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NOVEL TRICHLOROACETYL BASED SILYLATIONS: SIMPLE METHODS FOR t-BUTYLDIMETHYLSILYLATIONS AND FOR THE PROTECTION OF AMINO GROUPS.

Adam A.Galan and Thomas V.Lee
(School of Chemistry, The University, Bristol, BS8 1TS, U.K.)

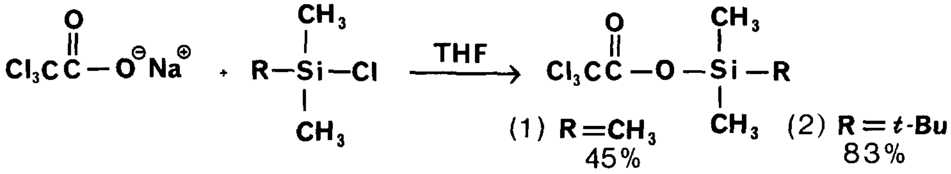
Christopher B.Chapleo
(Dept. of Medicinal Chemistry, Reckitt & Colman Ltd.,Hull,U.K.)

Summary: A new reagent for t-butyldimethylsilylation has been developed and the known trimethylsilyl trichloroacetate (1) has been shown to be of use for N-silylating amines.

A recent description of the use of trimethylsilyl trichloroacetate (1) for salt free silylations highlighted the great value of silylating reagents which react with the formation of volatile by-products.[1] We needed a silylating species such as this, as part of a larger synthetic program, which would allow the simple silylation of amines and permit the introduction of the t-butyldimethylsilyl group.

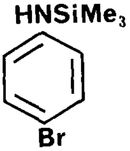
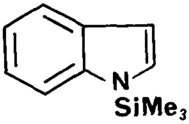
We now describe a useful extension to the chemistry of trimethylsilyl trichloroacetate (1) which demonstrates its use for the N-trimethylsilylation of amines. Additionally we have prepared t-butyldimethylsilyl trichloroacetate (2) as shown in the **SCHEME** and demonstrated its utility for the introduction of a t-butyldimethylsilyl group in various molecules.

SCHEME



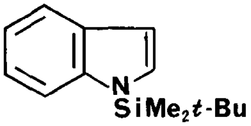
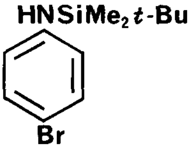
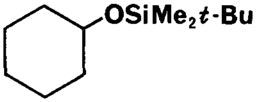
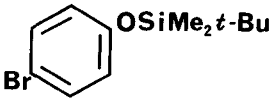
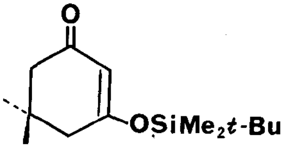
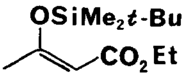
As seen in **TABLE 1** reaction of an amine group with trimethylsilyl trichloroacetate, dry potassium carbonate and 18-crown-6 at ca.100°C results in a clean silylation of the N-H group. The yields of the products are relatively good, which is an indication of the stability of the N-silyl species under these relatively harsh reaction conditions. In similar fashion to this we have studied the reactions of the t-butyldimethylsilyl analogue (2).

TABLE I

N-Silylated Amine	Reaction temp °C	Yield %
Ph_2NSiMe_3	110°C	70
	110°C	67
	100°C	47
	110°C	80

By using similar reaction conditions we have achieved the very efficient t-butyldimethylsilylation of the heterocyclic amino group as shown in **TABLE II.** Additionally we have achieved silylation of a primary aromatic amine, a phenol and a secondary alcohol. Also of great utility is the ability to use the reagent (2) in the formation of the t-butyldimethylsilyl mono enol ether of 1,3-diketones as demonstrated for the preparation of (3) and (4).

TABLE II

PRODUCT	REACTION TEMP(°C)	YIELD %
	120°C	80
	120°C	75
	120°C	55
	120°C	87
	150°C	98
 (3)	120°C	83
 (4)	120°C	97

The new chemistry described herein offers a simple alternative means of introducing the t-butyldimethylsilyl group onto a variety of acidic hydrogen functions and so should be of use in organic synthesis.

ACKNOWLEDGEMENTS : We would like to thank SERC and Reckitt & Colman Ltd. for a studentship to AAG.

REFERENCES AND NOTES

1. J.M.Renga and P-C.Wang, TETRAHEDRON LETTERS, (1985), 26, 1175.

2.For other methods see M.Lalonde and T.H.Chan, SYNTHESIS, (1985), 817. and J.M.Aizpura and C.Palomo, TETRAHEDRON LETTERS, (1985), 26, 475.

3.Preparation of t-butyldimethylsilyl trichloroacetate (2).

t-Butyldimethylsilyl chloride (54 mmole), in dry THF (100 ml) was added to a stirred suspension of dry sodium trichloroacetate (54 mmole) in dry THF (100 ml), at room temperature, under nitrogen. After stirring for 16 hours, the mixture was evaporated in vacuo, and the residues were triturated with dry hexane (100 ml), and stirred for 1 h, under nitrogen, at room temperature. The mixture was filtered under nitrogen, washed with dry hexane (2 x 50 ml), evaporated in vacuo and distilled at reduced pressure, to give the desired material, b.p. $51^{o}C/0.45$mm Hg, yield 83%.

4. Typical silylation procedure.

A stirred mixture of (2) (15 mmoles), amine (12.5 mmoles), potassium carbonate (0.25 mmoles), and 18-crown-6 (0.25 mmoles) were heated to ca.$100^{o}C$ when the evolution of chloroform and carbon dioxide begins. The reaction temperature was maintained at $100\text{-}120^{o}C$ for 2-3 hours. The reaction mixture was allowed to cool, before distillation at reduced pressure.

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