


Chapter 8

Benzoxazoles: Diverse Biological Activities and Therapeutic Potential

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ABSTRACT

Benzoxazoles are heterocyclic compounds featuring a benzene ring fused to an oxazole ring. They have attracted significant attention in medicinal chemistry due to their diverse biological activities. Many pharmacological compounds have a core structure called a heterocyclic scaffold, which is essential to their therapeutic actions. Modest alterations to this fundamental structure may result in notable variations in the medication's mechanism of action. Benzoxazole and its derivatives have shown substantial and noteworthy therapeutic effects. This chapter explores the synthesis, structural characteristics, and various medical applications of benzoxazoles, highlighting their roles as antibacterial, antifungal, antiviral, anticancer,

DOI: 10.4018/979-8-3693-7267-8.ch008

anti-inflammatory, and analgesic agents.

INTRODUCTION

Organic heterocyclic compounds with sulfur, oxygen, and nitrogen are crucial due to their diverse applications in various fields. These compounds are integral to pharmaceuticals, where they play roles in drug design and development, providing therapeutic benefits. In industrial applications, they contribute to the production of dyes, plastics, and agrochemicals. In medicine, they serve as the backbone for many antibiotics and antiviral drugs. Additionally, they are used in sensing technologies for detecting environmental pollutants and in food packaging to enhance preservation and safety. Their versatile nature makes them invaluable across multiple disciplines (Al-Saidi & Khan, 2024)(Al-Saidi & Khan, 2022)(Aljaar et al., 2019)(Alrooqi et al., 2022)(Gemili et al., 2019)(Gul et al., 2024)(Kabi et al., 2022)(Kabi et al., 2022)(Khan et al., 2021)(Khan et al., 2022)(Khan et al., 2022)(Mohammad Abu-Taweel et al., 2024)(Muhammad et al., 2022).

Benzoxazole is a heterocyclic compound featuring a benzene ring fused with an oxazole ring. The oxazole component consists of a five-membered ring with an oxygen atom and a nitrogen atom in the pyridine position. This compound was first synthesized by Hantzsch in 1887. Benzoxazole has the molecular formula C_7H_5NO , with a molar mass of 119.12 g/mol. It has a melting point range of 27–30°C and a boiling point of 182°C. This structure is significant due to its diverse applications in pharmaceuticals and materials science (Dinakaran et al., 2012)

(Parvathi et al., 2013)(Katritzky & Weeds, 1967)(Kaur et al., 2015)(Singh et al., 2010)(Jyothi & Merugu, 2017)(Cornforth & Cornforth, 1947). The ability to modify the benzoxazole structure at various positions has led to the development of numerous derivatives with specific and enhanced pharmacological profiles. These compounds exhibit remarkable biological activities, making them valuable in various medical applications. They possess anti-ulcer, anticancer, and antihypertensive properties, providing crucial benefits in treating ulcers, cancer, and high blood pressure. Their antifungal and anti-inflammatory capabilities help combat fungal infections and reduce inflammation. They are effective against tuberculosis and parasites, showcasing antitubercular and antiparasitic effects. Additionally, they offer anti-obesity and antimalarial benefits, aiding in weight management and malaria prevention. Their antiglycation and antiviral properties contribute to diabetes management and viral infection control. Moreover, they have analgesic, antioxidant, antihistaminic, and antibacterial potential, making them useful for pain relief, fighting oxidative stress, managing allergies, and treating bacterial infections (Aljaar et al., 2023)(Gujjarappa et al., 2022)(Aljaar et al., 2015)(Gujjarappa et al., 2020)(Aljaar et al.,

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