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A REVIEW ON BENZIMIDAZOLE AND ITS BIOLOGICAL ACTIVITIES

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ABSTRACT:

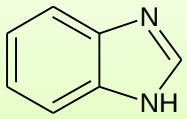
Benzimidazole is a heterocyclic organic compound having an important pharmacophoric group which is used in medicinal industry. The presences of specific group were determined by FTIR spectroscopy. Benzimidazole derivatives play important role in medical field with so many Pharmacological activities such as antimicrobial, antiviral, antidiabetic, anthelmintic and anticancer activity. The potency of these clinically useful drugs in treatment of microbial infections and other activities encouraged the development of some more potent and significant compounds. Benzimidazoles are remarkably effective compounds, extensive biochemical and pharmacological studies have confirmed that these molecules are effective against various strains of microorganisms.This review is summarized to know about the chemistry of different derivatives of substituted benzimidazoles along with their pharmacological activities.

KEY WORDS: - Benz imidazole, Pharmacological Activity, FTIR spectroscopy

1. INTRODUCTION

Benzimidazole is an important heterocyclic aromatic organic compound having important pharmacophore and a privileged structure in medicinal chemistry. It is a Bicyclic in nature which consists of an imidazole ring containing two nitrogen atom at adjacent position fused to benzene ring.

Nitrogen atom and the position of N is in 1 st and 3 $^{rd.}$ position of the molecule. Being a major constitute of various natural products, including purine, histamine, histidine and nucleic acid, benzimidazole derivatives have occupied a unique place in the field of medicinal chemistry, thus incorporation of the benzimidazole nucleus to prepare or synthesis novel benzimidazole derivatives has always carried the attention of many medicinal chemist and hence proved to be vital synthetic strategy in durg discovery.



Structure of Benzimidazole ring

Benzimidazole derivatives is used in different ways such as analgesic, anti-inflammatory, antibacterial antimicrobial, antifungal, antiviral, anti-helmenthic, anticonvulsant anticancer, antihypertensive, antiphrastic activity. Firstly benzimidazole was synthesised by Hoebrecker in 1872, who obtained 2, 5(or 2, 6)-dimethylbenzimidazole by the using of 2-nitro-4- methylacetanilide 2.

Now a days is a moiety of choice which possesses many pharmacological properties. The most prominent benzimidazole compound in nature is N-ribosyl-dimethylbenzimidazole, which serves as an axial ligand for cobalt in vitamin B12. In 1990 various benzimidazole derivatives were synthesized with substitution of fluorine, propylene, tetrahydroquinoline and cyclised compound which resulted in compounds with increased stability, bioavailability and significant biological activity. In 1991 benzimidazole derivatives were synthesized by derivatization at N-H of benzimidazole by electron donating group and substitution with long chain of propyl, acetamido, thio, thiazole-amino, tetramethyl piperidine on pyridine resulting in good analgesic activity. Nowadays Infectious microbial diseases are causing problems world-wide, because of resistance to number of antimicrobial agents (β-lactam antibiotics, macrolides, quinolones, and vancomycin). A variety of clinically significant species of microorganisms has become an important health problem globally. One way to fight with this challenge is the appropriate usage of the available marketed antibiotics the other is the development of novel anti-microbial agents. Hence, there will always be a vital need to discover new benzimidazole derivatives as an chemotherapeutic agent.

1.1. PHYSICAL PROPERTIES:

Amphotericity:

Benzimidazole is amphotric in nature i.e. acts as acid and as a base.

Molecular formula: $C_7H_6N_2$

Molecular weight : 118.14 g/mol

Melting point : 170^0C -172^0C

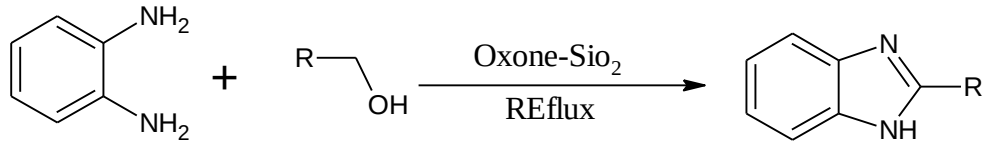
Activity (PK_a) : 12.8(for benzimidazole) & 5.6 (for the conjugate acid)

1.2. CHEMICAL PROPERTIES:

Benzimidaole undergoes following types of organic reactions:

1. Addition Reaction:-

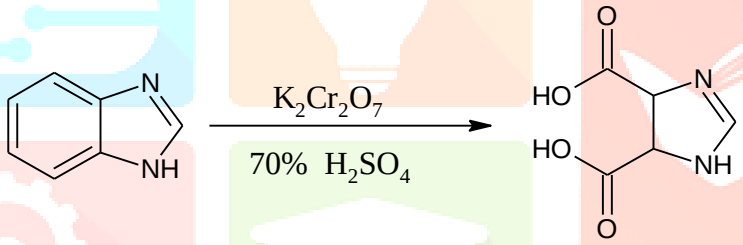
O-Phenylenediamine addition in the presence of ethanol and silicon oxidation to form a 2-methyl-1H-benzimidazole.



