

SYNLETT Spotlight 204

Tebbe's Reagent

Compiled by Kalpeshkumar C. Rana

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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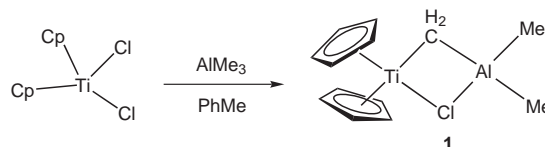
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Introduction

Tebbe's reagent (**1**) is an organometallic compound and has found diverse applications in organic synthesis such as methylenation of carbonyl compounds,¹ synthesis of C-glycosides,² 1,6-disaccharides³ and in the synthesis of intermediates, for example vinyl silanes⁴ and allenylketenes.⁵ It is readily prepared by reacting titanocene dichloride and trimethylaluminum in toluene at r.t. (Scheme 1).¹ When Tebbe's reagent is treated with a Lewis base, for example pyridine or THF, a highly reac-

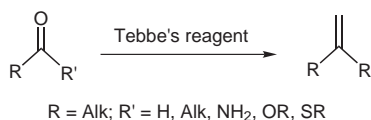
tive titanocene methylenide is generated. It methylenates a range of carboxylic and carbonic acid derivatives, presumably via oxatitanacyclobutane to furnish alkenes in a short period of time at room temperature and below.⁶



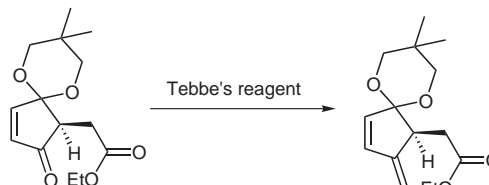
Scheme 1

Abstracts

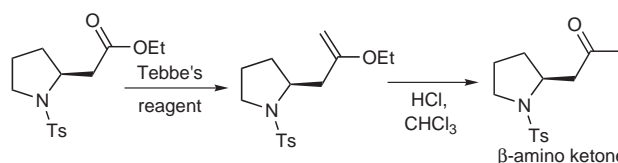
(A) Compounds containing carbonyl groups such as aldehydes, ketones, amides, esters, and thiolactones can be methylenated by using Tebbe's reagent.¹



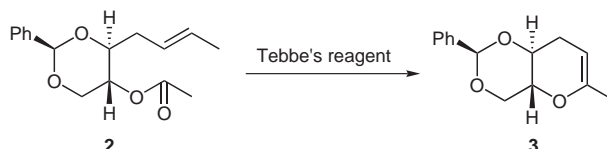
(B) Selective methylenation of aldehydes and ketones in the presence of an ester or amide group can be achieved using Tebbe's reagent.^{7a} This regioselectivity is also found in the methylenation of a methyl ester in the presence of a bulky silyl ester group.^{7b}



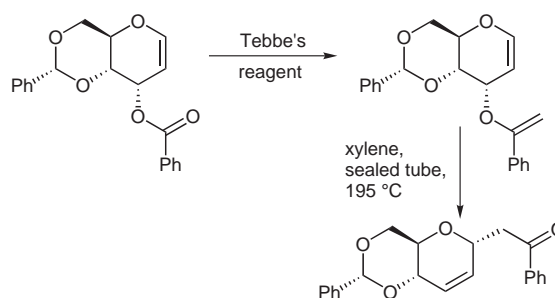
(C) An easy and effective synthesis of enantiomerically pure β-amino ketones and γ-amino alcohols can be achieved by Tebbe methylenation of proline derivatives.⁸



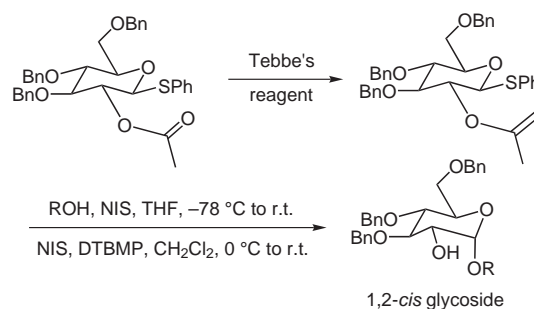
(D) Cyclic enol ether **3** is easily synthesized from olefinic ester **2** by using two equivalents of Tebbe reagent.⁹



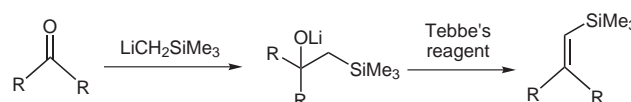
(E) C-glycosides¹⁰ can be readily prepared from 3-hydroxyl glycal esters via Tebbe methylenation and subsequent Claisen rearrangement.² 1,6-Linked C-disaccharides can also be prepared by Tebbe's reagent and Claisen rearrangement.³



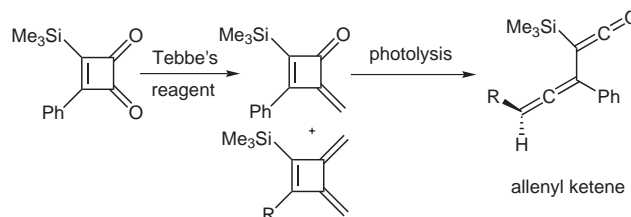
(F) Since 1,2-*cis* glycosides are difficult to prepare, Tebbe methylenation with *N*-iodosuccinimide has been used as intramolecular aglycon delivery to synthesize these.¹¹



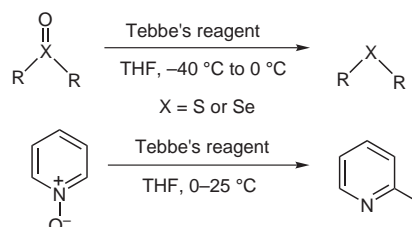
(G) Vinyl silanes play an important role as vinyl anion equivalents for stereospecific electrophilic reactions. They can be readily prepared with the help of Tebbe's reagent.⁴



(H) Allenyl ketene is synthesized from cyclobutenedione by Tebbe methylenation.⁵ The allenyl ketene can then undergo different nucleophilic and electrophilic additions and cycloaddition reactions.



(I) Sulfoxides, selenoxides, and pyridinium *N*-oxides can be converted into sulfides, selenides, and 2-methyl pyridines, respectively, on treatment with Tebbe's reagent.¹²



References

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