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Cu supported on clicked cellulose-modified magnetite nanocomposite as a highly active and selective catalyst for O-arylation Ullmann and sp-sp2 Sonogashira cross-coupling reactions

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PURPOSE OF THE ABSTRACT

Copper nanoparticles were covalently attached to the surface of cellulose-covered magnetite nanoparticles to design a reusable magnetic nanocomposite as catalyst. The prepared nanocomposite was employed in O-arylation reaction (Ullmann) of various phenols with aryl halides as well as in C?C reaction (Sonogashira) of various alkynes with aryl halides, employing H2O as green reaction media. The use of copper-mediated nanocomposite in Ullmann O-arylation and Sonogashira C?C allowed swift transformations under comparatively mild and ligand-free conditions, with excellent product yields and simple catalyst separation and recover (six cycles) as illustrated in Table 1.

FIGURES

Entry Reference	Catalyst	Reaction	Reaction conditions	Time (h)	Yield (%)
1	Chitosan-Cu/Fe	Ullmann	DMSO, 120 °C, K_2CO_3	15	55-95
2	Creatine	Ullmann	glycerin, 80 °C, K_2CO_3	24	35-80
3	Fe_3O_4 MNPs	Ullmann	H_2O, reflux, KOH	0.5-18	I: 84−97 Br: 62−91 Cl: 38−86
4	mpg-C_3N_4	Ullmann	DMF, 110 °C, K_2CO_3	5	I: 75−90 Br: 77−82 Cl: 33−40
5	AS	Ullmann	DMF, reflux, Cs_2CO_3	24	45−98
Present study	Fe_3O_4@CNF@Cu	Ullmann	H_2O, 40 °C, KOH, ultrasonic sonication	0.16 025 0.33	I: 98 Br: 95 Cl: 90
6	CuI / PPh_3	Sonogashira	H_2O, 140 °C, K_2CO_3	24	I: 43
7	Cu(I)-PANI@MWCNT	Sonogashira	DMF, 130 °C, KOH	2	I: 96
8	NHC /$CuSO_4 \cdot 5H_2O$	Sonogashira	DMF, 125 °C, K_2CO_3	8	I: 71
9	$Co(C_6H_9NO_2)_3$	Sonogashira	DMF, ethylene glycol, visible light, r.t. K_2CO_3	8	I: 82
Present study	Fe_3O_4@CNF@Cu	Sonogashira	H_2O, 40 °C, KOH, ultrasonic sonication	0.25 0.83 0.5	I: 97 Br: 90 Cl: 85

FIGURE 1

FIGURE 2

Table 1

Comparison of Fe3O4@CNF@Cu: Nanocomposite Catalyzed Ullmann, and Sonogashira, cross coupling reactions with Previously Reported Results.

KEYWORDS

Ullmann | Sonogashira | ultrasound | copper nanoparticle

BIBLIOGRAPHY