O-Phenylenediamine 2-methyl-1H-benzimidazole

2. Oxidation Reaction:

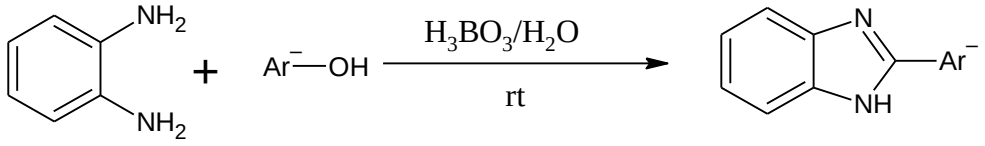
Benzimidazole oxidation in the presence of Potassium dichromate and 70% H_2SO_4 to form a 4, 5-dihydro-1H-imidazole -4, 5-dicarboxylic acid.



Benzimidazole 4, 5-dihydro-1H-imidazole -4, 5-dicarboxylic acid

3. Reduction Reaction:

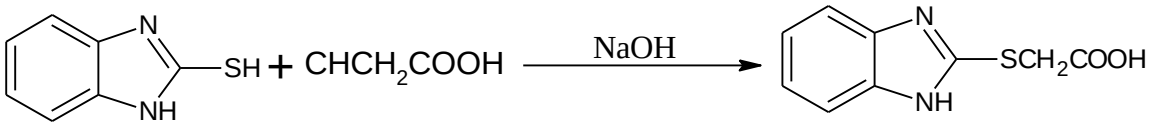
O-Phenylenediamine reduction in the presence of methanol and boric acid to form a 2-methyl-1H-benzimidazole.



O-Phenylenediamine 2-methyl-1H-benzimidazole

4. Substitution Reaction:

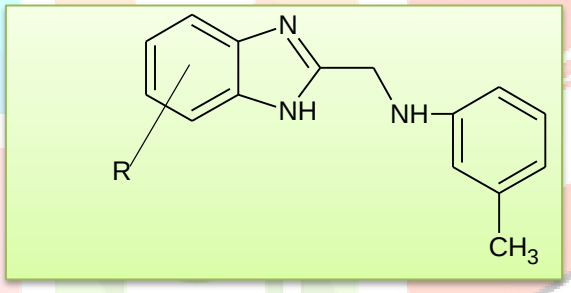
1H-benzimidazole-2-thiol substitution in the presence of carboxylic acid and NaOH to form a [(1H-benzimidazole-2-yl) sulfanyl] acetic acid.



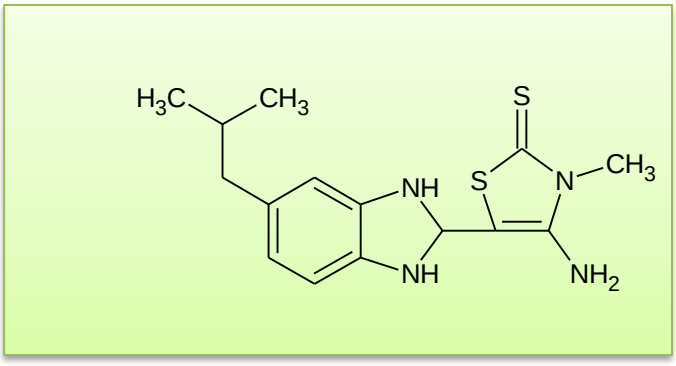
1H-benzimidazole-2-thiol [(1H-benzimidazole-2-yl) sulfanyl] acetic acid

2. SYNTHESIS AND BIOLOGICAL ACTIVITY OF BENZIMIDAZOLE:-

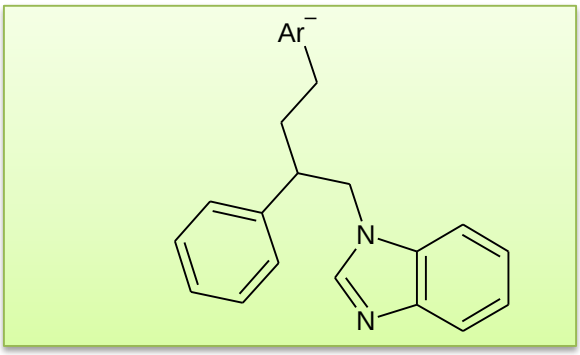
2.1. Achar KC have reported the mixtures of N- substituted Benzimidazole derivatives. Newly synthesized mixtures were estimated for analgesic &anti-inflammatory exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The mixture 2-methylaminobenzimidazole outgrowth was introduce to be more active analgesic &anti-inflammatory mixture than othercompound.In-vivo analgesic andanti-inflammatory conditioning of recently synthesized benzimidazole by-products.



