established and Imidazole is observed in many biological compounds like nucleic acid and histamine as shown in figure no 2.

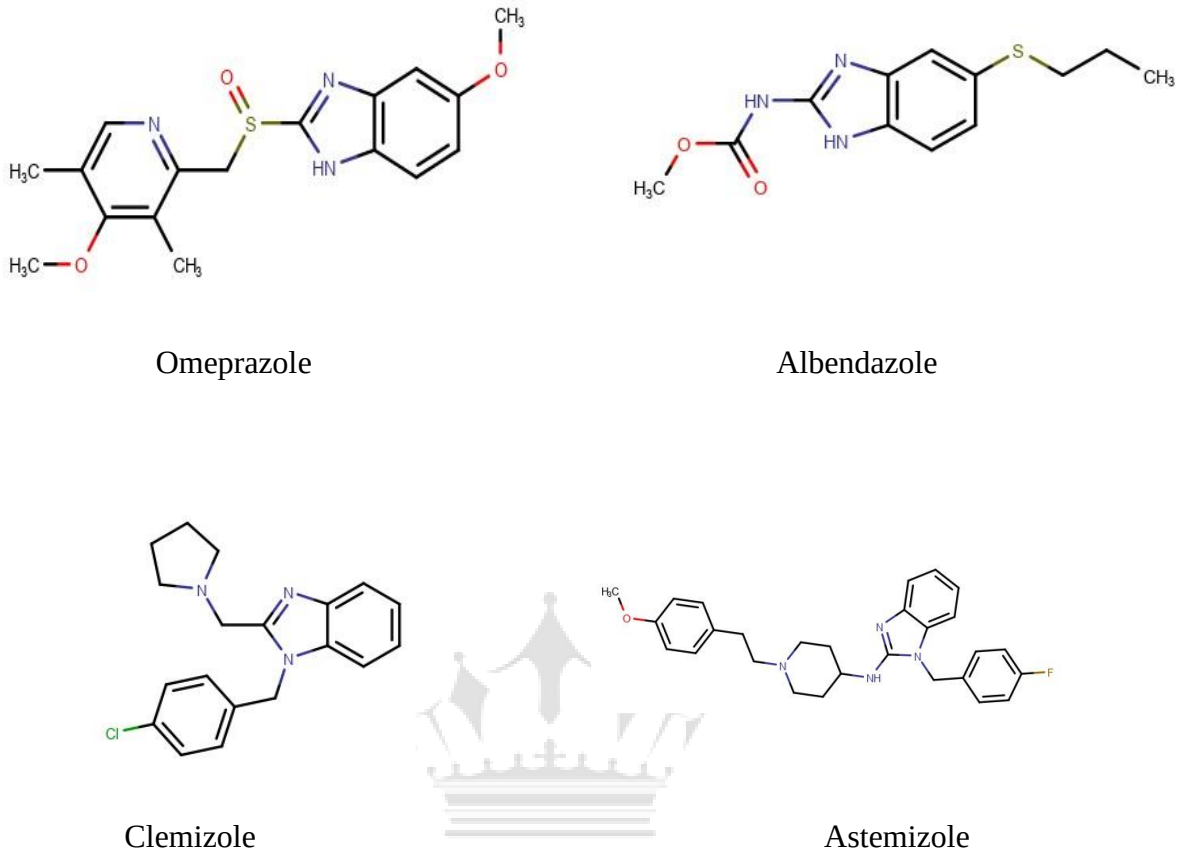
Adenine Guanine



Histamine

Figure no 2: Imidazole nucleus containing natural compounds

Imidazole has been an important component of many medicinal compounds which are shown in figure no 3.



