# Supporting Information

## Cu ion-exchanged and Cu nanoparticles decorated mesoporous ZSM-5 catalysts for the activation and utilization of phenylacetylene in the sustainable chemical synthesis

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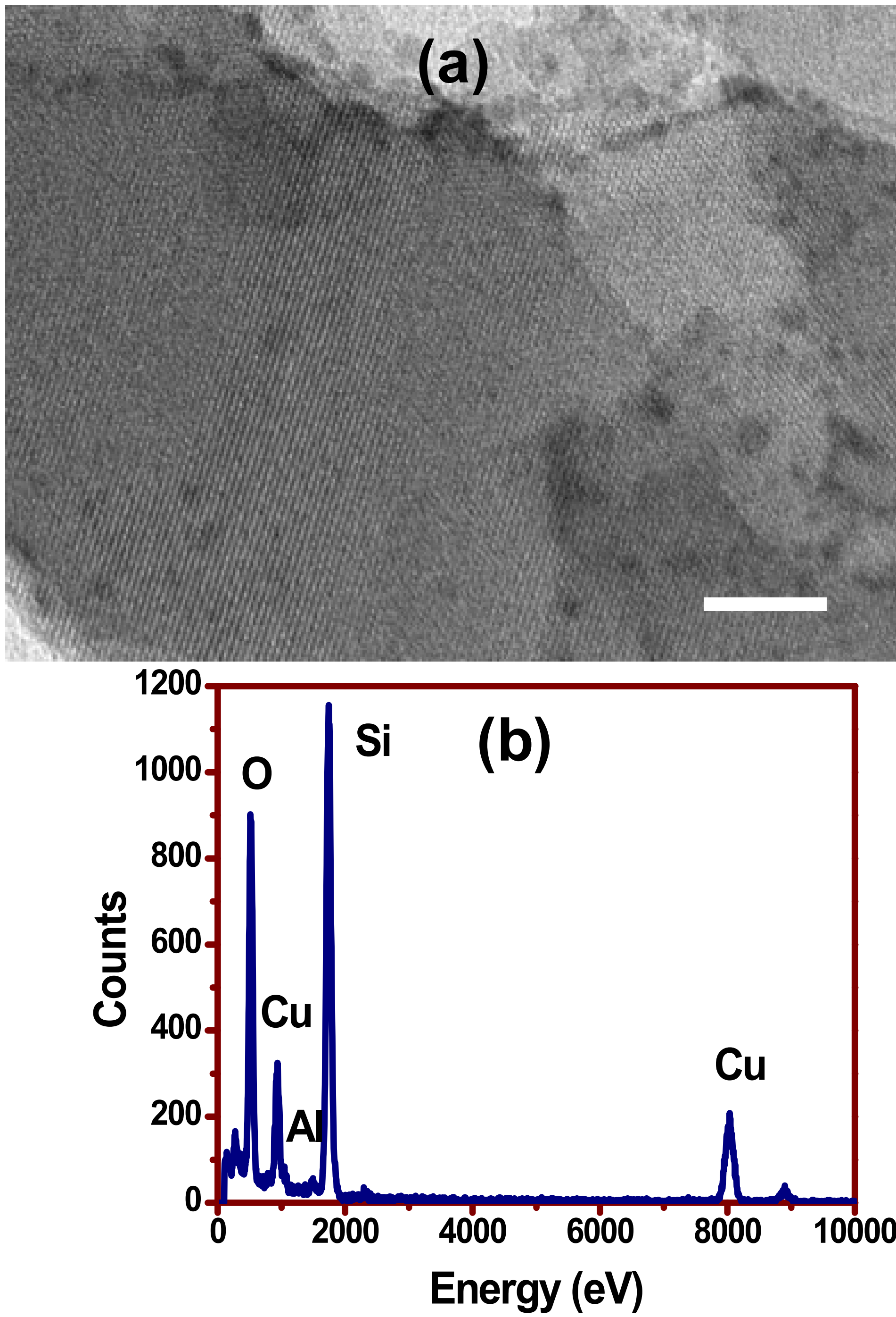


