

Addition–Cyclization Reactions of Cinnamoyl Isothiocyanate with Nitrogen and Oxygen Nucleophiles

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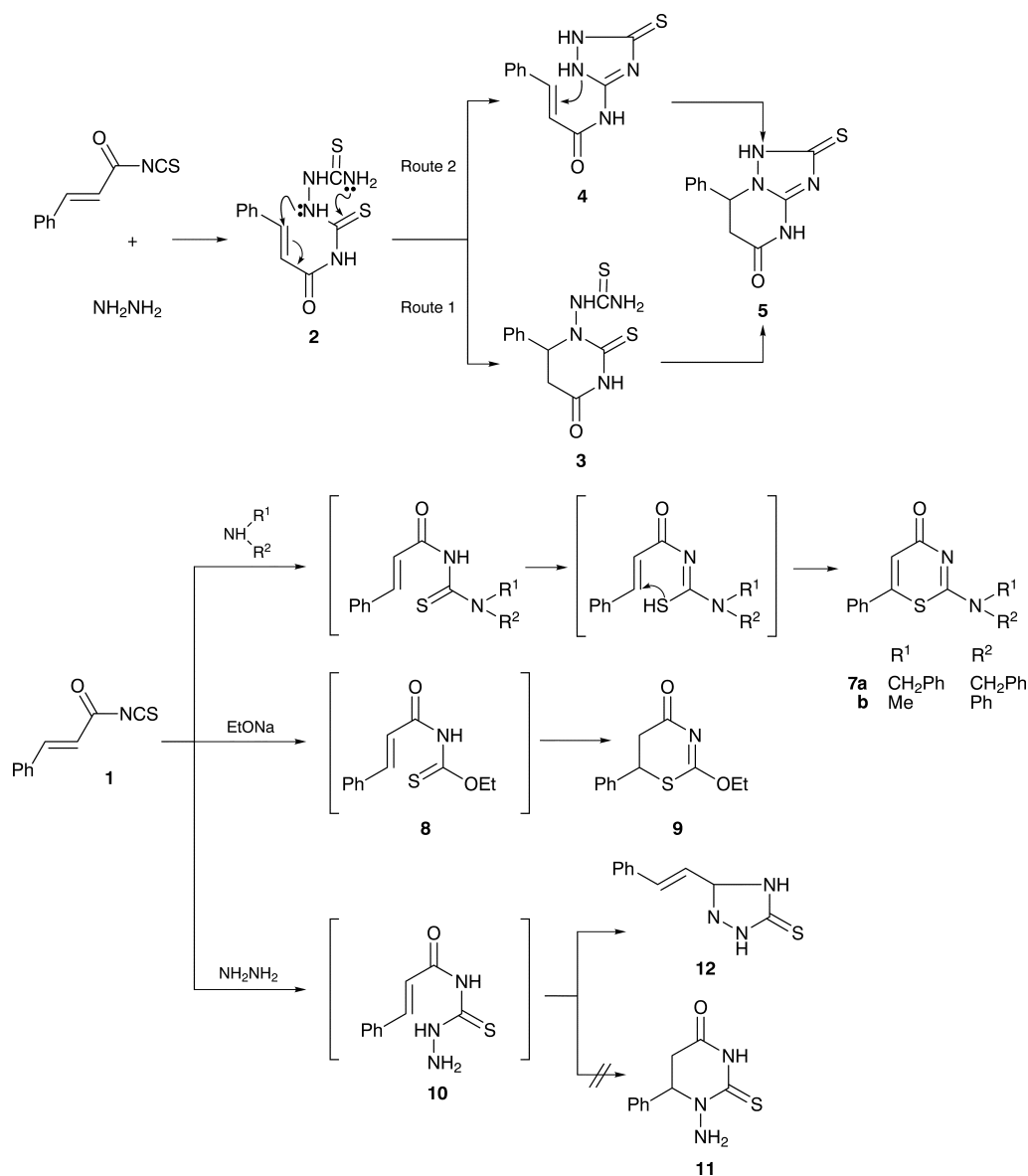
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The synthesis of pyrimidine, thiazine and pyridine derivatives utilizing cinnamoyl isothiocyanate is described.

