

0040-4039(95)01184-6

Photochemical Deprotection of 3',5'-Dimethoxybenzoin (DMB) Carbamates Derived from Secondary Amines

Michael C. Pirrung*1 and Chia-Yu Huang

Department of Chemistry, Duke University P. M. Gross Chemical Laboratory Durham, North Carolina 27708-0346

Key words: photochemically-removable protecting groups.

Abstract: Treatment of secondary amines with a (dimethoxybenzoin)carbonylimidazolium salt provides dimethoxybenzoin carbamates that can be deprotected photochemically.

We have recently reported the development of a novel photochemically-removable protecting group for alcohols based on conversion of the known² dimethoxybenzoin (DMB) to its carbonate derivative.³ A significant advantage afforded by the DMB group as compared to the more classical photochemically-removable nitrobenzyl derivatives is the (dimethoxy)phenylbenzofuran (BF) byproduct. Not only is it relatively inert, it exhibits strong absorption and fluorescence that permits the yield of a photochemical deprotection to be determined by optical methods. This makes it ideal for solid-phase and polymer-based chemistries where direct spectroscopic analysis of reactions can be difficult.



Photochemical generation of basic amines from nitrobenzyl carbamates⁴ to ultimately produce images in polymer films has been recently reported.⁵ Given the advantages of DMB derivatives over nitrobenzyl groups mentioned above, we examined the suitability of DMB-carbamates for amine protection and photochemical

deprotection. The reagent formed by treatment of carbonyldiimidazole with methyl triflate in nitromethane and then dimethoxybenzoin serves to effectively protect secondary amines (eq 1) in high yield (Table 1). With a primary amine (R=Bu, R'=H), the acylation reaction still occurs, but the proximity of the benzoin carbonyl to the still-nucleophilic nitrogen permits cyclization/tautomerism to form a five-membered ring. This derivative is photochemically inert and therefore useless for deprotection reactions.⁶



^a(dimethoxy)phenylbenzofuran ^b as •HCl ^c 8% of a reduction by-product isolated

The DMB-carbamates of secondary amines can be deprotected by irradiation (350 nm phosphor lamps, Rayonet photochemical reactor) in benzene or THF, producing the benzofuran (BF), carbon dioxide, and the amine (eq 2). The products are isolated by chromatography or an extractive workup (the amine as the free base or the hydrochloride salt) in comparable yields (Table 1), except in the case of the volatile diallylamine.

$$\begin{array}{c} O \\ O \\ R \\ R' \end{array} \xrightarrow{hv, 350 \text{ nm}} RNHR' + CO_2 + OMe \end{array} \xrightarrow{MeO} Ph (2)$$

Acknowledgment. Financial support was provided by NIH GM-46720.

References and Notes.

1. Fellow of the John Simon Guggenheim Memorial Foundation, 1994-95.

2. Sheehan, J.L.; Wilson, R.M.; Oxford, A.W. J. Am. Chem. Soc. 1971, 93, 7222-7227.

3. Pirrung, M. C.; Bradley, J.-C. J. Org. Chem. 1995, 60, 1116.

4. Cameron, J. F.; Fréchet, J. M. J. J. Am. Chem. Soc. 1991, 113, 4303. Martina, S.; MacDonald, S. A.; Enkelmann, V. J. Org. Chem. 1994, 59, 3281-3.

5. Beecher, J.E.; Cameron, J. F.; Fréchet, J. M. J. J. Mater. Chem. 1992, 2, 811-16.

6. Note added in press: A recent report describes the preparation, from dimethoxybenzoin and cyclohexyl isocyanate, and photochemistry of a DMB-carbamate: Cameron, J. F.; Willson, C. G.; Fréchet, J. M. J. J. Chem. Soc., Chem. Commun. 1995, 923.

(Received in USA 23 May 1995; revised 13 June 1995; accepted 20 June 1995)