**Figure S1.** (a) HRTEM image and (b) EDX spectrum of Cu(10%)/Meso-ZSM-5

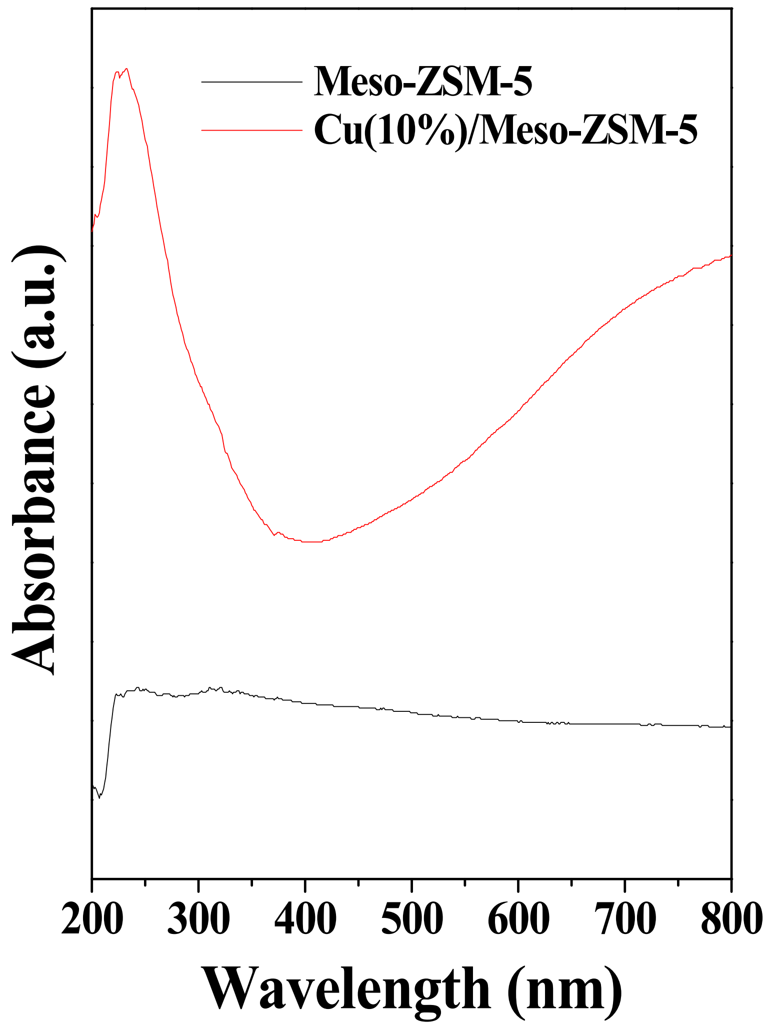


**Figure S2**. DR UV-Visible spectra of Meso-ZSM-5 and Cu(10%)/Meso-ZSM-5.

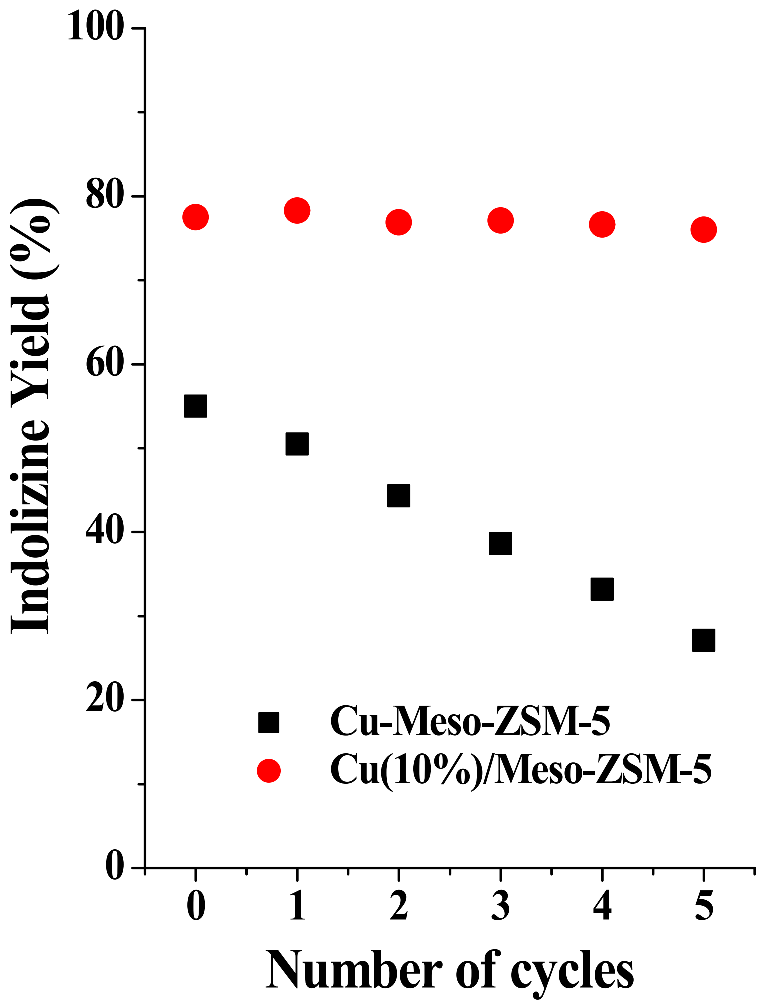


**Figure S3.** Catalytic performance of Cu-Meso-ZSM-5 and Cu(10%)/Meso-ZSM-5 during the recycling experiments up to five cycles.

**Synthesis of SBA-15**

Mesoporous SBA-15 material was prepared using molar gel composition 1TEOS: 0.016 P123: 127 $H_2O$: 0.46 HCl (35%) by the following reported procedure.[1,2] In a typical synthesis 6.11 g amphiphilic triblock copolymer P123 was dispersed in 100 g distilled water and stirred for 4 h at 300 K. Afterwards, 3.028 g conc. HCl diluted with 42.47 g distilled water was mixed to the above dispersed solution and