



A Publication
of Reliable Methods
for the Preparation
of Organic Compounds

Working with Hazardous Chemicals

The procedures in *Organic Syntheses* are intended for use only by persons with proper training in experimental organic chemistry. All hazardous materials should be handled using the standard procedures for work with chemicals described in references such as "Prudent Practices in the Laboratory" (The National Academies Press, Washington, D.C., 2011; the full text can be accessed free of charge at http://www.nap.edu/catalog.php?record_id=12654). All chemical waste should be disposed of in accordance with local regulations. For general guidelines for the management of chemical waste, see Chapter 8 of Prudent Practices.

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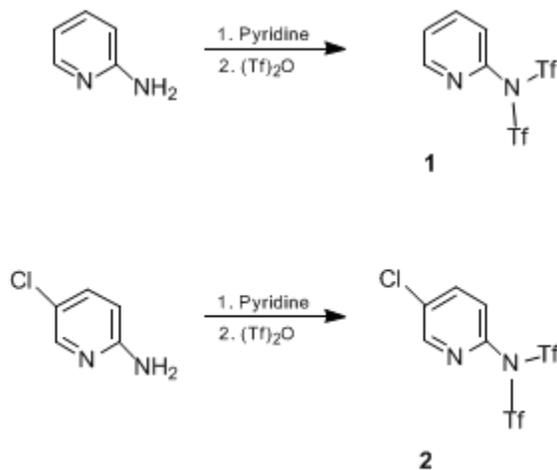
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September 2014: The paragraphs above replace the section "Handling and Disposal of Hazardous Chemicals" in the originally published version of this article. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

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PYRIDINE-DERIVED TRIFLATING REAGENTS: N-(2-PYRIDYL)-TRIFLIMIDE AND N-(5-CHLORO-2-PYRIDYL)TRIFLIMIDE

[Methanesulfonamide, 1,1,1-trifluoro-N-2-pyridinyl-N-[(trifluoromethyl)sulfonyl]-] and Methanesulfonamide, N-(5-chloro-2-pyridinyl)-1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-]



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Checked by Maria A. Cichy and Amos B. Smith, III.

1. Procedure

A. *N*-(2-Pyridyl)triflimide (**1**). A 2-L, two-necked, round-bottomed flask equipped with a mechanical stirrer (Note 1) and a rubber septum is charged with 2-aminopyridine (19.859 g, 0.211 mol) (Note 2) and pyridine (35.04 g, 35.88 mL, 0.443 mol) (Note 3) in 800 mL of dichloromethane (CH₂Cl₂) (Note 4) under an argon atmosphere. The reaction mixture is cooled to -78°C and a solution of triflic anhydride (125 g, 74.54 mL, 0.443 mol) (Note 5) in 150 mL of CH₂Cl₂ is added dropwise via a cannula over 3.5 hr with vigorous stirring. After the solution is stirred for 2 hr at -78°C , the cooling bath is removed and stirring is continued at room temperature for 19 hr. The reaction mixture is quenched with 50 mL of cold water and the layers are separated. The aqueous layer is extracted with CH₂Cl₂ (4 \times 50 mL). The combined organic extracts are washed with cold aqueous 10% sodium hydroxide (1 \times 150 mL), cold water (1 \times 100 mL), brine (1 \times 100 mL) and dried over magnesium sulfate. After filtration, the solvent is removed under vacuum to give 69 g of the crude product. After Kugelrohr distillation (Note 6), 61 g (81%) of pure *N*-(2-pyridyl)triflimide (bp 85–100°C/0.25 mm, mp 41–42°C) (Note 7) is obtained as a white solid.

B. *N*-(5-Chloro-2-pyridyl)triflimide (**2**). Using the same procedure as described above, 2-amino-5-chloropyridine (27.13 g, 0.211 mol) (Note 8) is converted to *N*-(5-chloro-2-pyridyl)triflimide (mp 47–48°C) (61.84 g, 75%, bp 88–100°C/0.15 mm) (Note 9).

2. Notes

1. A magnetic stirrer can be used with a large stirrer bar and 1.5 L of dichloromethane.
2. 2-Aminopyridine was purchased from Aldrich Chemical Company, Inc., and used without further purification.
3. Anhydrous pyridine was purchased from Aldrich Chemical Company, Inc., and kept over 3 Å molecular sieves for two days prior to use.
4. Anhydrous dichloromethane was purchased from Aldrich Chemical Company, Inc., and used without

further purification.

5. **Triflic anhydride** was purchased from Aldrich Chemical Company, Inc., and used as such.

6. Sometimes a second distillation is needed to obtain pure compound.

7. The spectral properties of **N-(2-pyridyl)triflimide** are as follows: IR (nujol) cm^{-1} : 1590, 1570, 1460, 1220, 1215, 1120, 1040, 990, 940, 910, 880, 735, 710; ^1H NMR (300 MHz, CDCl_3) δ : 7.46–7.55 (m, 2 H), 7.91–7.97 (dt, 1 H, $J = 8.06, 2.2$), 8.63 (dd, 1 H, $J = 4.4, 1.46$); ^{13}C NMR (75 MHz, CDCl_3) δ : 112.80, 117.10, 121.39, 125.50, 125.69, 126.79, 139.71, 145.98, 150.31.

8. **2-Amino-5-chloropyridine** was purchased from Aldrich Chemical Company, Inc., and used without further purification.

