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1, 4-Diazabicyclo[2.2.2]octanium diacetate: An effective, mild and reusable catalyst for the synthesis of 2,4,5–trisubstituted imidazoles

Leila Zare Fekri *, Maryam Nateghi-Sabet

Department of Chemistry, Payame Noor University, PO Box 19395-3697 Tehran, Iran

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ABSTRACT

1, 4-Diazabicyclo[2.2.2]octanium diacetate supplies an environmentally friendly procedure for the synthesis of 2,4,5-trisubstituted imidazoles through one-pot multicomponent condensation of benzyl or benzoin and ammonium acetate with various aldehydes. These compounds were obtained in high yields and short reaction times. The catalyst could be easily recovered and reused for five cycles with almost consistent activity. All of synthesized compounds were characterized by their physical constant, comparison with authentic samples, IR, ^{1}H NMR, ^{13}C NMR spectroscopy and elemental analysis.

1. Introduction

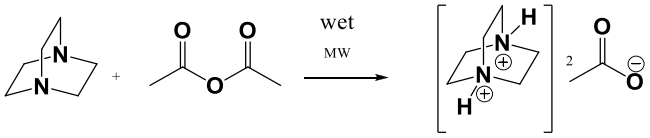
The imidazole substructures were found in a large number of pharmacologically active compounds and natural products such as the hypnotic agent etomidate, amino acid histidine [1], the proton pump inhibitor omeprazole [2], the antiulcerative agent cimetidine [3], B-Raf kinase [4], cyclooxygenase-2 (COX-2) [5], biosynthesis of interleukin-1 (IL-1) [6], plants growth regulators [7], anti-bacterial [8], pesticide [9], herapeutic agents [10], antitumour [11], modulators of P-glycoprotein (P-gp)-mediated multidrug resistance (MDR) [12], and also CB1 cannabinoid receptor antagonists [13].

In 1882, Radziszewski and Japp [14, 15] reported the first synthesis of a highly substituted imidazole from a 1,2-dicarbonyl compound, aldehydes and ammonia. In recent years, the synthesis of 2,4,5-trisubstituted imidazoles have been performed by various catalysts [16-27].

Most of these described procedures have some serious defects, such as tedious work-up and purification, significant amounts of toxic waste materials, highly acidic conditions, long reaction time, occurrence of side reactions, low yields, the use of expensive reagents or catalysts, low selectivity and high temperatures in refluxing or microwave condition. Therefore, in continuation of reported works to use green condition for the synthesis of organic compounds [26, 27] , the development of easy, green, effective, high-yielding, and eco-friendly approaches using novel catalysts for the synthesis of imidazoles is an important research topic for organic chemists.

2. Results and Discussion

As a part of our going interest for the development of efficient and environmentally friendly procedures for the synthesis of heterocyclic and pharmaceutical compounds [28-35], a new, efficient, facile and fast procedure was introduced for the synthesis of 2,4,5-triaryl-1H-imidazoles using the reaction between aldehydes 1, 1,2-Diketone 2 or α-hydroxyketone 3 and ammonium acetate in the presence of synthesized dicathionic acidic ionic liquid 1,4-diazabicyclo[2.2.2]octanium diacetae (Scheme 1).



Corresponding mail: zare@yahoo.com