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REACTIONS OF ISOCYANIDES. II - ADDITION TO ACETALS

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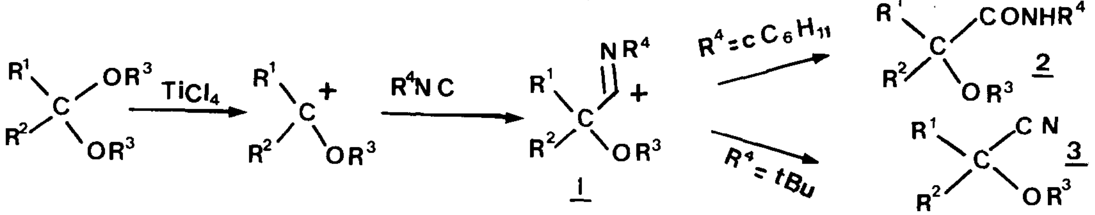
Summary : In the presence of $TiCl_4$, tert-butyl isocyanide reacts with aldehyde acetals to *afford* β-*alkoxycyanoenamines*.

Isocyanides, stable divalent carbon compounds are widely utilized as nucleophiles as well as electrophiles (1). Therefore, many reports have been published about the reaction of isocyanides with carbocation species (1, 2, 3).

The reaction of acetals with isocyanides in the presence of $TiCl_4$ leads to α-alkoxycarboxamide derivatives 2 (4, 5, 6) or to cyanohydrin ethers 3 (7) (Scheme 1).

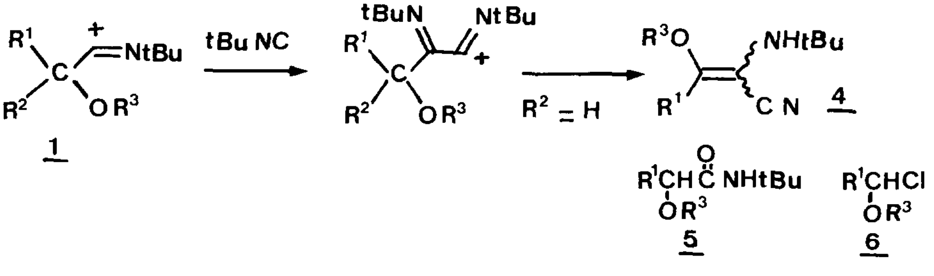
Scheme 1



In this communication, we wish to report on the nucleophilic addition of isocyanides to the highly electrophilic carbon of the imidoyl intermediate 1.

The reaction of several aldehyde acetals, each with two equivalents of tert-butylisocyanide and one equivalent of $TiCl_4$ (8), leads essentially to a new class of compounds, β-alkoxycyanoenamines 4, along with two minor by-products, α-alkoxycarboxamides 5 and α-chloroethers 6 (Scheme 2).

Scheme 2



We have not yet optimized the reaction conditions. Nevertheless, we have prepared in fair to good yields (Table) a new class of substituted enamines (9) from readily available starting materials (10).

Table

Acetal	R^1	H	CH_3	C_2H_5	C_3H_7	$(CH_3)_2CH$	C_6H_{13}	C_6H_5
	R^2	H	H	H	H	H	H	H
	R^3	CH_3	C_2H_5	CH_3	CH_3	CH_3	CH_3	CH_3
Yield	4	50	52	65	57	36	57	69
	5	-	14	8	7	30	1	0
	6	-	1.5	1	14	12	8.5	4.5

These β-alkoxycyanoenamines, which constitutes a special case of push-pull olefins, offer a promising role as synthetic building blocks. Consequently, their chemical reactivity is now under investigation in our laboratory.

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8 - The general procedure is described below :

To a stirred solution of tert-butylisocyanide (3 mmol) and aldehyde acetal (1 mmol) in anhydrous methylene chloride (10 mL) is added dropwise a solution of $TiCl_4$ (1.2 mmol) in methylene chloride (10 mL) at -50°C under an argon atmosphere. The reaction mixture is allowed to warm to room temperature and further stirred for 3 h. It is then poured in a saturated aqueous potassium carbonate solution. After usual work-up, the cyanoenamine is purified by chromatography on a silica gel column.

R^1 = Et ; R^2 = H ; R^3 = Me : I.R. (neat) : 3320, 2940, 2880, 2210, 1645 ; ^1H NMR ($CDCl_3$) : 1.15 (t, 3H) ; 1.20 (s, 9H) ; 2.55 (q, 2H) ; 3.73 (s, 3H). Anal. : Calcd. for $C_{10}H_{18}N_{2}O$: C, 65.90 ; H, 9.95 ; N, 15.37. Found : C, 65.23 ; H, 9.62 ; N, 15.42.

9 - For the synthesis and reactivity of α-cyanoenamines, see : N. DEKIMPE, R. VERHE, L. DEBUYCK, N. SCHAMP, Synthesis (1979) 741.

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