9. The spectral properties of **N-(5-chloro-2-pyridyl)triflimide** are as follows: IR (nujol) cm^{-1} : 1570, 1460, 1230, 1215, 1125, 1010, 925, 905, 745, 730; ^1H NMR (300 MHz, CDCl_3) δ : 7.42 (d, 1 H, $J = 8.8$), 7.90 (dd, 1 H, $J = 8.8, 2.2$), 8.58 (d, 1 H, $J = 2.93$); ^{13}C NMR (75 MHz, CDCl_3) δ : 112.77, 117.06, 121.36, 125.66, 126.18, 135.84, 139.33, 143.82, 149.31.

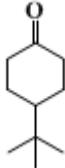
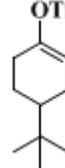
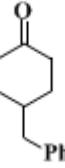
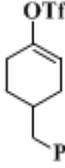
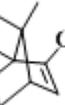
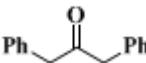
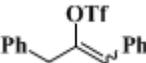
Waste Disposal Information

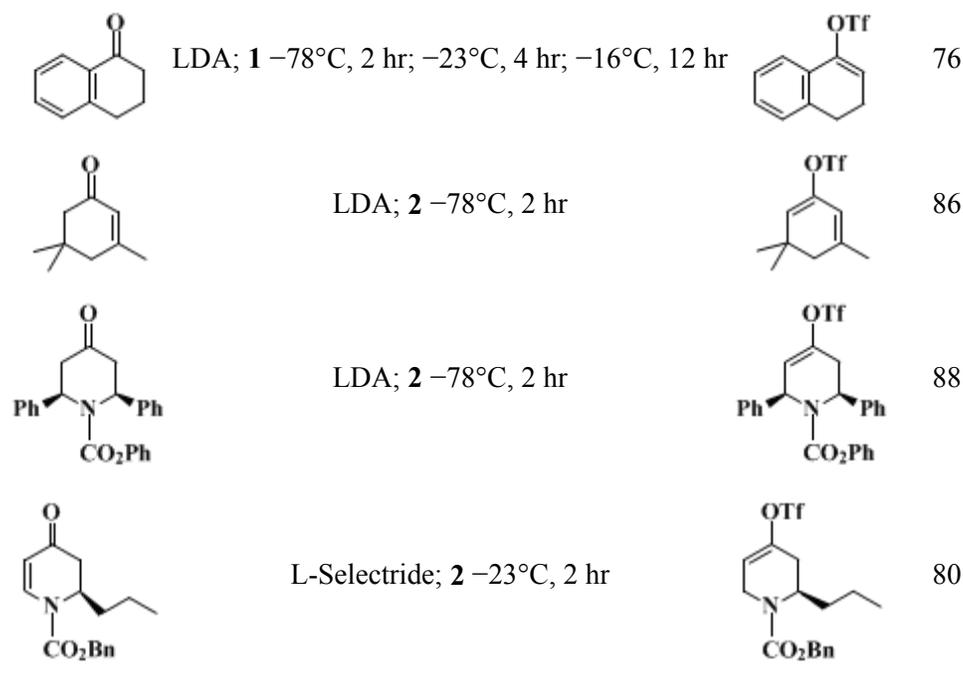
All toxic materials were disposed of in accordance with "Prudent Practices in the Laboratory"; National Academy Press; Washington, DC, 1995.

3. Discussion

Vinyl triflates are important intermediates, since they can be used as synthetic precursors for vinyl cations and alkylidene carbenes, and as substrates for regiospecific coupling reactions.^{2,3,4,5,6,7,8,9,10} Vinyl triflates are also valuable intermediates in a mild, two-step procedure for the deoxygenation of ketones.^{11,12,13} These new triflating reagents are highly reactive and easy to prepare and handle.¹⁴ When compared with other triflating reagents, the **vinyl triflate** can in most cases be made at lower temperatures, and any excess reagent and by-products can be removed by washing with cold aqueous 5% **sodium hydroxide** solution. The utility of the pyridine-derived triflating reagents is illustrated by the examples in the Table.¹⁴ Recently reagent **2** has been used in the total syntheses of (–)-porantheridine¹⁵ and **trans-decahydroquinoline** alkaloid (+)-219 A.¹⁶

TABLE¹⁴
PREPARATION OF VINYL TRIFLATES FROM KETONE ENOLATES

Ketone	Base; Reagent; Condition	Product	Yield, %
	NaHMDS; 2 –78°C, 2 hr		92
	LDA; 1 –78°C, 3 hr		76
	LDA; 2 –78°C, 2 hr		77
	LDA; 2 –78°C, 3 hr		79



References and Notes

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Appendix

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

brine

Methanesulfonamide, 1,1,1-trifluoro-N-2-pyridinyl-N-[(trifluoromethyl)sulfonyl]-]

(-)-porantheridine

sodium hydroxide (1310-73-2)

pyridine (110-86-1)

dichloromethane,
CH₂Cl₂ (75-09-2)

2-aminopyridine (504-29-0)

magnesium sulfate (7487-88-9)

argon (7440-37-1)

triflic anhydride (358-23-6)

vinyl triflate

N-(2-Pyridyl)triflimide,
N-(2-PYRIDYL)-TRIFLIMIDE (145100-50-1)

N-(5-Chloro-2-pyridyl)triflimide,
Methanesulfonamide, N-(5-chloro-2-pyridinyl)-1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]- (145100-51-2)

2-amino-5-chloropyridine (1072-98-6)

trans-decahydroquinoline