



A Publication
of Reliable Methods
for the Preparation
of Organic Compounds

Working with Hazardous Chemicals

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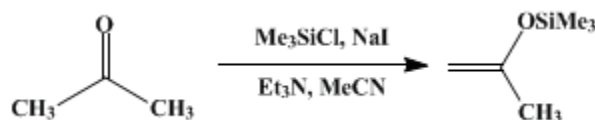
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These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

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ACETONE TRIMETHYLSILYL ENOL ETHER

[Silane trimethyl[(1-methylethenyl)oxy]-]



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1. Procedure

To a 5-L, four-necked flask, equipped with a mechanical stirrer, a reflux condenser with a nitrogen inlet, a thermometer, and a pressure-equalizing dropping funnel, are added 150 g (2.6 mol) of [acetone](#) ([Note 1](#)) and 192 g (1.9 mol) of [triethylamine](#) ([Note 2](#)) under a [nitrogen](#) atmosphere. To this mixture, stirred at room temperature under [nitrogen](#), is added via the dropping funnel 200 g (1.84 mol) of [chlorotrimethylsilane](#) over 10 min ([Note 3](#)). The flask is then immersed in a water bath and the contents are warmed to 35°C. The water bath is removed and the dropping funnel is charged with a solution of 285 g (1.9 mol) of [sodium iodide](#) ([Note 4](#)) in 2.14 L of [acetonitrile](#) ([Note 5](#)). This solution is added to the stirred mixture in the flask at such a rate that the temperature of the reaction is maintained at 34–40° C without external heating or cooling ([Note 6](#)). The addition requires approximately 1 hr. When addition is complete, the reaction mixture is stirred for a further 2 hr at room temperature. The contents of the flask are then poured into 5 L of ice-cold water, and the aqueous mixture is extracted with two 1-L portions of [pentane](#), and once with 500 mL of [pentane](#). The combined [pentane](#) extracts are dried over anhydrous [potassium carbonate](#), and filtered into a 3-L, round-bottomed flask. This is arranged for distillation at atmospheric pressure, incorporating a 30-cm Vigreux fractionating column. The [pentane](#) is distilled off at atmospheric pressure, until a head temperature of 88°C is attained. The crude material is transferred to a 500-mL flask, and the product is then distilled at atmospheric pressure through a 20-cm Vigreux column. A forerun of 20 g is collected between room temperature and 94°C. The product is the fraction boiling at 94–96°C, the yield of which is 116–130 g (48–54%) ([Note 7](#)).

2. Notes

1. "AnalaR"-grade [acetone](#), as supplied by BDH, was used.
2. [Triethylamine](#) was dried over [potassium hydroxide](#) pellets for at least 24 hr.
3. Commercial [chlorotrimethylsilane](#) was used without purification. When it was added to the [acetone/triethylamine](#) mixture, only a very mild exothermic reaction occurred (ca. 2°C). Dense white fumes formed, and a turbid solution was obtained.
4. [Sodium iodide](#) was reagent grade. It is essential to dry this material thoroughly. Heating at 140°C for 8 hr under reduced pressure (ca. 20 mm) is satisfactory. The loss of weight on drying is roughly 5%. If this is not done, [hexamethyldisiloxane](#) is the principal product.
5. [Acetonitrile](#) was reagent grade, dried by passage through 1 kg of neutral alumina (grade 1), and then stored over Linde 3A molecular sieves.
6. A copious white precipitate forms at this stage. If the reaction is not mildly exothermic, then very poor yields of product are obtained.
7. The yield is based on [chlorotrimethylsilane](#). Two small-scale runs—0.124 and 0.37 mol, also based on [chlorotrimethylsilane](#)—gave yields of 60 and 61%, respectively, which the submitters also reported on the larger scale. The material from the large-scale run was 92% pure by gas-chromatographic analysis. The impurities, identified by NMR, are [triethylamine](#) (0.5%) and [hexamethyldisiloxane](#) (7.5%). The product has the following spectral characteristics; IR (film) cm⁻¹: 1650, 1280, 1260, 1050; ¹H NMR (CDCl₃) δ: 0.13 (s, 9 H, SiCH₃), 1.69 (br s, 3 H, =CCH₃), 3.92 (m, 2 H, =CH₂).

3. Discussion

Trimethylsilyl enolates of aldehydes and ketones are now established as highly useful synthetic intermediates.² In particular, their Lewis-acid-catalyzed reactions (e.g., alkylation³ and mild, regiospecific aldol condensations⁴) provide useful alternatives to classical, base-generated metal enolate chemistry. This new methodology would be ideal for the introduction of the commonly encountered acetyl residue. However, the required silyl enol ether of acetone is not commercially available, nor is a simple, reliable, and economical synthesis adequately described in the literature. The above procedure is an adaptation of a literature method,⁵ and relies on the generation of [iodotrimethylsilane](#) in situ. We have found that the precautions described in [\(Note 4\)](#) and [\(Note 6\)](#) are crucial to the success of the preparation. This procedure makes available a useful reagent by a cheap, reliable route, starting from readily available materials, and in large or small quantity. The [trimethylsilyl enol ether of acetone](#) has been prepared previously in good yield by reaction of [acetone](#) with [trimethylsilyl triflate](#) and [triethylamine](#).⁶ However, the [silyl triflate](#) reagent is expensive for large-scale work. Another route⁷ involves the mercuric iodide-catalyzed rearrangement of [α-trimethylsilylacetone](#) (obtained from [trimethylsilylmethylmagnesium chloride](#) and [acetic anhydride](#)). This is a laborious, low-yield process. Other methods include a synthesis from [acetone](#), [chlorotrimethylsilane](#), and [triethylamine](#)⁸ (yields and exact procedure unspecified); or reaction of [acetone](#) with [hexamethyldisilazane](#),⁹ or [bis\(trimethylsilyl\)acetamide](#),¹⁰ and a catalytic amount of [sodium](#) in the presence of [hexamethylphosphoric triamide](#). Two authors¹¹ who used the method of House¹² (no experimental details supplied) note that their product always contained about 30% of [hexamethyldisiloxane](#), which could not be separated by fractional distillation.

This preparation is referenced from:

- [Org. Syn. Coll. Vol. 8, 323](#)

References and Notes

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Appendix
Chemical Abstracts Nomenclature (Collective Index Number);
(Registry Number)

ACETONE TRIMETHYSILYL ENOL ETHER

Silane trimethyl[(1-methylethenyl)oxy]-

silyl enol ether of acetone

potassium carbonate (584-08-7)

acetic anhydride (108-24-7)

acetonitrile (75-05-8)

nitrogen (7727-37-9)

acetone (67-64-1)

potassium hydroxide (1310-58-3)

sodium (13966-32-0)

sodium iodide (7681-82-5)

Pentane (109-66-0)

triethylamine (121-44-8)

hexamethylphosphoric triamide (680-31-9)

CHLOROTRIMETHYLSILANE (75-77-4)

hexamethyldisiloxane (107-46-0)

Iodotrimethylsilane (16029-98-4)

trimethylsilyl triflate (27607-77-8)

silyl triflate

α -trimethylsilylacetone,
trimethylsilyl enol ether of acetone

Trimethylsilylmethylmagnesium chloride (13170-43-9)

bis(trimethylsilyl)acetamide

hexamethyldisilazane (999-97-3)