IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, June 2024

A Brief Review on Medicinal Uses and Applications of Benztriazole

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Abstract: *In years ago, Madsen [19] first suggested using benzotriazole to treat copper and copper alloy antiques. It has been widely used in conservation labs ever since. The goal of this paper is to give conservators a thorough understanding of benzotriazole, including information on its chemistry, copper complexes, and suggested inhibitory mechanisms. For the past ten years, benotriazole has been used to treat copper artifacts; in recent years, a lot of research has been done on this topic. Though widely available, pertinent articles are scattered and difficult to find, with a predominant emphasis on industrial uses.*

Keywords: E-learning, training visually impaired, Speech recognition, Assistive technologies, User-centred design, usability testing

I. INTRODUCTION

Overview of Benzotriazole (BTA): Images in Emulsion Form: Developed as a constraint and employed in the analytical assessment of silver [6].Corrosion Prevention: Since 1947, copper and its alloys have been industrially treated to stop tarnishing and corrosion.Industrial Uses: Added to aqueous systems such as antifreezes, heating and cooling systems hydraulic fluids containing copper components.Vapor Phase Inhibitor: It was recently discovered to be useful in this capacity [1, 6].Use in Conservation: Since 1967, conservators have used this method to preserve antique copper and copper alloy objects [19].The

properties of benzotriazole (BtH) Flexibility: functions as a synthetic auxiliary with good leaving group characteristics and ease of insertion into compounds.Acid-Base Properties: Both electron-donating and electron-attracting properties are demonstrated by weak acid (pKa 8.2) and weak base (pKa <

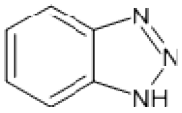
0).Applications in Synthesis: Utilized in the construction of several monocyclic and bicyclic heterocyclic compounds since 1980that are difficult to prepare using other techniques.

Structural characteristics Two fused rings are present in benzotriazole.Tautomers: Tautomers A and B both contain the five-membered ring.Derivatives: It is possible to create derivatives of both tautomers (structures C and D) [1].

Tautomers of benzotriazoles and their derivatives

The structural investigations using 1H-NMR, IR, and UV spectra show that at room temperature, isomer A is predominant. The bonds at locations 1-2 and 2-3 have the same characteristics. The proton migrates quickly between locations 1 and 3, without forming a strong bond with any nitrogen atoms. As a result, BTA has the capacity to either gain or lose a proton, functioning as a weak acid (pKa = 8.2) or a very weak Brønsted base (pKa < 0). It can also create stable coordination complexes on a copper surface

Structure of Benzotriazole with their properties



DOI: 10.48175/568

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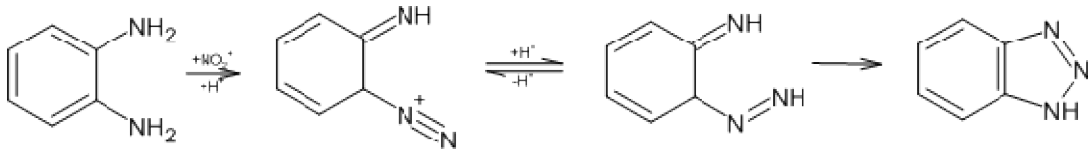
Molecular Formula	C6H5N3
Molecular Weight	119.124 g/mol
Composition	C(60.50%) H(4.23%) N(35.27%
Molar Refractivity	34.71 ± 0.3 cm3
Molar Volume	88.3 ± 3.0 cm3
Index of Refraction	1.715 ± 0.02
Surface Tension	73.9 ± 3.0 dyne/cm
Density	1.348 ± 0.06 g/cm3
Dielectric Constant	Not available
Polarizability	13.76 ± 0.5 10-24cm3

Synthesis

Scheme-I



O-phenylenediamines are cyclocondensed with sodium nitrite in acetic acid to produce benzotriazoles. The reagents must be heated together for the reaction to occur. The diamine undergoes spontaneous Cyclization after converting to the monodiazonium derivative.

Scheme-II

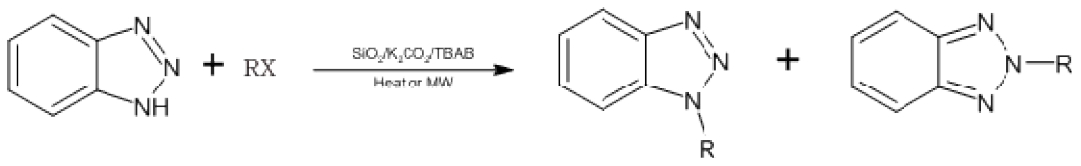
There are two main methods for synthesizing 1,2,3-benzotriazole. One is the direct reaction between o-phenylenediamines and nitrous acid. The alternative method involves treating the corresponding mono acylated or aroylated o-phenylenediamines with nitrous acid to form an acylated or aroylated benzotriazole, which is then hydrolyzed. When compared to procedures involving several intermediate steps, this direct method yields higher overall yields.

Scheme-III

N-Alkylation of Benzotriazole without the Use of Solvents The highly regioselective N-alkylation of benzotriazole can be accomplished in an effective, straightforward, and solvent-free manner by using SiO2, K2CO3, and tetrabutylammonium bromide (TBAB) in both thermal and microwave settings. This
process produces moderate to high yields of 1-alkyl benzotriazoles in a regioselective manner in a short reaction time

Applications

Benzotriazole boasts remarkable versatility, serving as a restrainer in photographic processes, an analytical reagent for silver determination, and a corrosion inhibitor in both atmospheric and



underwater settings. Its derivatives, highlighted for potential drug precursor roles, add to its diverse applications. Additionally, Benzotriazole finds utility in antifreezes, heating/cooling systems, hydraulic fluids, and vapor-phase inhibitors.

