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A One Step Conversion of Olefins into α-Azidoketones using Azidotrimethylsilane-Chromium Trioxide Reagent System[1]

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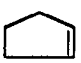
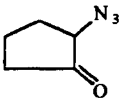
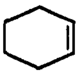
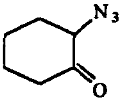
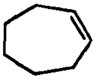
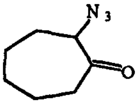
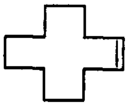
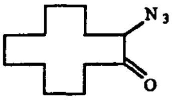
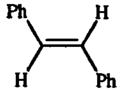
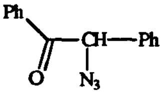
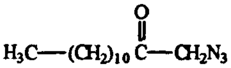
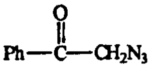
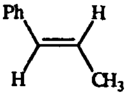
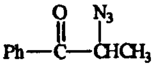
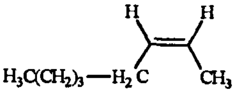
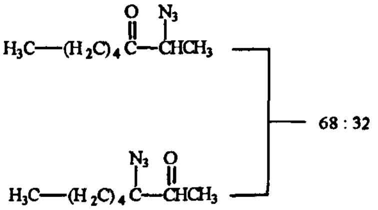
Abstract: *α-Azidoketones are conveniently obtained in good yields from the corresponding olefins upon reaction with azidotrimethylsilane-chromium trioxide reagent system.*

α-Azidoketones are useful intermediates in organic synthesis especially in the synthesis of heterocyclic compounds such as oxazoles[2], 1-pyrazines[3], 2-acylimidazoles[4] and others[5]. They are also useful in the synthesis of α-imino ketones[6] or tautomeric α-amino enones[5(ii),7]. In addition to this, they could also serve as useful intermediates towards the synthesis of vicinal amino alcohols which are parts of several useful compounds such as sphingosines[8], daunosamine[9] and hydroxy amino acids[10]. As a result of this, several synthesis of α-azidoketones have been developed. Most of these methods rely upon the replacement of a leaving group 'α' to a carbonyl functionality by azide ion. These leaving groups generally include halogens[4] (Cl^- and Br^-), mesylates[2(iii)] and triflates.[11] More recently, Patonay and Hoffman[12] have found that nosylates [4-(nitrobenzene)sulfonates] are better leaving groups in the synthesis of α-azidoketones than halides, mesylates or triflates. Apart from these, one of the recent reports by Magnus and Barth[13] involves a novel oxidative conversion of triisopropylsilyl enol ethers into α-azidoketones with NaN_3 and ceric ammonium nitrate. In view of the easy preparations of silyl enol ethers in regioselective manner[14], this method appears to be very useful. However, it would be ideal if non oxygenated substrates such as olefins are transformed into α-azidoketones using readily available reagents.

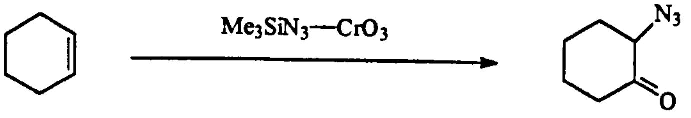
Recently, a combination of azidotrimethylsilane and chromium trioxide has been reported[15] to convert aldehydes into acyl azides. The authors have postulated that chromyl azide (formed *in situ*) is the probable reagent responsible for this transformation. We, therefore, reasoned that since chromyl chloride converts olefins into chlorohydrins[16] or α-chloroketones[17], the above combination of azidotrimethylsilane and chromium trioxide, if it really leads to chromyl azide, must convert olefins into α-azidoketones (or to vicinal hydroxy azides). In this letter we wish to report that indeed a variety of olefins are transformed (cf. Table 1) into α-azidoketones in one step upon treatment with Me_3SiN_3-CrO_3 reagent system in dichloromethane. Unsymmetrical olefins give those α-azidoketones which have the carbonyls in the internal positions (cf. entries

Table 1

Conversion of Olefins into α-Azidoketones

Entry	Olefin	α-Azidoketone	Yield (%)
1.			59
2.			58
3.			66
4.			82
5.			76
6.	$H_3C—(CH_2)_{10}CH=CH_2$	 $H_3C—(CH_2)_{10}\overset{O}{\overset{\Vert}{C}}—CH_2N_3$	78
7.	$PhCH=CH_2$	 $Ph—\overset{O}{\overset{\Vert}{C}}—CH_2N_3$	70
8.		 $Ph—\overset{O}{\overset{\Vert}{C}}—\overset{N_3}{\overset{\vert}{C}}HCH_3$	60
9.		 $H_3C—(H_2C)_4\overset{O}{\overset{\Vert}{C}}—\overset{N_3}{\overset{\vert}{C}}HCH_3$ $H_3C—(H_2C)_4\overset{N_3}{\overset{\vert}{C}}—\overset{O}{\overset{\Vert}{C}}HCH_3$ 68 : 32	51

6,7,8 and 9). It, therefore, appears that chromyl azide, formed *in situ*, is probably responsible for such a facile transformation[18]. Steroidal olefins have been reported[19] to give vicinal hydroxy azides upon treatment with the *in situ* generated chromyl azide from sodium azide and chromium trioxide in acetic acid. When cyclohexene



is reacted with sodium azide and chromium trioxide in acetic acid under analogous conditions mainly (80%) the corresponding hydroxy azide is obtained alongwith a small amount (~5%) of the α-azidocyclohexanone. Under the present reaction conditions, however, no reaction takes place between sodium azide, chromium trioxide and cyclohexene mainly because of the insolubility of sodium azide in dichloromethane[20]. We, therefore, believe that it is necessary to use trimethylsilylazide to convert olefins into the corresponding α-azidoketones under the present conditions. We expect that simplicity of the present procedure and ready availability of the reagents utilised would make this procedure useful in organic synthesis.

A general experimental procedure is as follows: To a stirred solution of azidotrimethylsilane (172 mg, 1.5 mmol) in 3 ml of dry dichloromethane was added CrO_3 (160 mg, 1.6 mmol). The stirring was continued for another 15 min., during which time all the CrO_3 was found to dissolve. An olefin (1 mmol), dissolved in 1 ml of dichloromethane, was then added to the stirred reaction mixture at room temperature and stirring continued for 24 hr. The reaction mixture was then filtered through a pad of celite. Evaporation of the solvent followed by purification by column chromatography gave pure α-azidoketones.

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20. We thank the referee for suggesting to carry out these experiments in order to establish the necessity of the trimethylsilyl group for obtaining α-azidoketones and also in pointing out the references 19(i) and (ii).

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