Acetic Anhydride (Ac₂O)

Compiled by Lucas Villas Bôas Hoelz

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Acetic anhydride (Ac₂O) is a very refractive liquid smelling strongly of acetic acid with a boiling point at 139 °C.1 It is a cheap and commercialized reagent widely used in the synthesis of oxazolones,2 thiohydantoins,3 thioacetates,4 enamides,5 geminal diacetates,6 thiadiazoles,7 as well as in the preparation of carbonyl compounds from imines.8 Further, it is used in acetylations,9 brominations,10 Grignard reactions,11 and reductive acylations of nitropyroles.12

Preparation

Ac₂O (1) was formerly produced starting from sodium acetate and acetyl chloride (A). However, nowadays it is usually prepared from acetic acid dehydration (B, Scheme 1).13

Abstracts

(A) Sun and Cui described the synthesis of oxazolones from a mixture of aryl or heteroaryl aldehydes, hippuric acid (2) and anhydrous sodium acetate in Ac₂O under microwave irradiation. All reactions were carried out in a few seconds and provided good yields (49–56%).2

(B) According to Reyes and Burgess, the reaction of some amino acids (e.g., glycine, alanine, and phenylalanine) with Ac₂O and ammonium thiocyanate gave the 1-acetyl-2-thiohydantoins in good yields (51–71%), respectively.3

(C) Nasir Baig and co-workers reported a simple and efficient methodology to synthesize thioacetates from alkyl halides in good yields (80–97%). [BnEt₃N]₂MoS₄ and Ac₂O are key reagents in this multi-step tandem reaction process.4

(D) Benzylc and non-benzylic ketoximes can be successfully converted into enamides using a mixture of Ac₂O and Et₃P in toluene.5

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(E) Geminal diacetates can be prepared from aliphatic and aromatic aldehydes in moderate to excellent yields (36–93%) by a simple treatment with Ac₂O in the presence of InCl₃/Al₂O₃.⁶

(F) Thiosemicarbazones react with Ac₂O under mild conditions to give thiadiazole compounds in moderate to high yields (40–95%).⁷

(G) The SDS (sodium dodecyl sulphate) surfactant mediated cleavage of imines to the corresponding carbonyls (aldehydes and ketones) and acetanilides can be achieved with Ac₂O in water in very good to excellent yields (85–91%).⁸

(H) Various alcohols and phenols can be acetylated under solvent-free conditions using Ac₂O as acylating agent and a catalytic amount of heterogeneous cobalt(II) Salen complex (catalyst A). The products were prepared under mild conditions, short reaction times, and in high yields (95–99%).⁹

(I) An efficient procedure for the monobromination of activated aromatic compounds can be achieved by treatment with KBr in Ac₂O followed by a dropwise addition of nitric acid in Ac₂O.¹⁰

(J) 3,5-Bis(trifluoromethyl)phenylmagnesium chloride reacts with Ac₂O to produce 3,5-bis(trifluoromethyl)acetophenone. The product is formed within one hour in high yields (86–97%).¹¹

(K) The reductive acylation of nitropyrrroles using a mixture of Ac₂O, acetic acid, and indium powder provided pyrrolylamides in moderate to good yields (41–86%).¹²

References


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