

SYNLETT Spotlight 240

Dimethylsulfoxonium Methylide (DSM): A Versatile Reagent

Compiled by Chhama Awasthi



This feature focuses on a reagent chosen by a postgraduate, highlighting the uses and preparation of the reagent in current research

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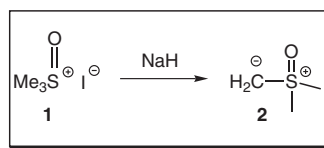
Dedicated to my honorable mentor Prof. L. D. S. Yadav

Introduction

Dimethylsulfoxonium methylide (DSM), also known as Corey–Chaykovsky reagent, has proved to be a versatile nucleophilic reagent capable of reacting with different chemical systems. Its industrial availability coupled with its potential to achieve original chemical transformations makes it a reagent of choice for the synthesis of new leads and innovative substances. It has found wide application in organic synthesis such as epoxidation,¹ cyclopropanation,^{2,3} aziridination,⁴ extension of esters,⁵ diolefination of cycloalkanones,⁶ ring transformation,⁷ polymerization,⁸ formation of silyl enol ethers,⁹ ring opening,^{10,11} and formation of chiral spiro[2.5]octanones by methylenation of cyclohexanones.¹²

Preparation

In 1962, Corey and Chaykovsky performed the synthesis of dimethylsulfoxonium methylide **2** by proton transfer of readily accessible trimethylsulfoxonium halides **1** to a strong base. Solutions of **2** in dimethyl sulfoxide were prepared from the iodide (or chloride) **1** by stirring with one equivalent of powdered sodium hydride under nitrogen at room temperature (rapid evolution of hydrogen, exothermic).¹³

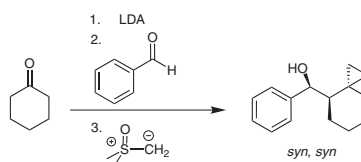


Scheme 1

Abstract

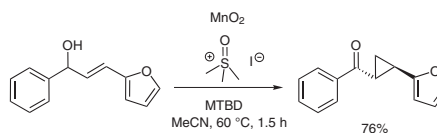
(A) Epoxidation:

Recently, Hansen and co-workers have reported a DSM-promoted tandem aldol–epoxidation reaction which constructs three new stereocenters with complete diastereoselectivity.¹



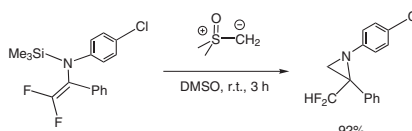
(B) Cyclopropanation:

One-pot oxidative cyclopropanation reactions of activated alcohols can be brought about by DSM.²



(C) Aziridination:

Dimethylsulfoxonium methylide affords difluoromethylaziridines upon reaction with difluoro enamines.⁴



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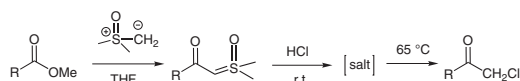
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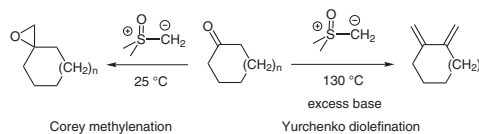
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(D) Extension of Esters:

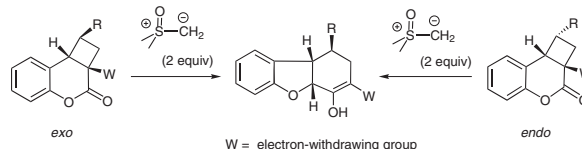
Using dimethylsulfoxonium methylide, a variety of methyl esters can be converted into α -chloro ketones with extension of the carbon chain.⁵

**(E) Diolation of Cycloalkanones:**

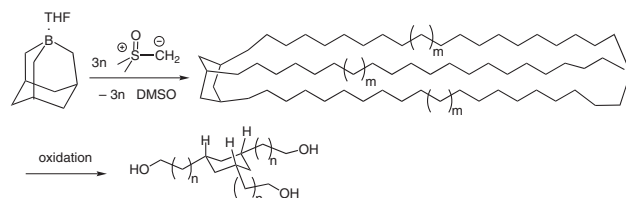
Terminal/exocyclic 1,3-dienes are widely used in synthetic organic chemistry. Very recently, Butova and co-workers have synthesized exocyclic 1,3-dienes by a one-pot diolation of cyclic ketones employing DSM and excess of a base at 130 °C. Under these conditions the Corey reaction is suppressed and terminal 1,3-dienes are formed instead of epoxides. This reaction is termed as Yurchenko diolation.⁶

**(F) Ring Transformation:**

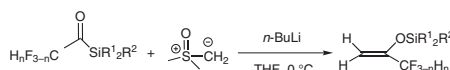
Coumarin derivatives with electron-withdrawing group at position 3 have been reported to undergo a novel ring transformation with DSM, which has been applied to the second-generation synthesis of (\pm)-linderol A.⁷

**(G) Polymerization:**

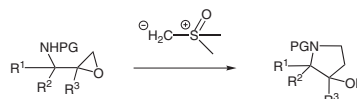
Trialkyl and triaryl organoboranes undergo multiple, repetitive homologation upon reaction with DSM. The polyhomologation of 1-boraadamantane·THF with DSM generates a novel macrocyclic trialkylborane, which upon oxidation affords three-armed star polymethylene polymer incorporating a *cis,cis*-1,3,5-trisubstituted cyclohexane core.⁸

**(H) Formation of Silyl Enol Ethers:**

Dimethylsulfoxonium methylide has been demonstrated to react with mono- and difluoroacetyltrialkylsilanes to give enol silyl ether products exclusively.⁹

**(I) Ring Opening:**

N-Tosyl-protected 3-hydroxypyrrolidines are prepared by reaction of DSM with readily available epoxysulfonamides via regioselective ring-opening followed by 5-*exo-tet* cyclization in preference to oxetane formation.¹⁰

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