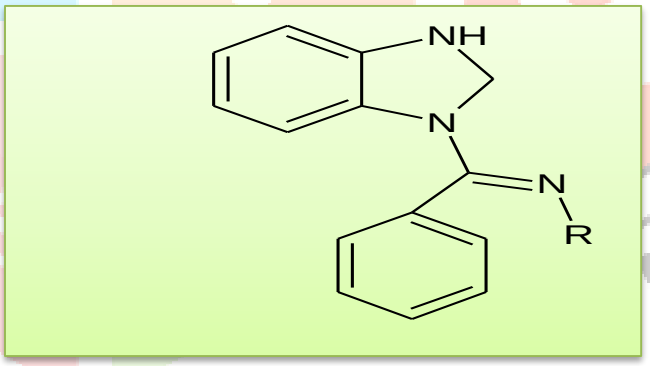
2.2. HananM. Refaat have reported the mixtures of N- substituted Benzimidazolederivatives.Newly synthesized emulsion were estimated for anticancer exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The emulsion 2- ((4-oxothiazolidin-2-ylidene) methyl and (4-amino2-thioxothiazol-5-yl) benzimidazoles derivations was introduce to be more active anticancer active emulsion than other emulsion. The synthesized products were subordinated to in vitro anticancer webbing that revealed that all the tested composites produced antitumor exertion.



2.3. O¨ zden O ¨ zel Gu ¨ ven, have reported the mixtures of N- substituted Benzimidazolederivatives.Newly synthesized mixture were estimated for anticancer exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The mixture 3- (2-phenylpropyl)-1H-indole benzimidazoles derivations was plant to be more active anticancer active mixture than other emulsion.



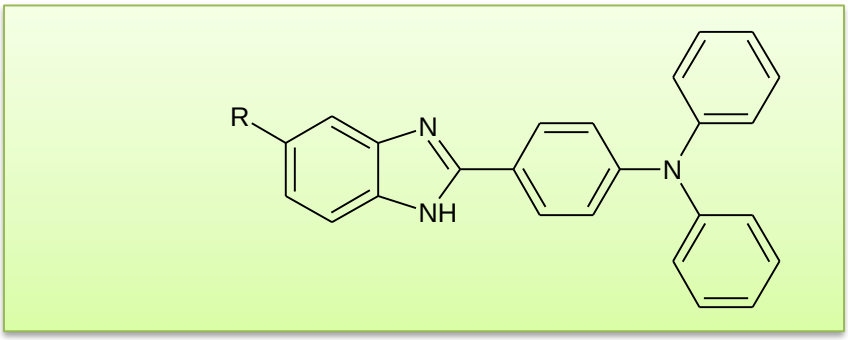
2.4. Asma Eswayah have reported the conflation of N- substituted Benzimidazole derivations. Recently synthesized emulsion were estimated for analgesic exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The mixture N-acylated benzimidazole outgrowth was plant to be more active anticancer active emulsion than other mixture. Conflation and Analgesic Exertion Evaluation of Some New Benzimidazole Derivations.



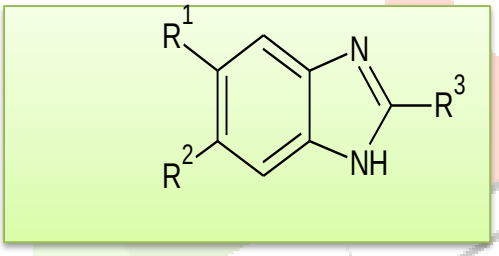
2.5. Muhammad Tahaa has reported the mixtures of N- substituted Benzimidazolederivatives.Newly synthesized mixture were estimated for nascence glycosidase inhibitory exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The mixture 3-methyl oxadiazole benzimidazoles outgrowth was plant to be more active nascence glycosidase inhibitory active combination than othercompound.Synthesis, α-glycosidase inhibitory eventuality and molecular docking study of benzimidazole.

2.6. Jiaxu Fu has reported the conflation of N- substituted Benzimidazole derivations. Recently synthesized mixture were estimated for natural exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The combination N, N-dimethylformamide benzimidazoles derivations was plant to be more active natural active emulsion than other mixture. Fryer supported conflation and natural

exertion in the luminescent parcels of diphenylamine substituted mono and di fanned benzimidazole derivations.



2.7. Juan Valdez has reported the mixtures of N- substituted Benzimidazolederivatives.Newly synthesized emulsion were estimated for antiparasitic exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The emulsion 2-methoxycarbonylamino derivations benzimidazoles outgrowth was plant to be more active antiparasitic active emulsion than other emulsion. Conflation and Antiparasitic Exertion of 1H-BenzimidazoleDerivatives.These are Composites 1 – 14 have been synthesized and tested in vitro against the protozoa Giardia lamblia, Entamoeba histolytica and the helminth Trichinella spiralis.



