Electrocntic Supplementary Information

Representative spectral data for:

2-(Aminomethyl)benzimidazole/Cu$^{2+}$ immobilized on Fe$_3$O$_4$@SiO$_2$: a convenient magnetic nanocatalyst for click reaction of aryl halide/benzyl halide, sodium azide and terminal alkyne

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Instruments and reagents

All initial chemicals and materials were purchased from Merck and Aldrich. Also characterizations were carried out using following instruments: a) FT-IR: Shimadzu FT-IR-8400S spectrophotometer, b) ^1^H-NMR: Bruker Avance 500 MHz, c) SEM: KYKY- EM3200 at 26 KV, d) XRD: Jeoljdx-8030, e) TGA: Q50 V6.3 Build 189.

Characterization:

FT-IR spectra of Fe$_3$O$_4$, Fe$_3$O$_4$@SiO$_2$ and Fe$_3$O$_4$@SiO$_2$@AMBI/Cu are illustrated in figure S1. As can be seen, functional groups of Fe$_3$O$_4$, Fe$_3$O$_4$@SiO$_2$ and Fe$_3$O$_4$@SiO$_2$@AMBI/Cu can be seen in FT-IR spectra. In FT-IR spectra of Fe$_3$O$_4$, a broad peak at around 500-600 cm$^{-1}$ is attributed to the Fe-O group. In Fe$_3$O$_4$@SiO$_2$ spectra, in addition of Fe-O peak, a broad peak at 1050-1250 cm$^{-1}$ is related to the presence of the Si-O group. Also in Fe$_3$O$_4$@SiO$_2$@AMBI/Cu spectra, in addition of all above peaks, C=C stretching peak and a characterization peak of N-H were appeared at 1649 cm$^{-1}$ and 3400 cm$^{-1}$, respectively.

![Figure S1. FT-IR spectra of a) Fe$_3$O$_4$, b) Fe$_3$O$_4$@SiO$_2$, and c) Fe$_3$O$_4$@SiO$_2$@AMBI/Cu](image)

The morphology and the size of the synthesized Fe$_3$O$_4$@SiO$_2$@AMBI/Cu were studied by SEM and TEM and they are showed in figure S2. Consequently, nanoparticles were homogenously dispersed on Fe$_3$O$_4$ as a core with an average diameter of about 20 nm. These analysis revealed that no roughness and aggregation be present in the surface of Fe$_3$O$_4$@SiO$_2$@AMBI/Cu.
The purity and crystalline structure of the synthesized Fe$_3$O$_4$@SiO$_2$@AMBI/Cu were studied using X-ray diffraction. The XRD pattern of the powders of final nanocatalyst is indicated in figure S3. Corresponding peaks of Fe$_3$O$_4$ in XRD were observed at 2θ = 30.0, 35.0, 42.0, 52.0, 56.0 and 62.0 which are similar to the pattern of reported Fe$_3$O$_4$ nanoparticles before [19, 30].

EDX analyses is performed to study the elemental compositions of Fe$_3$O$_4$@SiO$_2$@AMBI/Cu. The EDX spectrum of Fe$_3$O$_4$@SiO$_2$@AMBI/Cu is presented in figure S4. In this spectrum, existence of Fe and O proved the synthesis of Fe$_3$O$_4$. In addition, EDX shows the presence of Cu, N, and Si which proved the successful synthesis of Fe$_3$O$_4$@SiO$_2$@AMBI/Cu.
The TGA analysis of the synthesized Fe₃O₄@SiO₂@AMBI/Cu was taken to understand the stability of it (figure S5). In TGA, the weight loss under 200 °C is related to volatile compounds, the weight loss at about 500 °C is related to decomposition of ligand, and also due to the existence of Cu and Fe₃O₄, it didn’t decompose completely at temperatures above 800 °C.
Copies of $^1\text{H}$ and $^{13}\text{C}$ NMR spectra for some compounds

$^1\text{H}$ NMR spectra for compound 4a
$^{13}$C NMR spectra for compound 4a
Dept spectra for compound 4a
$^1$H NMR spectra for compound 4b
$^{13}$C NMR spectra for compound 4b
Dept spectra for compound 4b
$^1$H NMR spectra for compound 6a
$^{13}$C NMR spectra for compound 6a
DEPT spectra for compound 6a
$^1$H NMR spectra for compound 6c
$^{13}$C NMR spectra for compound 6c
DEPT spectra for compound 6c
$^1$H NMR spectra for compound 6e
$^{13}$C NMR spectra for compound 6e
DEPT spectra for compound 6e
$^1$H NMR spectra for compound 6l
$^{13}$C NMR spectra for compound 6l
DEPT spectra for compound 6l