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Environmental relevance

Benzotriazole exhibits moderate water solubility, slow degradability, and limited sorption tendency. Consequently, only a partial removal occurs in wastewater treatment plants, leading to a significant portion reaching surface water like rivers and lakes. Although it is deemed of low toxicity and poses a low health hazard to humans, it does show some antiestrogenic properties.

Medicinal uses Anticancer Benzotriazoles

Numerous anticancer medications have been effectively created and employed in clinical settings to treat cancer, including azole compounds, platinum complexes, alkylating agents, and porphyrin
medicines. But the majority of contemporary anticancer medications frequently show toxicity to healthy tissues, resulting in a host of adverse effects that reduce the effectiveness of treatment. Drug resistance and dose-related cumulative cardiotoxicity further impede long-term efficacy. Research efforts are thus increasingly concentrated on creating and creating novel therapeutic agents for the treatment of cancer. Benzotriazole compounds have demonstrated strong anticancer action; two examples are the antitumor drug Vorozole, which is currently undergoing clinical trials, and 4,5,6,7-tetrabromobenzotriazole (TBB). A widely marketed anticancer medication called TBB shows strong selective suppression of protein kinase CK2.The effective investigation of TBB has sparked ongoing work to create new benzotriazole-based anticancer drugs that targetmany receptors or kinases. Furthermore, it has been shown that benzotriazole-containing metal complexes and structural variants of benzotriazole may be able to
overcome the shortcomings of existing clinical medications.Because kinases are important for cell division, inhibiting them is an important part of treating cancer. Because of their distinct structure,
benzotriazole derivatives can attach to different kinases with ease via a variety of non-covalent forces, such as hydrophobic effects, van der Waals forces, cation-π interactions, coordination, ion-dipole
interactions, and hydrogen bonds. This binding capacity efficiently suppresses the function of many kinases, including histone deacetylases, focal adhesion kinase, protein kinases CK2 and CHK1, and others.

Antibacterial Benzotriazoles

Worldwide, bacterial infections are common, but they are particularly common in the tropical regions of Africa, parts of South America, and the Indian subcontinent. Morbidity and mortality associated with food poisoning, rheumatic diseases, salmonellosis, and diarrhea caused by bacteria are the main causes of health problems.

Benzotriazoles as antifungals

An increasing number of azole chemicals are being used to treat fungal infections, which are common diseases. Benzotriazoles are less harmful to organisms because they have a bigger conjugated system, a benzene ring, and a structure that contains three nitrogens, compared to triazole or imidazole.
Benzotriazoles have been the subject of numerous studies in an attempt to investigate their potential as new antifungal agents.

Benzotriazoles as antituberculars

Mycobacterium tuberculosis is the primary cause of tuberculosis (TB). Although antitubercular drugs such as isoniazid and rifampicin are available, their clinical usage is restricted due to the recurrent
emergence of resistant strains and severe responses. The creation of novel, highly effective anti- tubercular medications devoid of cross-resistance is required due to the decreased efficacy and unavoidable harmful side effects. Using affordable, safe first-line medications in conjunction with traditional short-course chemotherapy is a promising approach. According to recent studies, nitrogen heterocyclic benzotriazole compounds have a great deal of promise as TB treatments.

Benztriazole as antiviral

About 60% of pandemic infectious diseases are caused by the antiviral benzotriazoles virus, a very small pathogen that poses a major risk to human health. Conventional nucleosides are important medications used to treat viral infections.

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However, because nucleosides are poorly soluble in typical organic solvents, nucleoside modification is extremely difficult. Furthermore, rather than eradicating the viruses directly, modern antiviral medications harm host cells in addition to inhibiting virus proliferation. As a result, in recent decades, a great deal of research has gone into creating and developing non-nucleoside molecules as novel antiviral medications. The discovery of novel benzotriazole compounds with antiviral properties has created fresh avenues for research in this area.

Antiparasitic Benzotriazoles

Parasitosis, an epidemic disease, inflicts severe damage on both society and the economy. It is linked to various infectious parasites, such as helminthiasis and protozoiasis. The threats posed by parasites to public health, coupled with the inadequacy of current treatments and the emergence of drug resistance, highlight the pressing need for more effective drugs. Benzotriazole derivatives, demonstrating advanced antiparasitic activity, have shown potential in addressing this challenge.

Antioxidative Benzotriazoles

Excessive oxidized free radicals from human metabolism can lead to various health issues, including aging, cancer, and neurodegenerative diseases. Resolving these problems involves eliminating these radicals and enhancing the body's antioxidative activities. Antioxidants, such as benzotriazole compounds, act as reducing agents to stabilize free radicals and show significant potential as novel antioxidative agents or candidates.

II. CONCLUSION

Benzotriazole is an adaptable synthetic auxiliary that can be used in many different contexts. Numerous Studies show that its derivatives exhibit a variety of pharmacological activities, indicating potential for Use in the development of medicines. Medicinal chemists can use the review's emphasis on synthetic Techniques, like copper-free 'click' approaches and solvent-free N-alkylation, to develop safer and more Potent benzotriazole-based compounds. This data lays the groundwork for the development of Pharmaceuticals with enhanced safety and efficacy.

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