stirred for 2 h to get a clear solution. After complete dissolution of P123, 14 g of TEOS was added drop wise to the resulting solution and allowed to stir for 20 h at 313 K. Finally, the resulting mixture was hydrothermally treated in a Teflon-lined autoclave at 373 K for 2 days. The solid product was filtered through Buchner funnel and washed several times with distilled water and dried at oven at 353 K and calcined at 823 K for 6 h.

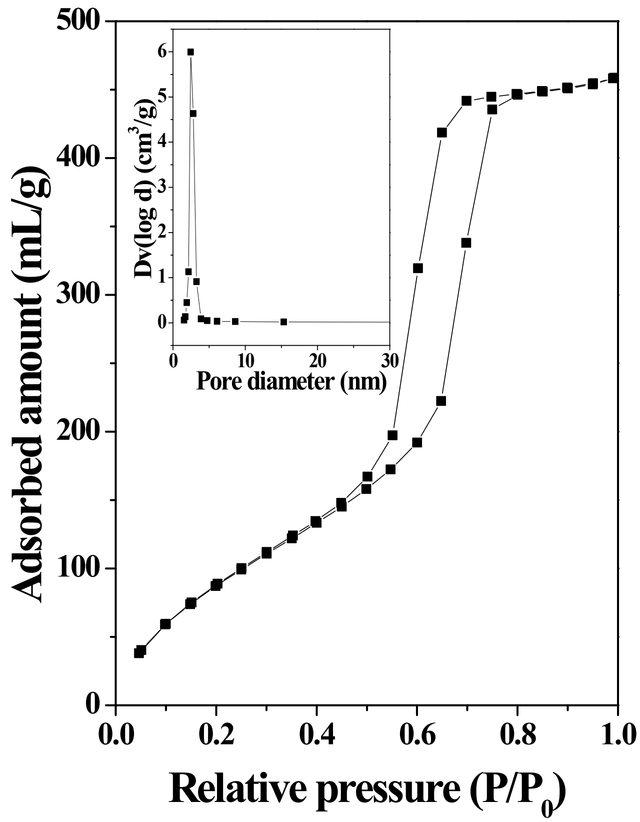


**Fig. S4.** $N_2$-adsoprtion-desorption isotherm for SBA-15. Inset shows pore size distribution.

**Table S1.** Textural properties of SBA-15.

| Material | $\mathbf{S_{BET}}$ (m$^2$/g) | Ex. SA (m$^2$/g) | $V_{Total}$ (mL/g) | Mesopore volume (mL/g) |
|---|---|---|---|---|
| SBA-15 | 624 | 553 | 0.84 | 0.79 |