2.8. Walia R has reported the mixtures of N- substituted Benzimidazolederivatives.Newly synthesized mixture were estimated for antimicrobial exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion technique. The mixture 2- (Trifluoromethyl)-1Hbenzimidazole derivations was plant to be more active antibacterial emulsion than other emulsion.

2.9. HS. Lamba have reported the conflation of N- substituted Benzimidazolederivatives.Newly synthesized emulsion were estimated for Antimicrobial and anti-fungal exertion Isoxazolyl substituted admixtures were screened for exertion against Gram Negative species likeE.coli and Proteus vulgaris, Gram positive like Bacillus mycoides and staphylococcus au. Some Benzimidazole composites having hydrazone half were studied in order to probe their possible antibacterial and antifungal exertion. Utmost of the test composites plant to be significantly effective against Proteus vulgaris, Staphylococcus typhimurium, Klebsiella pneumoniae and Pseudomonas aeruginosa gram-negative bacterial strains some fluroquinolones substituted Benzimidazole derivations have been reported by fryer helped technique. The synthesized composites are reported to be the derivations of Ciprofloxacin.

2.10. Afaf H has reported the conflation of N- substituted Benzimidazole derivations. Recently synthesized emulsion were estimated for antimicrobial exertion. Against staphylococcus aureus, Bacillus subtilis,E-coil, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion system. The emulsion 3- (2-methylbenzimidazol-1-yl) propanoic acid hydrazide was introduce to be more active antimicrobial emulsion than other emulsion. CS2/ KOH gave oxadiazole which passed Mannich response to give. Emulsion 2 was treated with hydrazine hydrate to give was treated with both aldehydes and acetic anhydride. to give. acids gave 10 and (11a-c) individually.

Conclusion

Benz imidazole is an all-around Heterocyclic patch with multiple pharmacological conditioning. Hence there's need to research on conflation of multiple derivations of Benz imidazole and evaluation of their natural conditioning.

REFERECNCES:

1. Walia R, Hedaitullah MD, Naaz SF *et.al* Benzimidazole derivatives–an overview. Int. J. Res. Pharm. Chem. 2011; 1(3):565-74.

2. HS. Lamba *et. al.*, Benzimidazole derivatives: Spectrum of pharmacological activity and toxicological properties. Pharmaceutical Chemistry Journ.

3. Afaf H.*et.al*.Synthesis and Antimicrobial Activity of Some New Benzimidazole Derivatives.Molecules 2000, 5, 1429–1438.

4.Khalid Iqbal *et.al*.Studies of antimicrobial activity of Benzimidazole derivatives–an overview. Int. J. Res. Pharm. Chem. 2011; 1(3):565-74.

5.Juan Valdez,*et.al*., Synthesis and Antiparasitic Activity of 1H-Benzimidazole Derivatives.Bioorganic & Medicinal Chemistry Letters 12 (2002) 2221–2224.

6.Achar KC, Hosamani KM, Seetharamareddy HR.*et.al.,* In-vivo analgesic and anti-inflammatory activities of newly synthesized benzimidazole derivatives. European journal of medicinal chemistry. 2010 May 1; 45(5):2048-54.

7. Hanan M. Refaat *et.al.,* Synthesis and anticancer activity of some novel 2-substituted benzimidazole derivatives European Journal of Medicinal Chemistry 45 (2010) 2949e2956.

8. O¨ zden O¨ zel Gu¨ven,a,*et.al.,* Synthesis and antimicrobial activity of some novel phenyl and benzimidazole substituted benzyl ethers Bioorganic & Medicinal Chemistry Letters 17 (2007) 2233–2236.

9. Asma Eswayah,*et.al*., Synthesis and Analgesic Activity Evaluation of Some New Benzimidazole Derivatives American Journal of Chemistry and Application 2017; 4(5): 30-35.

10. Muhammad Tahaa,*et.al.,* Synthesis, α-glycosidase inhibitory potential and molecular docking study of benzimidazole derivatives.

11. Azize Gizem Uslua *et.al.,* Benzimidazole derivatives as potent and isoform selective tumor-associated carbonic anhydrase IX/XII inhibitors Bioorganic Chemistry 95 (2020) 103544.

12. Jiaxu Fu,*et.al.*, Microwave-assisted synthesis and luminescent properties of triphenylamine substituted mono- and di- branched benzimidazole derivatives.Chemical papers pg . no 240-340.

13. Tianrong Zhang,*et.al.*, Design, synthesis and biological activity evaluation of novel methyl substituted benzimidazole derivatives T. Zhang et al. / Tetrahedron 76 (2020) 131027.