

A FACILE PROCEDURE FOR O-TRITYLATION¹

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Summary: The title operation is achieved via readily accessible organosilicon compounds.

Although trityl group is widely used for the protection of hydroxylic functions, there exist only a few methods for such operation.^{2,3} We report here a facile recipe which finds widespread application for the blocking of alcohols, phenols, carboxylic acids, etc.

This procedure utilizes equimolar amounts of a trimethylsilylated hydroxyl compound (I) and trimethyltrityloxysilane (II) and 1 mol % of trimethylsilyl triflate (TMSOTf) as the catalyst. The condensation reaction proceeds smoothly in dichloromethane at 0 °C to room temperature.⁴ Some examples are listed in Table I.

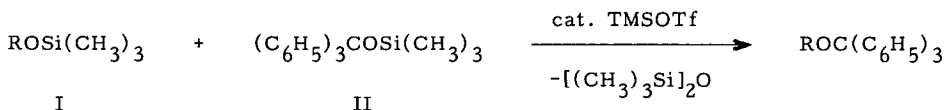


Table I. Trimethylsilyl Triflate Catalyzed O-Tritylation^a

| ROSi(CH ₃) ₃ | conditions temp, °C time, h | | product ^b | % yield ^c |
|--|-----------------------------------|-----|---|----------------------|
| C ₂ H ₅ OSi(CH ₃) ₃ | 0 | 0.5 | C ₂ H ₅ OC(C ₆ H ₅) ₃ | 97 |
| 2,3,5-tris(<u>O</u> -trimethylsilyl)- <u>O</u> -methyl-β- <u>D</u> -ribofuranose | 0 | 0.5 | 2,3-bis(<u>O</u> -trimethylsilyl)-5- <u>O</u> -trityl- <u>O</u> -methyl- <u>D</u> -ribofuranose | 85 ^d |
| C ₆ H ₅ OSi(CH ₃) ₃ | 14 | 18 | C ₆ H ₅ OC(C ₆ H ₅) ₃ | 98 |
| CH ₃ (CH ₂) ₈ COOSi(CH ₃) ₃ | 15 | 4 | CH ₃ (CH ₂) ₈ COOC(C ₆ H ₅) ₃ | 78 |
| CH ₂ =C(CH ₃)COOSi(CH ₃) ₃ | 0 | 6 | CH ₂ =C(CH ₃)COOC(C ₆ H ₅) ₃ | 73 |
| C ₆ H ₅ COOSi(CH ₃) ₃ | 0 | 2 | C ₆ H ₅ COOC(C ₆ H ₅) ₃ | 86 |

^a The reaction was carried out in dichloromethane using I, II, and TMSOTf in 1:1:0.01 mol ratio. ^b Satisfactory spectral data (NMR, IR, and MS) were obtained for each compound. ^c Isolated yield after silica gel chromatography. ^d A 1:3 mixture of α and β isomers.

Acid catalyzed O-tritylation is generally a reversible process⁵ but, in this particular reaction, high stability of hexamethyldisiloxane is capable of shifting the equilibrium to the tritylated product. The facile tritylation of carboxylic acids is to be noted, since this has been effected only by using the silver or other metal salts and trityl halides.⁶ In addition, this method may be suitable for the derivatization of acid- or base-sensitive compounds and allows the ready synthesis of trityl methacrylate, a vinyl monomer for the preparation of the optically active, isotactic polymer which is useful for the resolution of various racemic compounds.⁷

The following procedure is representative. To a mixture of trimethyltrityloxysilane⁸ (3.38 g, 10.2 mmol) and trimethylsilyl methacrylate⁹ (1.63 g, 10.3 mmol) in dry dichloromethane (50 mL) was added a 0.12 M solution of TMSOTf in dichloromethane (0.8 mL, 0.96 mmol) at 0 °C under argon atmosphere. After reaction at 0 °C for 6 h, the mixture was quenched by addition of a few drops of pyridine at this temperature, poured into saturated NaHCO₃ solution (50 mL), and extracted with dichloromethane (3 x 30 mL). The combined extracts were dried over anhydrous K₂CO₃ and evaporated. Column chromatography on silica gel, eluting with 20:1 petroleum ether/ether mixture, gave trityl methacrylate as colorless crystals (2.25 g, 73% yield), mp 98–99 °C (recrystallized from hexane).

REFERENCES AND NOTES

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3. For tritylation using tritylpyridinium tetrafluoroborate, see S. Hanessian and A. P. A. Staub, Tetrahedron Lett., 3555 (1973).
4. In place of trimethyltrityloxysilane, tert-butoxytrimethylsilane may be used, though less effectively. For instance, the reaction of trimethylsilyl decanoate in the presence of TMSOTf (14 °C, 70 h) afforded the corresponding tert-butyl ester in 37% yield.
5. TMSOTf is an effective, stoichiometric reagent for cleavage of tert-alkyl esters. H. Emde, Ph.D. Thesis, Stuttgart University, 1979; H. Ahlbrecht and E.-O. Düber, Synthesis, 630 (1980).
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8. Prepared in 80% yield from sodium triphenylmethoxide and chlorotrimethylsilane in boiling THF, mp 35–36 °C: K. Uhle and U. Werner, Z. Chem., 13, 224 (1973).
9. A mixture of methacrylic acid (4.3 g, 0.05 mol), hexamethyldisilazane (4.2 g, 0.025 mol), and (NH₄)₂SO₄ (20 mg) was heated at 120 °C. After the gas evolution ceased, this was distilled to give trimethylsilyl methacrylate¹⁰ as a colorless liquid, bp 70–71 °C/90 mmHg (4.4 g, 56%).
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