Reference:

1. R. Srivastava, D. Srinivas and P. Ratnasamy, *J. Catal.,* 2005, ***233***, 1-15.

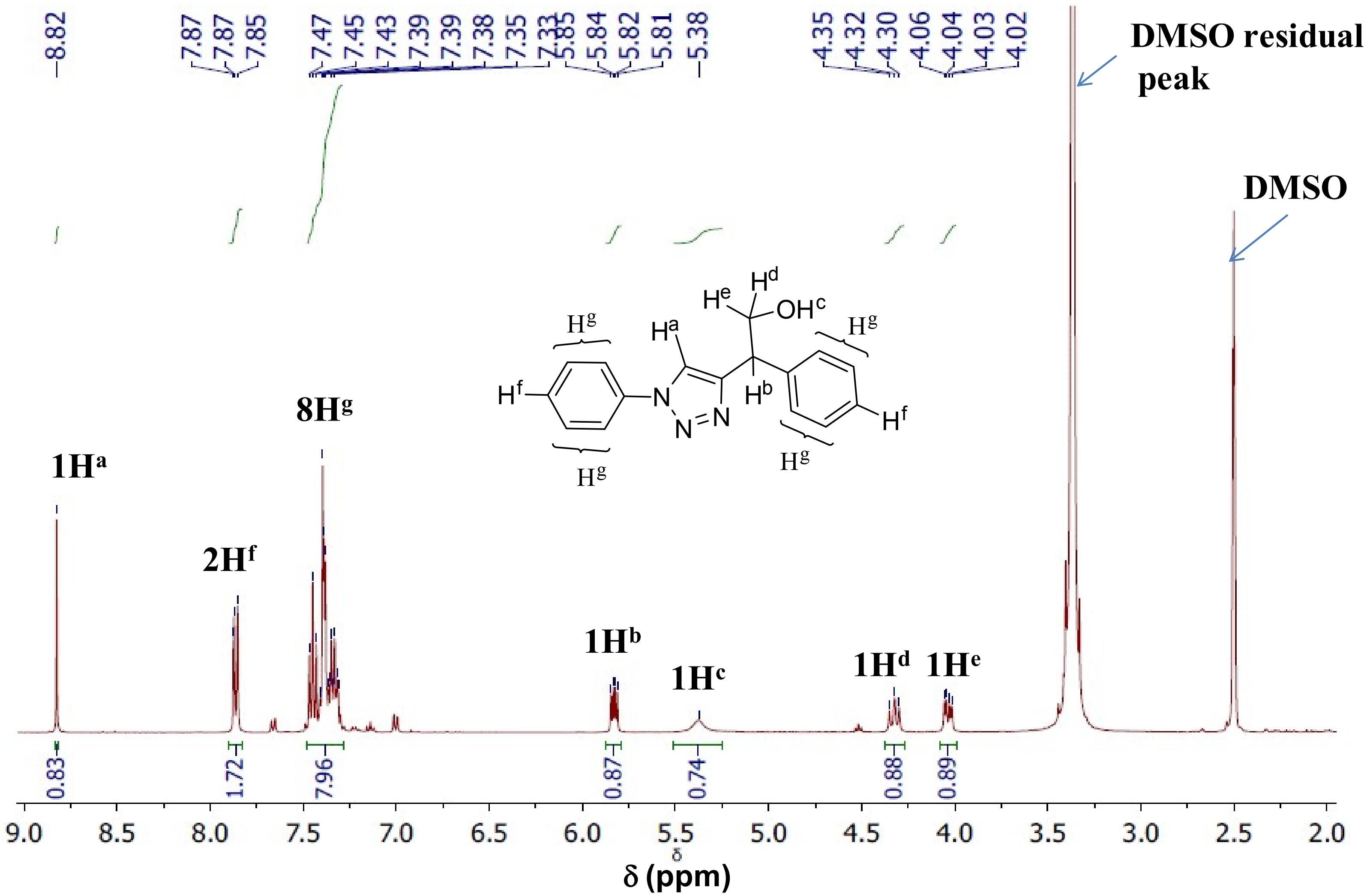


**Figure S5.