Carbon Tetrabromide

Compiled by Zhong-Yan Cao

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Introduction

Carbon tetrabromide, also known as tetrabromomethane, is a commercially available white solid which is stable at room temperature and can be easily handled. It is prepared either by the complete bromination of methane or by the reaction of tetrachloromethane with aluminum bromide. In combination with a tertiary phosphine, it has been used for the bromination of various functional groups, such as alcohols (Appel reaction), \(^1\) N-heterocycles, \(^2\) ethers, \(^3\) and for converting aldehydes/ketones into 1,1-dibromoalkenes \(^4\) or alkynes \(^5\) (Corey–Fuchs reaction). In addition, carbon tetrabromide is a highly efficient catalyst for versatile reactions, including acylation of phenols, alcohols and thiols, \(^6\) acetalization and tetrahydropyranylation \(^7\) and oxidation of aromatic methyl ketones \(^8\) or alkynes \(^9\) to carboxylic acids under very mild conditions. Carbon tetrabromide can further promote the synthesis of thioureas and thiuram disulfides. \(^10\) Apart from these applications, carbon tetrabromide is also used as a crystal growth \(^11\) and chain transfer agent \(^12\) in polymer chemistry.

Abstracts

(A) A highly stereoselective synthesis of Z-allyl bromides from Baylis–Hillman adducts has been realized using CBr\(_4\) and Ph\(_3\)P. The product can be further elaborated into the natural bioactive fatty acid amides semiplenamides C and E. \(^13\)

(B) Selective aerobic photooxidative dibromination of ethyl aromatics to dibromoacetophenones has been achieved using CBr\(_4\), visible light and molecular oxygen. \(^14\)

(C) CBr\(_4\) can participate in atom transfer radical additions to olefins using a visible-light photocatalyst. The 1,1-dibromoalkenes are obtained after further manipulation. \(^15\)

(D) Dong et al. reported the preparation of fully substituted isoxazoles from cyclopropyl oximes using a combination of CBr\(_4\) and Ph\(_3\)P as the bromination reagent. \(^16\)
(E) Chiral 1,3-oxazoline heterocycles bearing fluorinated aliphatic chains ($R^1$) were obtained from a tandem one-pot reaction promoted by a combination of $\text{CBr}_4$ and $\text{Ph}_3\text{P}$. The product skeleton is present in many bioactive molecules, natural products, organomaterials and ligands for asymmetric catalysis.\(^\text{(17)}\)

(F) In the presence of $\text{CBr}_4$, dithiocarbamates and thioethers were prepared by reaction of dithioc acids, generated in situ, or thiols with nucleophiles such as active methylene compounds or $N$-methyl indole at room temperature.\(^\text{(16)}\)

(G) Benzoxanthenes owning spectroscopic properties for leuco dyes, laser technology and fluorescent materials can be prepared using $\text{CBr}_4$ as the catalyst under solvent-free conditions.\(^\text{(19)}\)

References