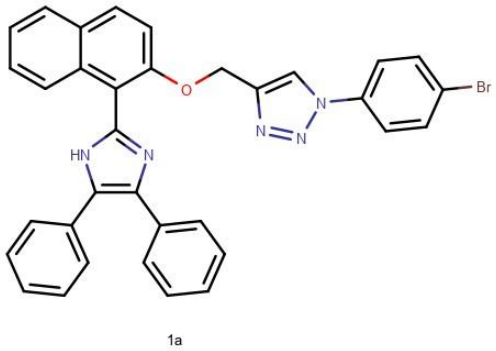
Omeprazole Albendazole

Clemizole Astemizole

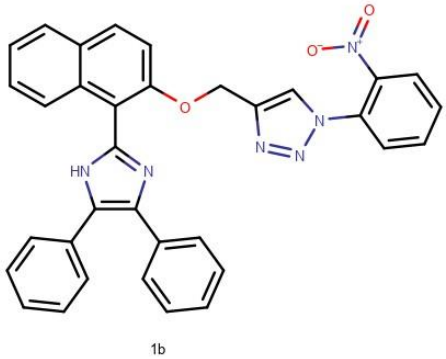
Figure no 3: Benzimidazole nucleus containing drugs

Number of compounds with potent antimicrobial activity with Imidazole as important pharmacophore is reported. Here we have summarized some antimicrobial applications of the imidazole.

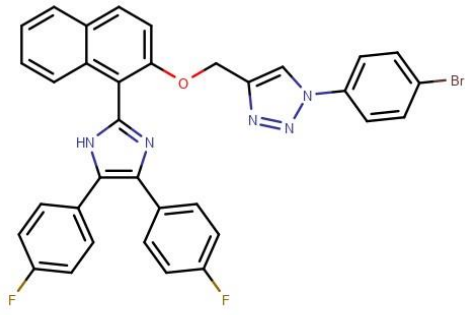
Verma et. al. (2019) reported the antimicrobial activity of 2,4,5-Trisubstituted-1H-Imidazole–Triazole . 1-(4-Bromophenyl)-4-(((1-(4,5-diphenyl-1H-imidazol-2-yl) naphthalen-2-yl)oxy)methyl)-1H-1,2,3-triazole (1a), 4-(((1-(4,5-Diphenyl-1H-imidazol-2-yl)naphthalen-2-yl)oxy)methyl)-1-(2-nitrophenyl)-1H-1,2,3-triazole(1b), 4-(((1-(4,5-Bis(4-fluorophenyl)-1H-imidazol-2-yl)naphthalen-2-yl)oxy)methyl)-1-(4-bromophenyl)-1H-1,2,3-triazole (1c) are the potent compounds observed in the series.



1a

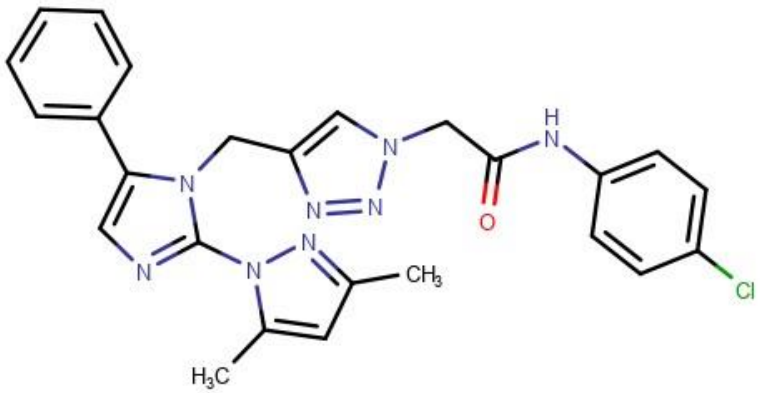


1b



1c

Verma et. al. (2020) reported the antimicrobial activity of pyrazole-imidazole-triazole hybrids with their molecular docking. N-(4-Chlorophenyl)-2-(4-((2-(3,5-dimethyl-1H-pyrazol-1-yl)-5-phenyl-1H-imidazole-1-yl)methyl)-1H-1,2,3-triazol-1-yl)acetamide (2) is the potent compounds observed in the series.