** $^{1}$H NMR spectrum of 2-Phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)ethanol.

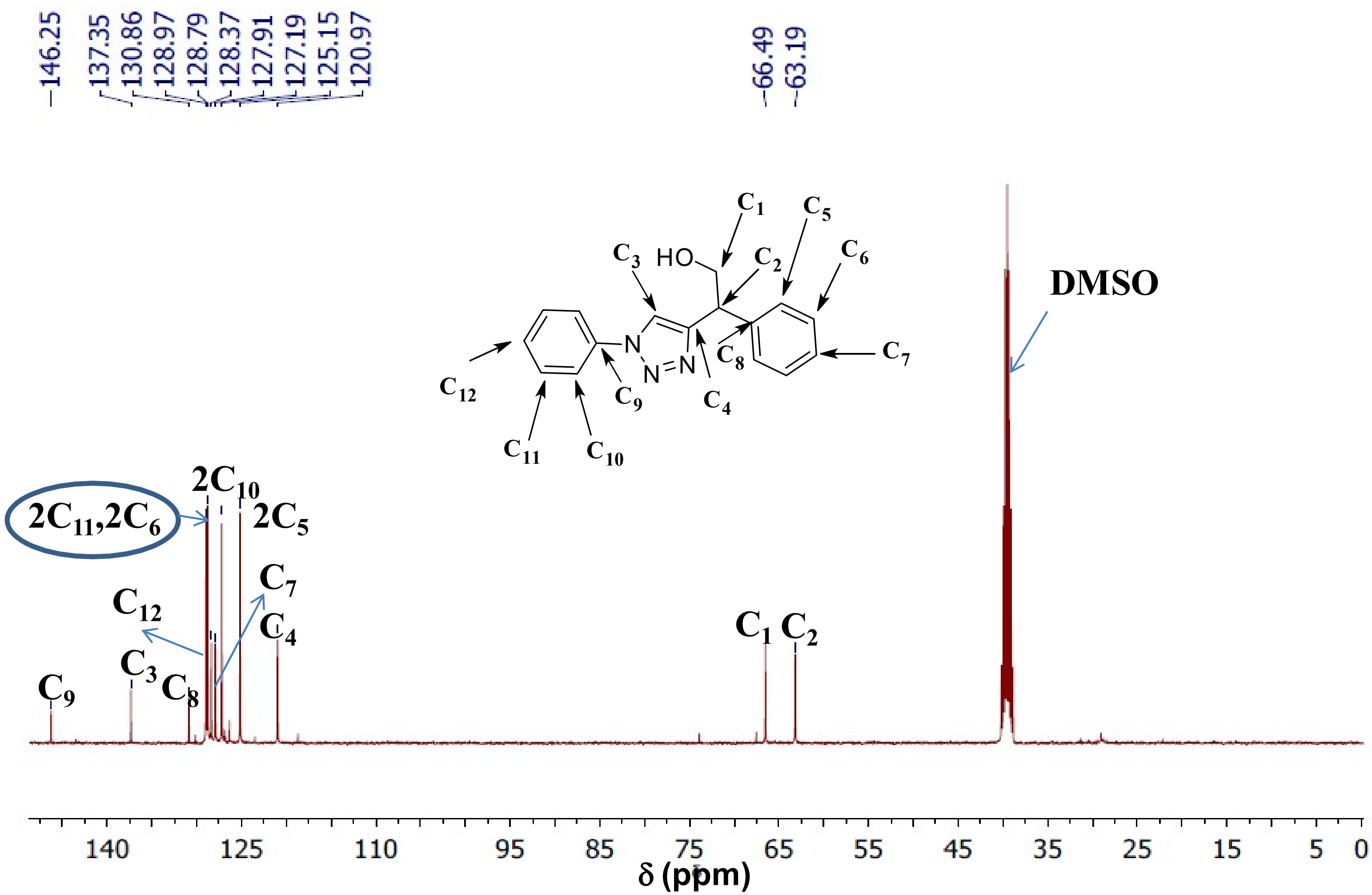


**Figure S6.** $^{13}C$ NMR spectrum of 