Two alternative cyclizations are possible for the cinnamoyl bithiourea **2**. The first route (*a*) leads to triazole **3** as a result of intramolecular nucleophilic attack of one of the primary NH₂ groups, as it is a stronger nucleophile, on the thiocarbonyl group and leads to evolution of H₂S.^{8,9} The second route (*b*), leading to perhydropyrimidine **4**, results from

In the reaction of dibenzylamine or *N*-methylaniline with isothiocyanate 1,3-thiazines **7a,b** were formed directly, without the possibility of isolating thiourea **6**. Refluxing of isothiocyanate and sodium ethoxide in dioxane afforded 1,3-thiazine **9** presumably *via* the thioamide.

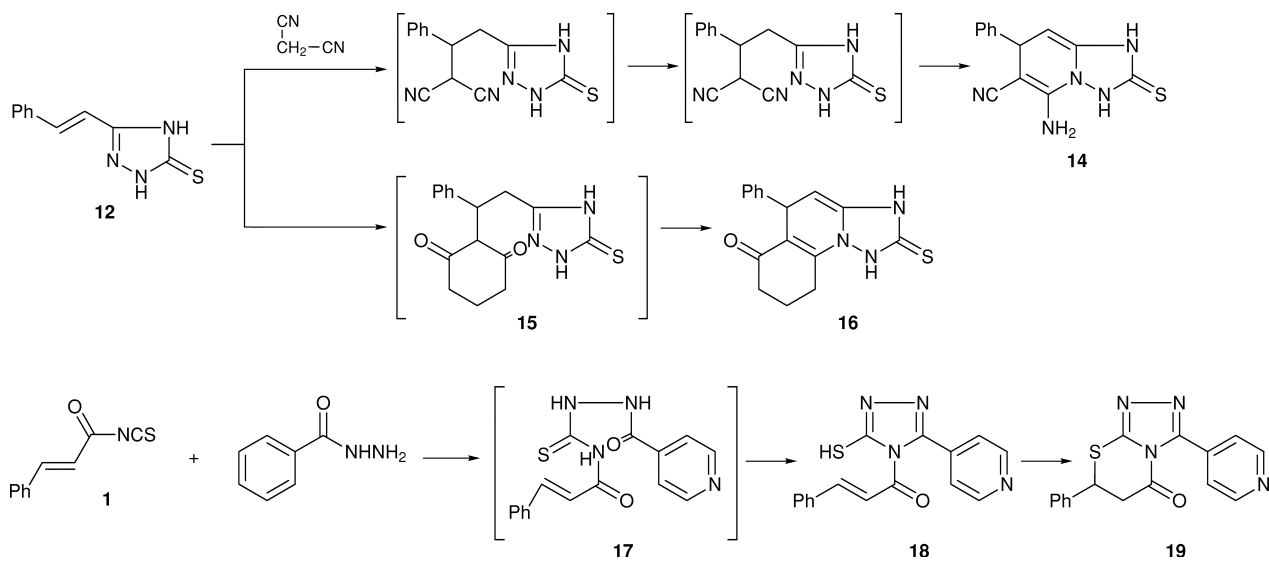
The reaction of **12** with malononitrile performed in boil-



intramolecular nucleophilic addition of thioamide NH to the cinnamoyl moiety.¹ It was found that the evolution of H₂S occurred on refluxing the bithiourea **2** in ethanolic sodium ethanolate to give an alkali-soluble product formulated as the triazolopyrimidine **5**.

ing ethanolic solution in the presence of ethoxide furnished triazolo[1,5-*a*]pyridine **14**. The ¹H NMR spectrum of **14** revealed a signal for the methinyl proton at δ 4.9. The reaction of **12** with malononitrile leading to **14** is assumed to proceed as shown, and involves an initial Michael reaction involving attack of the anion of malononitrile to the olefinic carbon in **12** which is followed by intramolecular cycloaddi-

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tion to afford **14**. Styrylthiosemicarbazide (**12**) and CH acidic cyclohexa-1,3-dione in the presence of a base undergoes an addition/cyclization reaction to give the triazolo[1,5-*b*]quinoline derivative **16**.

The reaction of heteroallene **1** with 4-pyridinecarbohydrazide yielded *N*-cinnamoylthiosemicarbazide **18**, presumably *via* the non-isolable thiosemicarbazide **17**. Base induced cyclization of **18** resulted in intramolecular cycloaddition of thiolate to the cinnamoyl moiety affording triazolothiazine **19**.

Techniques used: IR, ¹H NMR, elemental analysis

References: 9

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