Eco-friendly and Efficient Synthesis of 2-aryl-1-arylmethyl-1*H*-Benzo[*d*]imidazoles by using Sodium Hypochlorite

Patil Sachin V.[1]* and Nagargoje Deepak R.[2]

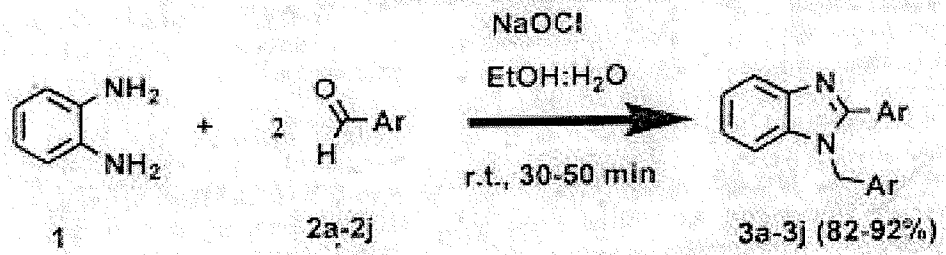
1. Department of Chemistry, HPT Arts and RYK Science College, Nashik-422005, INDIA
2. Department of Chemistry, Arts, Science and Commerce College, Malkapur-443101, INDIA
*sachin.dbskare@yahoo.com

Abstract

We are herein reporting a new ecofriendly, convenient and facile method for the synthesis of 2-aryl-1-arylmethyl-1H-benzo[d]imidazoles using sodium hypochlorite. Various imidazole derivatives were prepared from reaction of o-phenylenediamine with substituted aryl and heteroaryl aldehydes in aqueous ethanol at ambient temperature in one step with good to excellent yield. Easy reaction conditions, use of aqueous medium, easy isolation and purification of products make this method superior to other known methods.

Keywords: Aqueous medium, sodium hypochlorite, o-phenylenediamine, benzimidazole.

Graphical Abstract



Introduction

Heterocyclic compounds containing benzimidazole nuclei showed extensive attention in medicinal chemistry due to their significant biological activities[1-10,12]. The importance of benzimidazole derivatives attracted researchers to develop some new effective and economical methods for the preparation of benzimidazoles. Some solid-phase synthetic methods are discovered for the synthesis of benzimidazole derivatives[26]. A number of procedures that involve the condensation of o-phenylenediamine with different substituted aldehydes in the presence of transition metal triflate salts such as zinc triflate, have been reported[20]. The condensation of o-phenylenediamine with different substituted aldehydes in the presence of oxidizing agents such as (bromodimethyl) sulphonium bromide[2], sulphamic acid[28], iodobenzene diacetate[4], H_2O_2-HCl[17], silica sulfuric acid[23] etc. have been used. In another approach, benzimidazoles have been prepared by solid phase reaction to afford a combinatorial chemistry[27].

In addition to this, benzimidazoles have been prepared by using montmorillonite K-10 supported La(OTf)$_3$[21], nano copper(0)-stabilized on alumina[19], ($Na_2CaP_2O_7$)[14], KIT-6 mesoporous silica-coated magnetite nanoparticles[6], glucose-functionalized silica-coated $NiFe_2O_4$ nanoparticles[5], phosphine manganese(I) complex[3], UiO-66-NH-SO$_3$H[8], ytterbium loaded mesoporous silica nanoparticles[17] and bimetallic Cu-Mn B spinel oxide[24]. However, most of these methods have some disadvantages like high temperature requirement, low yield, special oxidation process, long reaction time and tedious working procedures.

Therefore, the survey continues to find better catalyst for the preparation of benzimidazole derivatives which will be highly superior to others. Nowadays, the organic reactions in aqueous medium have attracted much attention in synthetic organic chemistry as water is the most abundant, inexpensive and eco-friendly solvent. It also shows a unique reactivity from other conventional organic solvents[15].

With continuation of our research work in the development of biologically active substituted benzimidazole derivatives[11-13], we are herein reporting an eco-friendly, facile and efficient method for the synthesis of 2-aryl-1-arylmethyl-1*H*-benzo[*d*]imidazole. This method involves a one-pot reaction of o-phenylenediamine with aromatic and heteroaromatic aldehydes using 20-mol% sodium hypochlorite as a catalyst in aqueous ethanol at ambient temperature for 30-50 minutes. Several aldehydes substituted with electron donating and electron withdrawing groups are effectively converted to a series of 2-aryl-1-arylmethyl-1*H*-benzo[d]imidazole derivatives as the product.

The products were isolated by simple filtration at proper pH adjustment. All the products were purified by crystallization

12