2-Phenyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)ethanol.

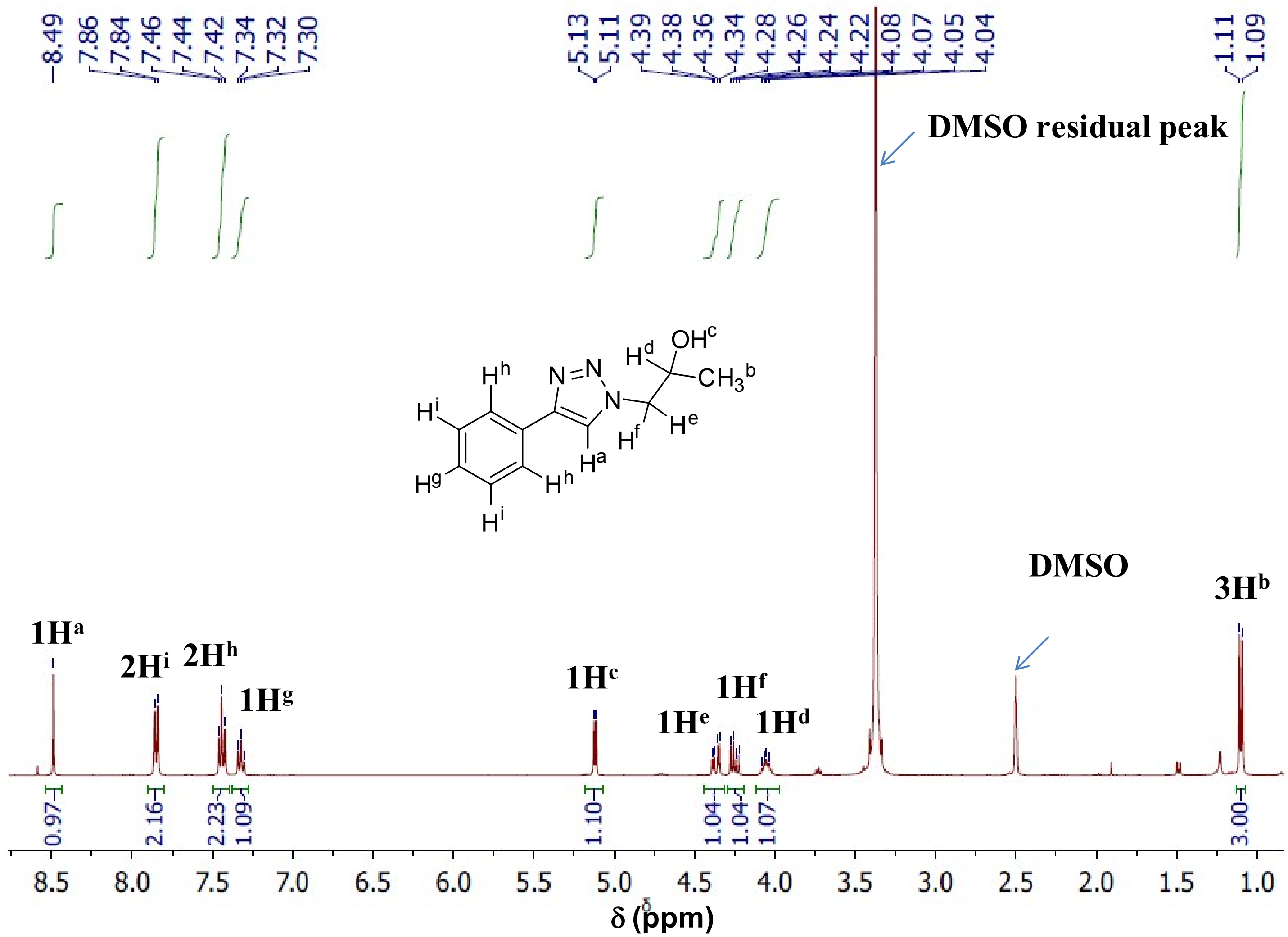


**Figure S7.** $^{1}H$ NMR spectrum of 1-(4-Phenyl-1H-(4-phenyl-1,2,3