SYNLETT Spotlight 473

Phenylacetylene

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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 Professor Dr. Grzegorz Młostoń, Dr. Emilia Obijalska, and my family.

Introduction

Phenylacetylene (1-phenylethyne, 1-phenylacetylene) is a terminal alkyne which under standard conditions is a light yellow liquid with a characteristic odor. It can be conveniently prepared via the reaction of benzaldehyde with the Bestmann–Ohira reagent in the presence of a base at room temperature.^{1a} Other methods applied for its preparation consists in the treatment of acetophenone with lithium diisopropylamide (LDA) and diethyl chlorophosphate.^{1b} Phenylacetylene is widely applied as a versatile building block, for example in Kinugasa reactions, Diels–Alder re-

actions, 1,3-dipolar cycloaddition reactions, diverse transition-metal-supported coupling reactions, and in nucleophilic additions.

Scheme 1

Abstracts

(A) Phenylacetylene is widely explored as a model acetylenic substrate in Kinugasa reactions. Saito et al. described an enantioselective version of this reaction which was performed in the presence of chiral oxazoline ligands.² The reported diastereo- and enantioselectivities were satisfactory, but chemical yields were rather low. In another paper, the applications of modified bis(oxazoline) ligands were reported, and in this case the desired β -lactams were obtained in high chemical yields. In addition, better diastereo- and enantioselectivities were observed.³

(B) Cyclic, achiral, and enantiopure nitrones were used in reactions with phenylacetylene under Kinugasa reaction conditions. In both cases only one diastereoisomer of the desired β -lactam was isolated in low to moderate yield.⁴

(C) Analogous reactions with diverse nitrones in the presence of catalytic amounts of indium tribromide (InBr_3) and a tertiary amine led to *N*-hydroxypropargyl amines in moderate to good yields.⁵

(D) In a three-component reaction, performed in the presence of a catalytic amount of Ni(II)-Y zeolite, phenylacetylene reacted with aldehydes and secondary amines yielding β -ynamines in high to excellent yields.⁶

(E) 1,3-Dipolar cycloadditions of aryl- and alkylazides with phenylacetylene, carried out in the presence of copper(II) salts, sodium iodide, and a base, led to 5-iodo-1,2,3-triazoles formed as the main or exclusive products. However, the formation of 4-unsubstituted 1,2,3-triazoles as side-products was observed in reactions carried out in the presence of copper(II) chlorate(VII).⁷

(F) Heterocyclization of *gem*-dibromovinylphenols followed by Sonogashira reaction of the initially formed 2-bromobenzofurane with phenylacetylene gave 2-phenylethynyl-substituted benzofurans in high yield.⁸ Upon optimizing the reaction conditions, copper(I) iodide, DABCO, and cesium carbonate were used in a one-pot procedure.

(G) In a microwave assisted, palladium-catalyzed tandem reaction, phenylacetylene and 2-bromobenzamide were used for the efficient preparation of isoindolinone derivatives.⁹

(H) The nucleophilic addition of phenylacetylene to isatin derivatives was achieved under copper-mediated C–H bond activation conditions.¹⁰

(I) 2-Substituted, optically active tetrahydroquinolines were obtained in high chemical yields and with high enantiomeric excess via the reaction of 2-aminobenzaldehydes with phenylacetylene under asymmetric cooperative triple catalysis.¹¹

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