Generation of Oxazolium and Thiazolium Methylides by a Caesium Fluoride-induced Desilylation Reaction

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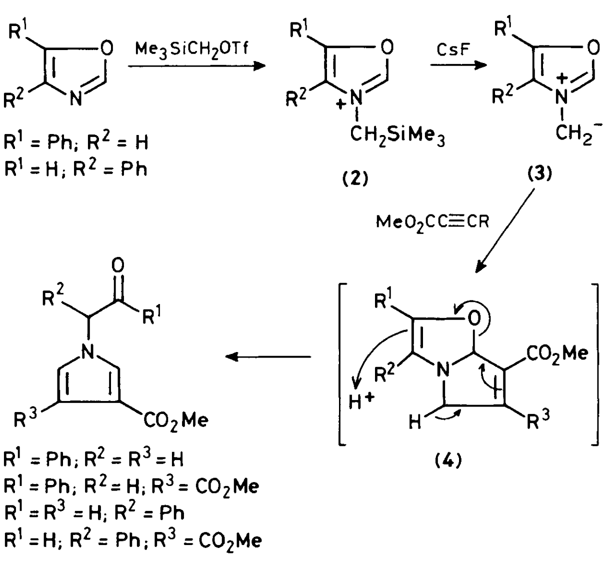
The reaction of *N*-(trimethylsilylmethyl)-oxazolium and -thiazolium salts with caesium fluoride gives *N*-azomethine-ylides which can be successfully trapped with acetylenic esters.

Considerable effort has recently been directed toward the synthesis of alkaloids using various types of iminium-ylide based dipoles.[1–4] There are now several approaches to the generation of non-stabilized azomethine-ylides by desilylation of α-trimethylsilyl iminium salts or equivalent species.[1–8] In this communication we report that the caesium fluoride induced desilylations of several oxazolium and thiazolium salts occur readily and provide access to azomethine-ylides of nitrogen heteroaromatics in synthetically useful yield.[9]

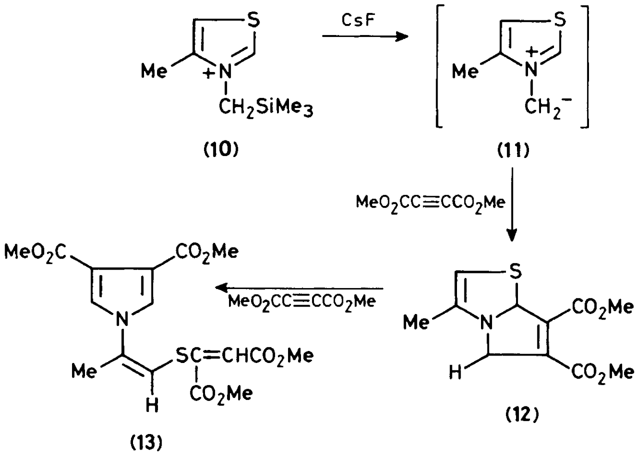
Treatment of 5- (**1**) or 4-phenyloxazole (**5**) with trimethylsilylmethyl trifluoromethanesulphonate (Me_3SiCH_2OTf) in methylene chloride followed by removal of the solvent gave rise to oxazolium salt (**2**) in quantitative yield. Cycloaddition of the nonstabilized *N*-oxazolium methylide (**3**) was achieved by stirring a tetrahydrofuran solution of silyloxazolium trifluoromethanesulphonate (**2**) with anhydrous caesium fluoride at room temperature in the presence of an acetylenic dipolarophile. The initially formed cycloadduct (**4**) was not isolated but instead undergoes a ready 1,4-elimination to give pyrroles (**6**)—(**9**) in high (80—90%) yield. The best results were obtained in a one-pot procedure where the oxazole is alkylated and the resulting oxazolium salt is immediately treated with CsF and the acetylenic ester.

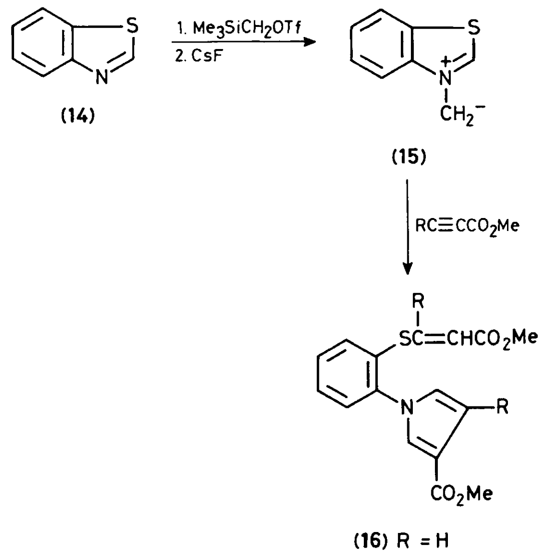
For further examples of this chemistry, we examined the reaction of a number of thiazoles with trimethylsilylmethyl trifluoromethanesulphonate followed by treatment of the resulting thiazolium salt with caesium fluoride in the presence of an acetylenic trapping reagent. Azomethine-ylide (**11**) undergoes cycloaddition with dimethyl acetylenedicarboxylate to give (**12**) which reacts further with an excess of alkyne to produce pyrrole (**13**) as a mixture of stereoisomers. Similarly, treatment of benzothiazole (**14**) under identical conditions afforded pyrrole (**16**) [or (**17**)] in excellent yield.



(**1**) $R^1 = Ph$; $R^2 = H$
(**5**) $R^1 = H$; $R^2 = Ph$

(**6**) $R^1 = Ph$; $R^2 = R^3 = H$
(**7**) $R^1 = Ph$; $R^2 = H$; $R^3 = CO_2Me$
(**8**) $R^1 = R^3 = H$; $R^2 = Ph$
(**9**) $R^1 = H$; $R^2 = Ph$; $R^3 = CO_2Me$





(14)

(15)

(16) R = H
(17) R = CO_2Me

Attempts to trap azomethine-ylides (**3**), (**11**), or (**15**) with a variety of olefinic trapping agents failed. Our inability to trap these heterocyclic *N*-ylides is probably the result of a large frontier orbital gap between the dipole and alkene.[10] When azomethine-ylides are used as 1,3-dipoles, the dipole HOMO and dipolarophile LUMO interaction is of greatest importance in stabilizing the transition state.[11] Acetylenic esters have lower lying LUMO energies than electron deficient alkenes[12] thereby accounting for this difference in reactivity.

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