Chapter 13
Thiadiazoles: Chemistry and Biological Activities

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ABSTRACT

Heterocycles containing nitrogen, oxygen and sulfur have been under investigation for a long time because of their important medicinal properties. The literature survey has described that thiadiazole moieties serve as analgesic, anti-inflammatory, anti-microbial activities, antihypertensive,anticancer, antituberculosis and vasodilator and this heterocyclic nucleus still possess considerable characteristics to attract the chemists for designing of newer biologically active molecules. Among them 1,2,4-thiadiazole, 1,3,4-thiadiazole and their derivatives are recognized as heterocyclic nuclei of great value in the field of medicinal chemistry. As a heterocyclic unit in a peptidomimetics might add conformational limitations to the structure, influencing the structure-activity-relationship. In this chapter, we are focusing on the synthetic strategies of 1,2,3-thiadiazole, 1,2,5-thiadiazole, 1,2,4-thiadiazole, 1,3,4-thiadiazole and their application in the industrial and biomedical fields.

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INTRODUCTION

Thiadiazole, a bioisotere of oxadiazole is a potent inhibitor of metalloproteases and aminopeptidases (Hu. Y, 2014). The most preferred heterocycles oxadiazole and thiadiazole's are found in numerous medications and natural compounds (Atmaram U.A, 2022).Thiadiazole has a toxophoric -N=C-S- moiety and is non-carcinogenic due to its strong polarity, its nucleus is linked to a wide range of biological activity (Siddiqui. N, 2009) . The development of sulfur-based medications and the subsequent identification of mesoionic chemicals significantly quickened the pace of advancement in the thiadiazole field (Sharma.B, 2013). Because of its mesoionic nature (Badami B.V) thiadiazole pharmacophore can readily penetrate biological membranes and interact with a variety of biological proteins. Thiadiazoles with amino, hydroxyl, and mercapto substituents can exist in a variety of tautomeric forms (Sandstrom. J,1969), this characteristic is the subject of extensive research using contemporary experimental techniques. Pharmacologically, thiadiazole has a wide range of actions, including diuretic (Ergena. A, 2022), antitubercular (Kolavi. G, 2006), anti-microbial (Farghaly. T, 2011), anti-inflammatory (Kadi. A, 2010), antifungal (Karaburun. A, 2018), anticonvulsant (Luszczki. A, 2015) and antitumor (Szeliga. M, 2020). The well-known commercial medications bearing thiadiazole moiety include Cefazolin (5) (Vergeron. M, 1973), Cefazedone (6) (Gao. L, 2015) (cell wall synthesis inhibitors), Methazolamide (7) (Maren T.H, 1977), Acetazolamide (8) (Reiss W.G,) (carbonic anhydrase inhibitors), Megazol (9) (Chauviere. G, 2003), (protein and DNA synthesis inhibitor), Sulphamethizole (10) (dihydropteroate synthase inhibitor) (Verzas Nevado J.J, 1991), Azetepa (11), (an alkylating agents) (Jchoy D. S, 1967), Furidiazine (12) (Wei . J, 2021), Besaglybuzole (13) (Otsuka .M, 1999) and Cefozopran (14) (Lizawa. Y, 1993). Over the last ten years, thiadiazole synthesis has advanced significantly. It is customary in these syntheses to create C–S and N–S bonds using disulfides, sulfonyl chlorides and sulfonyl hydrazides.