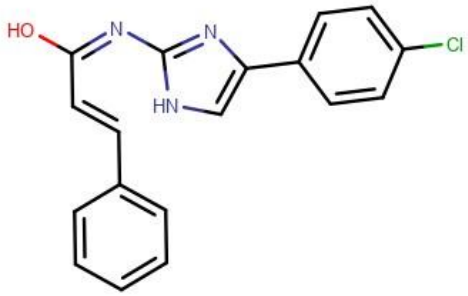
2

Sta¸czek et. al. (2020) reported antimicrobial activity of hydrazones (3)which are synthesized using 3-oxide-1H-imidazole-4-carbohydrazides. 1-Benzyl-5-methyl-N0-[(Z)-(5-nitro-2-furyl)methylidene]- 1H-imidazole-4-carbohydrazide 3-oxide, 1,5-Dimethyl-N0-[(Z)-(5-nitro-

2-furyl)methylidene]-1H-imidazole-4-carbohydrazide 3-oxide , 1-Cyclohexyl-5-methyl-N0-[(Z)-(5-nitro-2-furyl)methylidene]-1H-imidazole-4-carbohydrazide 3-oxide was found to be potent compounds from the developed series.

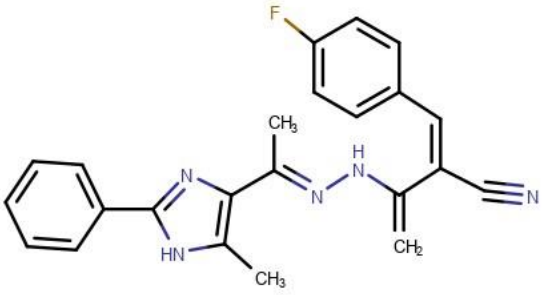
3

Amido-linked pyrrolyl and pyrazolyl-oxazoles, thiazoles, and imidazoles have been developed by Padmavathi et. al. (2011). Results indicated chlorosubstituted imidazolyl cinnamate (4) was found to be a lead compound.



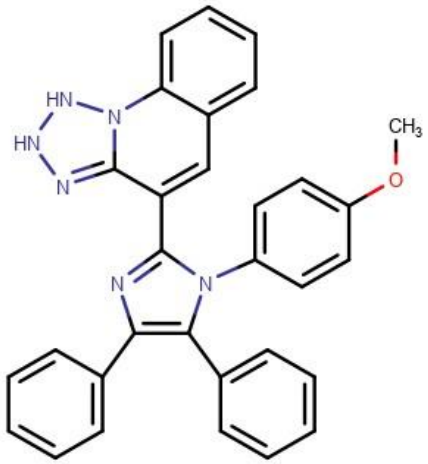
4

Abdel-Wahab et. al.(2020) reported the development of imidazole-based heterocycles as antimicrobial, antioxidant, anti-hemolytic, and cytotoxic. 2-Cyano-3-(4-fluorophenyl)-N0-[1-(5-methyl-2-phenyl-1Himidazol- 4-yl)ethylidene]acrylohydrazide (5) is the promising antimicrobial agent.



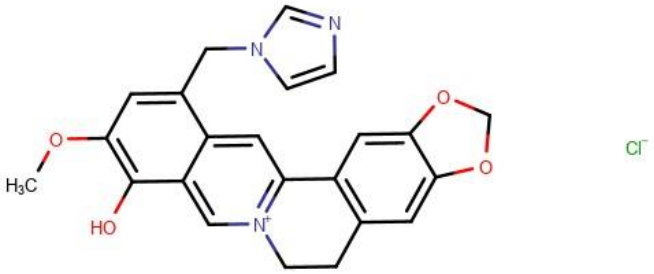
5

Kathrotiya et. al. (2012) reported development of the tetrazolo[1,5-a]-quinoline based imidazoles as antimicrobial agents using molecular iodine. 1-(4-methoxyphenyl)-4,5-diphenyl-2-{1H,2H-[1,2,3,4]tetrazolo[1,5-a]quinolin-4-yl}-1H-imidazole (6) was found to be more promising antimicrobial agent.



