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NEW METHODS AND REAGENTS IN ORGANIC SYNTHESIS. 81.[1]
LITHIUM TRIMETHYLSILYLDIAZOMETHANE: A USEFUL REAGENT FOR THE *PREPARATION OF* 1,2,3-*TRIAZOLES FROM* KETENIMINES ‡

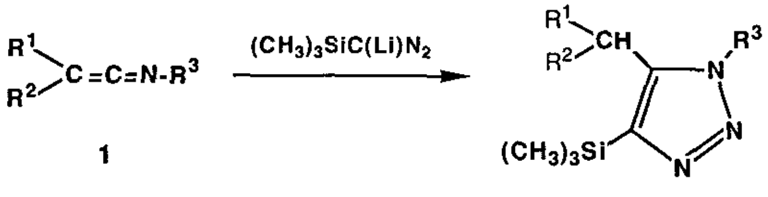
Toyohiko Aoyama, Sachiko Katsuta, and Takayuki Shioiri*

Faculty of Pharmaceutical Sciences, Nagoya City University
Tanabe-dori, Mizuho-ku, Nagoya 467, Japan

Abstract — Lithium trimethylsilyldiazomethane smoothly reacts with ketenimines to give 1,2,3-triazoles in good yields.

We have already revealed that the lithium salt of trimethylsilyldiazomethane (TMSC(Li)N_2), a useful [C-N-N] azole synthon,[2] smoothly reacts with heterocumulenes such as isocyanates,[3] isothiocyanates,[4] and carbon disulfide[5] to give 1,2,3-triazoles, 1,3,4-thiadiazoles, and 1,2,3-thiadiazoles, respectively. Our continued interest in the azole synthesis using TMSC(Li)N_2 has led us to investigate the reaction of TMSC(Li)N_2 with ketenimines **1**.

We have found that TMSC(Li)N_2, easily prepared from trimethylsilyldiazomethane (TMSCHN_2) and n-butyllithium, smoothly reacts with **1** to give 1,5-disubstituted 4-trimethylsilyl-1,2,3-triazoles **2**.



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‡ Dedicated to Sir Derek H.R. Barton on the occasion of his 70th birthday.

A typical experimental procedure for the preparation of **2** is as follows: To a solution of TMSCHN$_2$[6] (1.87 M hexane solution, 0.64 ml, 1.2 mmol) in diethyl ether (10 ml) was added dropwise n-butyllithium (15 % hexane solution, 0.76 ml, 1.2 mmol) at 0°C under argon and the mixture was stirred at 0°C for 20 min. A solution of ketenimine **1**[7] (1 mmol) in diethyl ether (2 ml) was then added dropwise at 0°C. The mixture was stirred at 0°C for 2 h. After addition of cold water, the mixture was extracted with benzene. The organic layer was washed with water, dried over magnesium sulfate, and concentrated in vacuo. The residue was purified by column chromatography on silica gel (BW-820MH, Fuji Davison) to give **2**.

