4TH National Conference of Iran Chmistry, Chemical Enginereeng And Nano

EFFICIENT AND GREEN SYNTHESIS OF BIS(INDOLYL)METHANES CATALYZED BY FE_3O_4@SIO_2-IMID-PMAN MAGNETIC NANOCATALYST

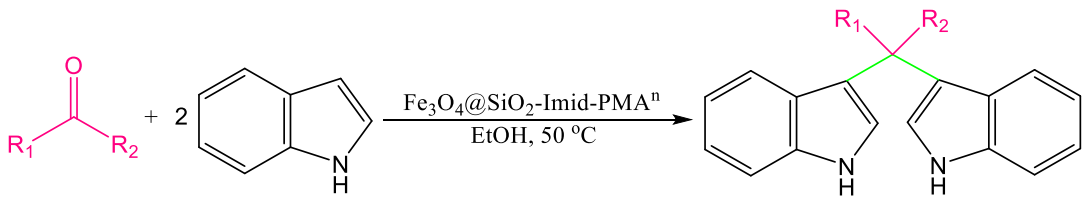
M. Esmaeilpour[1], A. R. Sardarian[2*], H. Eslahi[3], M. Kazemnejadi[4]
Department of Chemistry, College of sciences, Shiraz University, Shiraz 71946 84795 Iran, [1]m1250m551085@yahoo.com, [2]sardarian@susc.ac.ir, [3] Hassaneslahi7@gmail.com, [4]Miladkazemnejadi@yahoo.com

Abstract: Highly efficient and eco-friendly protocol for the synthesis of bis(3-indolyl)methanes by the electrophilic substitution reaction of indole with aldehydes catalyzed by Fe_3O_4@SiO_2-imid-PMA^n was described. Simple work-up procedure, shorter reaction times, excellent yields, avoiding hazardous organic solvents, and reusability of the catalyst are the most obvious advantages of this method. Also, the catalyst can be easily recovered by a magnetic field and reused for six consecutive reaction cycles without significant loss of activity.

Keywords: Bis(indolyl)methanes; Indole, Aldehydes, Green synthesis, Multi-component reactions, Magnetic nanoparticles, Magnetic separation.

1. INTRODUCTION

Indole and its derivatives are important intermediates in organic synthesis and exhibit various physiological properties and pharmacological activities [1]. Over the past decade, a number of natural products containing bis(indolyl) methanes or bis(indolyl)ethanes have been isolated from marine sources [2]. Bis(indolyl)methanes are found in cruciferous plants and are known to promote beneficial estrogen metabolism and induce apoptosis in human cancer cell [3]. Therefore, the preparation of these intermediates has received increased attention from synthetic organic chemists and biologists. Owing to their diverse biological properties, many methods have been developed for their synthesis using various catalytic systems such as silica sulfuric acid [4], $HClO_4$-SiO_2 [5], cellulose sulfuric acid [6], amberlyst-15 [7], iodine [8], sulfamic acid [9], boric acid [10], fluoroboric acid [11], polyvinylsulfonic acid [12], dodecylsulfonic acid [13], $ZrOCl_2 \cdot 8H_2O$ [14], ceric ammonium nitrate [15], $Dy(OTf)_3$ [16], zeolite [17], protic solvent [18], $NbCl_5$ [19], and ionic liquids [20]. However, most of these reported methods suffer from one or several drawbacks such as expensive, moisture-sensitive, use of hazardous, prolonged reaction times, low yields and large quantity of reagents, involving eco-friendly, tedious workup procedure, harsh reaction conditions, and difficulty in recovery, and reusability of the catalysts. Therefore, still there is a need to develop an efficient, and versatile method for the synthesis of bis(indolyl)methanes (Scheme 1).



Scheme 1 The synthesis of bis(indolyl)methanes in the present of Fe_3O_4@SiO_2-Imid-PMA^n.