# Chapter 3
# Isoxazole:
## A Bioactive Five-Membered Heterocycle With Diverse Applications

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## ABSTRACT

*Isoxazole is a versatile five-membered heterocyclic compound that has attracted significant attention due to its diverse medicinal chemistry and material science applications. This chapter provides a comprehensive overview of synthetic methodologies for preparing isoxazole derivatives, including traditional approaches such as cyclization reactions and modern techniques like microwave-assisted synthesis. The advantages and limitations of each method, highlighting the influence of structural variations on synthesis efficiency, are discussed. Furthermore, the biological activities associated with isoxazole compounds, showcasing their roles as potential pharmacological agents including anti-inflammatory, antibacterial, antifungal, and anticancer properties, are explored. By integrating synthetic strategies with biological evaluation, this chapter aims to illustrate the significance of isoxazole derivatives in drug discovery and development and their potential applications in therapeutic settings.*

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## 1. INTRODUCTION

Organic compounds containing carbon and a heteroatom are known as Heterocyclic compounds. They have grown in number significantly because to both their synthetic utility and intense synthetic research. Heterocyclic compounds containing Nitrogen and Oxygen play a significant role in medicinal chemistry and due to their wide range of therapeutic activities, they are used for the synthesis of various medicinal agents. Due to the structural diversity of the heterocyclic compounds, these compounds possess a wide spectrum of therapeutic applications. Nitrogen-containing heterocyclic compounds are regarded as an important class of chemicals in medicinal research as it has a wide range of applications (Sysak & Obmińska-Mrukowicz, 2017). Among all, isoxazole plays a vital role in pharmaceutical applications. Isoxazole are unsaturated five-membered heterocyclic compound containing one nitrogen, one oxygen, and carbon in the ring. Since it was the isomer "oxazole" that was initially found, Hantszch proposed the word "isoxazole" to describe the five-membered fully unsaturated heterocycles. The trival name is based on the Hantszch-Widman system of nomenclature, where "iso" represents isomer, the nitrogen atom is represented by "aza" and the oxygen atom by "oxa". The name "isoxazole" is the result of adding the suffix "ole" which indicates that the ring is five-membered(Wiley, 2021). Isoxazole possess various therapeutic applications such as anti-bacterial(Shaik et al., 2020), anti-malarial (Mabasa et al., 2024), anti-viral(Li et al., 2017), anti-fungal((Trefzger et al., 2020), anti-cancer(Eid et al., 2021), anti-convulsant, anti-oxidant, anti-lipidemic, anti-inflammatory and analgesic(Abdelall, 2020).

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