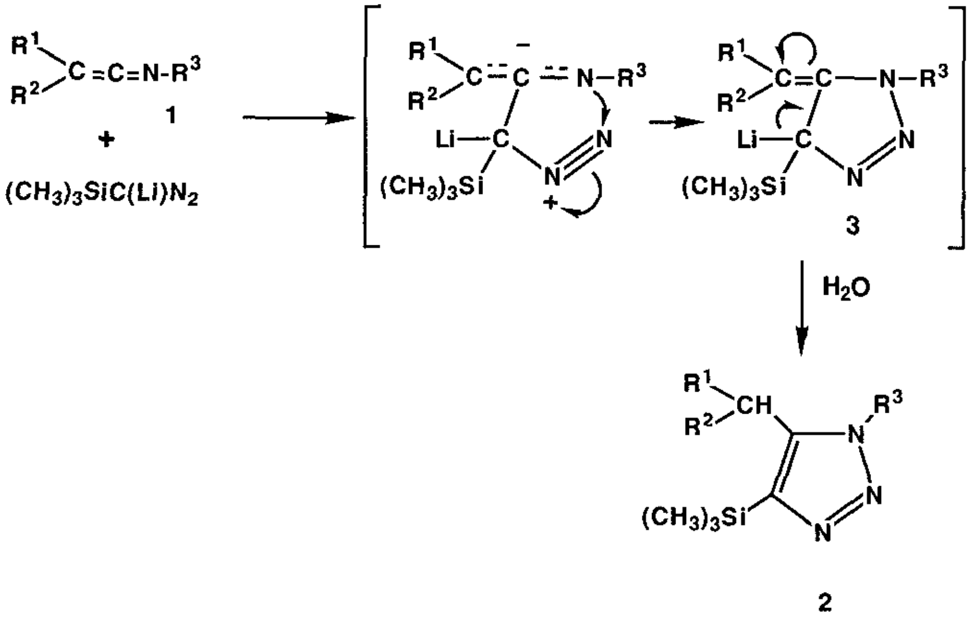
The results are summarized in Table. Various ketenimines **1** including aliphatic and aromatic ones react with TMSC(Li)N$_2$ to give **2** in good yields. In the cases of **1a** and **1d**, the desired 1,2,3-triazoles **2** are obtained as the major products, but small amounts of 3H-pyrazoles, resulting from the reaction of TMSC(Li)N$_2$ with carbon-carbon double bond moiety of **1**, are also

Table[a] Preparation of 1,2,3-Triazoles **2**

Compd. No.	R^1	R^2	R^3	Yield (%)	mp[b] (°C)
a	C$_6$H$_5$	C$_6$H$_5$	p-MeC$_6$H$_4$	74[c]	108-109
b	C$_6$H$_5$	C$_6$H$_5$	p-BrC$_6$H$_4$	69	122-122.5
c	C$_6$H$_5$	C$_6$H$_5$	p-MeOC$_6$H$_4$	68	134-136
d	C$_6$H$_5$	C$_6$H$_5$	n-C$_4$H$_9$	67[d]	74.5-75.5
e	Me	Me	p-MeC$_6$H$_4$	82	104-104.5
f	C$_2$H$_5$	n-C$_4$H$_9$	n-C$_4$H$_9$	82	oil

a) All 1,2,3-triazoles **2** gave satisfactory elemental analysis and spectral data. b) Recrystallized from benzene-hexane or hexane. c) 3,3-Diphenyl-4-(p-toluidino)-5-trimethylsilyl-3H-pyrazole was also obtained in 6 % yield. The structure was determined on the basis of the ir and ^{1}H-nmr spectral data. d) 4-Butylamino-3,3-diphenyl-3H-pyrazole was also obtained in 11 % yield. The structure was determined on the basis of the elemental analysis and spectral data.

formed. Diethyl ether seems to be the solvent of choice. The use of tetrahydrofuran as the solvent showed the decrease in yield. n-Butyllithium is essential to conduct the reaction since TMSCHN$_2$ does not react with **1** at all. Desilylation of **2** is easily achieved with 10% aqueous potassium hydroxide in methanol in high yields.[8] The reaction mechanism of the formation of **2** may be as follows: Nucleophilic attack[3,9] of TMSC(Li)N$_2$ on the electron deficient sp carbon atom of **1**, followed by cyclization gives the intermediate **3**. Aqueous work-up of **3** affords **2**.



Although the reaction of several ketenimines with diazomethane is known[10] to produce 1,2,3-triazoles, a long reaction time is required for the completion of the reaction and the yields of triazoles are low. The method described here makes possible the efficient conversion of ketenimines to 1,2,3-triazoles under mild reaction conditions, and will provide a new and convenient method for the preparation of 1,2,3-triazoles.

ACKNOWLEDGEMENT

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8. For example, **2a** (92 mg, 0.2 mmol) was refluxed with 10 % aqueous potassium hydroxide (5 ml) in methanol (10 ml) for 6 h to give 5-diphenylmethyl-1-(p-tolyl)-1,2,3-triazole in 93 % yield, mp 139.5-140.5°C (Lit.,[10] 146.5-148.5°C). Analogously, 1-(p-bromophenyl)-5-diphenylmethyl-1,2,3-triazole was obtained from **2b** in 96 % yield, mp 169-170°C (Lit.,[10] 172-173°C).
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