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Review on thiazoles

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Abstract:

Thiazole, or 1,3-thiazole, is a heterocyclic compound that contains both sulfur and nitrogen; the term 'thiazole' also refers to a large family of derivatives. Thiazole itself is a pale yellow liquid with a pyridine-like odor and the molecular formula C_3H_3NS.[2] The thiazole ring is notable as a component of the vitamin thiamine (B_1).

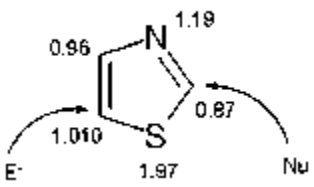
Keywords:

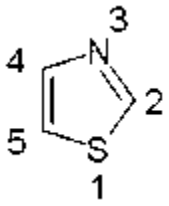
Thiazoles, condensed, anti-inflammatory, anti-fungal, odor, azoles

Introduction:

Thiazoles are members of the azoles, heterocycles that include imidazoles and oxazoles. Thiazole can also be considered a functional group. Oxazoles are related compounds, with sulfur replaced by oxygen. Thiazoles are structurally similar to imidazoles, with the thiazole sulfur replaced by nitrogen.

Thiazole rings are planar and aromatic. Thiazoles are characterized by larger pi-electron delocalization than the corresponding oxazoles and have therefore greater aromaticity. This aromaticity is evidenced by the chemical shift of the ring protons in proton NMR spectroscopy (between 7.27 and 8.77 ppm), clearly indicating a strong diamagnetic ring current. The calculated pi-electron density marks C5 as the primary site for electrophilic substitution, and C2 as the site for nucleophilic substitution.





Occurrence of thiazoles and thiazolium salts

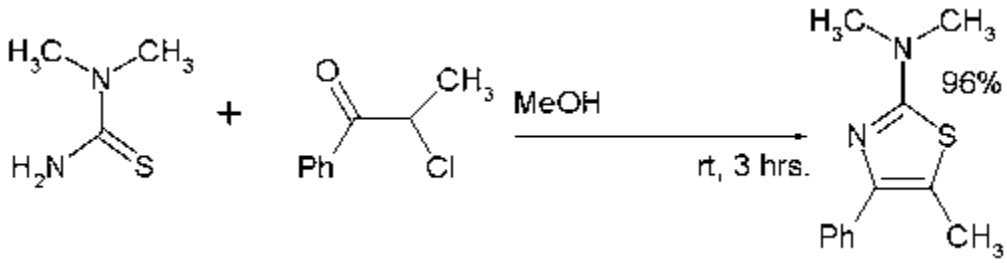
Thiazoles are found in a variety of specialized products, often fused with benzene derivatives, the so-called benzothiazoles. In addition to vitamin B_1, the thiazole ring is found in epothilone. Other important thiazole derivatives are benzothiazoles, for example, the firefly chemical luciferin. Whereas thiazoles are well represented in biomolecules, oxazoles are not. It is found in naturally occurring peptides, and utilised in the development of peptidomimetics (i.e. molecules that mimic the function and structure of peptides).[3]

Commercial significant thiazoles include mainly dyes and fungicides. Thifluzamide, Tricyclazole, and Thiabendazole are marketed for control of various agricultural pests. Another widely used thiazole derivative is the non-steroidal anti-inflammatory drug Meloxicam. The following anthroquinone dyes contain benzothiazole subunits: Algol Yellow 8 (CAS# [6451-12-3]), Algol Yellow GC (CAS# [129-09-9]), Indanthren Rubine B (CAS# [6371-49-9]), Indanthren Blue CLG (CAS# [6371-50-2], and Indanthren Blue CLB (CAS#[6492-78-0]). These thiazole dyes are used for dyeing cotton.

Organic synthesis

Various laboratory methods exist for the organic synthesis of thiazoles.

- The Hantzsch thiazole synthesis (1889) is a reaction between haloketones and thioamides. For example, 2,4-dimethylthiazole is synthesized from acetamide, phosphorus pentasulfide, and chloroacetone.[4] Another example [5] is given below:



- In an adaptation of the Robinson-Gabriel synthesis, a 2-acylamino-ketones reacts with phosphorus pentasulfide.

- In the Cook-Heilbron synthesis, an α-aminonitrile reacts with carbon disulfide.
- Certain thiazoles can be accessed through application of the Herz reaction.

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