Chapter 10
Synthetic Strategies and Biomedical Applications of Tetrazoles

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ABSTRACT

The present chapter Tetrazoles: synthetic strategies and Biomedical applications reveals different synthetic protocols for the preparation of tetrazoles. A standard aside, nitrile condensation route to metal-catalyzed condensation route, including the greener approaches and ionic liquid mediated approaches were discussed further these tetrazoles are considered on bio isosteres of carboxylic and found various applications in pharma and medicine and exhibit catalytic activities in organic Synthesis. Various methods limit the role of NaN_3 and emissions the alter-

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nate protocol for the construction of tetrazole. Tetrazole alone and in conjunction with the organic groups including heterocycles exhibit various pharmacological activities that were covered in the chapter. Finally, the chapter allows a reader to choose the best possible pathway to construct the tetrazole ring and provides all necessary references.

INTRODUCTION

Peptides, the shorter chains of amino acids, exhibit a high degree of flexibility in their structure (Hersh, Broyles, Capcha, Dikici, Shehadeh, Daunert, & Deo, 2021)

(Ganguly, Sharma, & Majumder, 2020) owing to the unique features of the amino acids that make them up, as well as the surrounding environment. However, while this flexibility is advantageous in certain contexts, it can hinder the ability of peptides to effectively bind to specific biological targets, such as receptors or enzymes. In order to overcome this restraint, researchers have sought to introduce structural motifs that impose conformational restrictions on peptides. By doing so, the binding affinity and therapeutic potential of the peptides can be enhanced. Non-natural amino acids play an essential role in this process, as they enable the design and synthesis of pharmacologically relevant molecules, analogs of bioactive peptides (Freidinger, 2003) (Zaky, Simal-Gandara, Eun, Shim, & Abd El-Aty, 2022) (Giannis & Kolter, 1993), and peptidomimetics (Bhandari, Rafiq, Gat, Gat, Waghmare, & Kumar, 2020) (Jimmidi, 2023). Of particular significance are heterocyclic α-amino acids (Wang, 2023) (Poulie & Bunch, 2013), which have garnered attention in various scientific domains, such as biochemistry, enzymology, and pharmacology (Kabir & Uzzaman, 2022). Their exceptional properties make them valuable building units in the development of novel therapeutic agents and biologically active compounds.

Heterocyclic substances, which are distinguished by the presence of at least one non-carbon atom in the ring structure, are ubiquitous in nature and also a prominent area of focus in organic chemistry research (Saini, Aran, Jaya, & Rakesh, 2013). These compounds are integral to biochemical processes as they form the core structure of essential components in living cells, including the nucleic acids (Cyranski, Miroslaw, Mariusz, & Tadeusz, 2003)

(Dua, Suman, Sonwane, & Srivastava, 2011).

Numerous heterocyclic compounds and their derivates are very well known in the literature with a vast array of pharmacologically active heterocyclic compounds finding widespread use in medicinal chemistry. Notably, natural products containing heterocyclic units, act as antibiotics-penicillin and cephalosporin, alkaloids-vinblastine, ellipticine, morphine, reserpine and cardiac glycosides, all of which have significant therapeutic implications (Ghisalberti, Marcello, & Elizabeth, 1998).