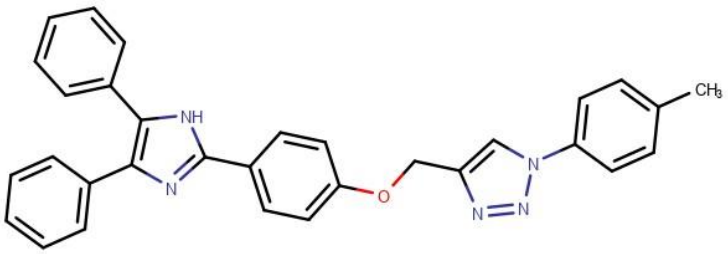
6

Cheng-He Zhou et. al. (2016) reported the development of berberine imidazoles as antimicrobial agents. 12-((1H-imidazole-1-yl)methyl)-9-hydroxy-10-methoxy-5,6-dihydro-[1,3]dioxolo[4,5-g]isoquinolino[3,2-a] isoquinolin-7-ium chloride(7) was found to be promising agent.



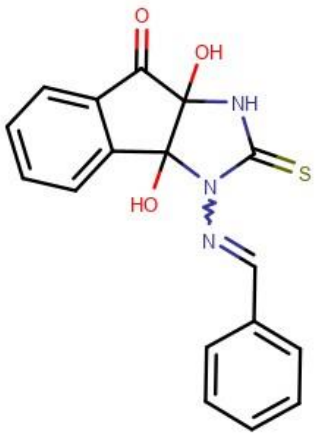
7

Verma et. al.(2019) developed triazole containing triaryl-1H-imidazole (8) as antimicrobial agents and reported their docking studies.



8

Saini et. al. (2017) developed 3-(arylideneamino)-3a,8adihydroxy-1,3,3a,8a-tetrahydroindeno[1,2-d]imidazole-2,8-diones and their 2-thioxo derivatives as antimicrobial agents.



9

SUMMARY:

Imidazole is one most promising heterocyclic agents utilized as a synthetic intermediate or scaffold. Various Imidazole derivatives have good antimicrobial activity, so the Imidazole nucleus will be attractive heterocycles in antimicrobial drug design.

REFERENCES:

1. Abdel-Wahab BF, Awad GEA, Badria FA (2011) Synthesis, antimicrobial, antioxidant, anti-hemolytic and cytotoxic evaluation of new imidazole-based heterocycles. Eur J Med Chem 46:1505–1511. doi: 10.1016/j.ejmech.2011.01.062
2. Beheshti A, Nozarian K, Mousavifard ES, et al (2021) Design and construction of the imidazole-2-thione-based copper(I) complexes by varying the co-anion and synthesis conditions and verifying their antimicrobial activity. J Solid State Chem 294:. doi: 10.1016/j.jssc.2020.121874
3. Chauhan S, Verma V, Kumar D, Kumar A (2019) Facile Synthesis, Antimicrobial Activity and Molecular Docking of Novel 2,4,5-Trisubstituted-1H-Imidazole–Triazole Hybrid Compounds. J Heterocycl Chem 56:2571–2579. doi: 10.1002/jhet.3655
4. Chauhan S, Verma V, Kumar D, Kumar A (2019) Synthesis, antimicrobial evaluation and docking study of triazole containing triaryl-1H-imidazole. Synth Commun 49:1427–1435. doi: 10.1080/00397911.2019.1600192
5. Desai NC, Maheta AS, Rajpara KM, et al (2014) Green synthesis of novel quinoline based imidazole derivatives and evaluation of their antimicrobial activity. J Saudi Chem Soc 18:963–971. doi: 10.1016/j.jscs.2011.11.021
6. Kim HS, Jadhav JR, Jung SJ, Kwak JH (2013) Synthesis and antimicrobial activity of imidazole and pyridine appended cholestane-based conjugates. Bioorganic Med Chem Lett 23:4315–4318. doi: 10.1016/j.bmcl.2013.05.098
7. Li Y, Lu X, Jing H, et al (2017) Synthesis, structures and antimicrobial activities of silver(I) complexes derived from 2-propyl-1H-imidazole-4,5-dicarboxylic acid. Inorganica Chim Acta 467:117–122. doi: 10.1016/j.ica.2017.07.070
8. Mungra DC, Kathrotiya HG, Ladani NK, et al (2012) Molecular iodine catalyzed synthesis of tetrazolo[1,5-a]-quinoline based imidazoles as a new class of antimicrobial and antituberculosis agents. Chinese Chem Lett 23:1367–1370. doi: 10.1016/j.cclet.2012.11.007
9. Nayak PS, Narayana B, Sarojini BK, et al (2016) Design, synthesis, molecular docking and biological evaluation of imides, pyridazines, and imidazoles derived from itaconic anhydride for potential antioxidant and antimicrobial activities. J Taibah Univ Sci 10:823–838. doi: 10.1016/j.jtusci.2014.09.005
10. Obaleye JA, Ajibola AA, Bernardus VB, Hosten EC (2020) Synthesis, X-ray crystallography, spectroscopic and in vitro antimicrobial studies of a new Cu(II) complex of trichloroacetic acid and imidazole. J Mol Struct 1203:. doi: 10.1016/j.molstruc.2019.127435
11. Padmavathi V, Prema Kumari C, Venkatesh BC, Padmaja A (2011) Synthesis and antimicrobial activity of amido linked pyrrolyl and pyrazolyl-oxazoles, thiazoles and imidazoles. Eur J Med Chem 46:5317–5326. doi: 10.1016/j.ejmech.2011.08.032
12. Pieczonka AM, Strzelczyk A, Sadowska B, Sta˛czek P. et al (2013) Synthesis and evaluation of antimicrobial activity of hydrazones derived from 3-oxido-1H-imidazole-4-carbohydrazides. Eur J Med Chem 64:389–395. doi: 10.1016/j.ejmech.2013.04.023
13. Prabhala P, Savanur HM, Sutar SM, et al (2021) In silico molecular docking and In vitro antimicrobial evaluation of some C5-substituted imidazole analogues. Eur J Med Chem Reports 3:100015. doi: 10.1016/j.ejmcr.2021.100015

14. Punia S, Verma V, Kumar D, et al (2021) Facile synthesis, antimicrobial evaluation and molecular docking studies of pyrazole-imidazole-triazole hybrids. J Mol Struct 1223:1–11. doi: 10.1016/j.molstruc.2020.129216
15. Saini Y, Khajuria R, Kaur R, et al (2017) Synthesis and antimicrobial evaluation of novel 3-(arylideneamino)-3a,8a-dihydroxy-1,3,3a,8a-tetrahydroindeno[1,2-d]imidazole-2,8-diones and their 2-thioxo analogues. Synth Commun 47:1159–1168. doi: 10.1080/00397911.2017.1316407
16. Shahid HA, Jahangir S, Yousuf S, et al (2016) Synthesis, crystal structure, structural characterization and in vitro antimicrobial activities of 1-methyl-4-nitro-1H-imidazole Antimicrobial activities of 1-methyl-4-nitro-1H-imidazole. Arab J Chem 9:668–675. doi: 10.1016/j.arabjc.2014.11.001
17. Verma A, Joshi S, Singh D (2013) Imidazole: Having versatile biological activities. J Chem 2013:. doi: 10.1155/2013/329412
18. Vijesh AM, Isloor AM, Telkar S, et al (2013) Molecular docking studies of some new imidazole derivatives for antimicrobial properties. Arab J Chem 6:197–204. doi: 10.1016/j.arabjc.2011.10.007
19. Wen SQ, Jeyakkumar P, Avula SR, Cheng-He Zhou et al (2016) Discovery of novel berberine imidazoles as safe antimicrobial agents by down regulating ROS generation. Bioorganic Med Chem Lett 26:2768–2773. doi: 10.1016/j.bmcl.2016.04.070