-triazol-1-yl) propan-2-ol.

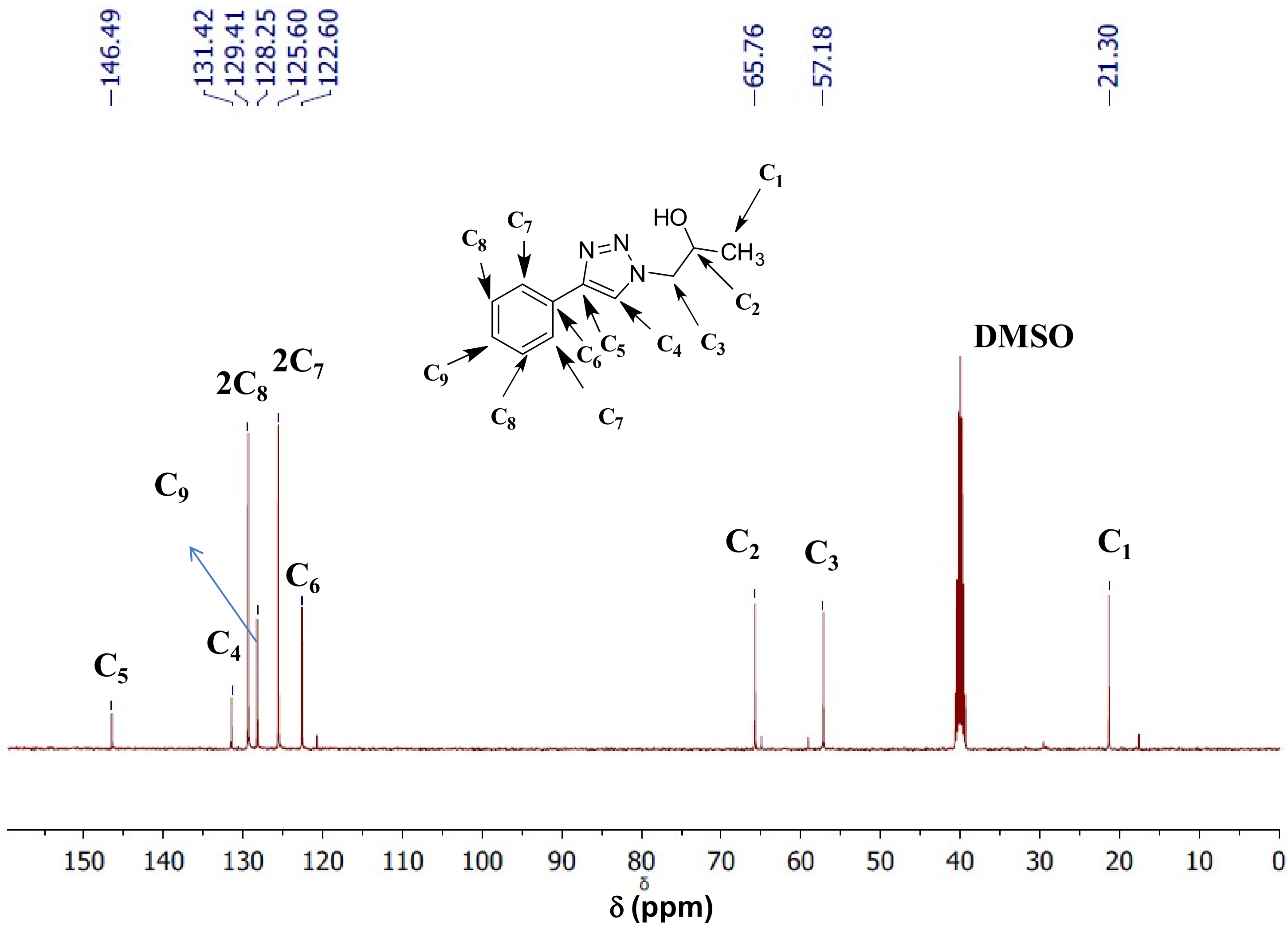


**Figure S8.** $^{13}$C NMR spectrum of 1-(4-Phenyl-1H-(4-phenyl-1,2,3-triazol-1-yl) propan-2-ol.

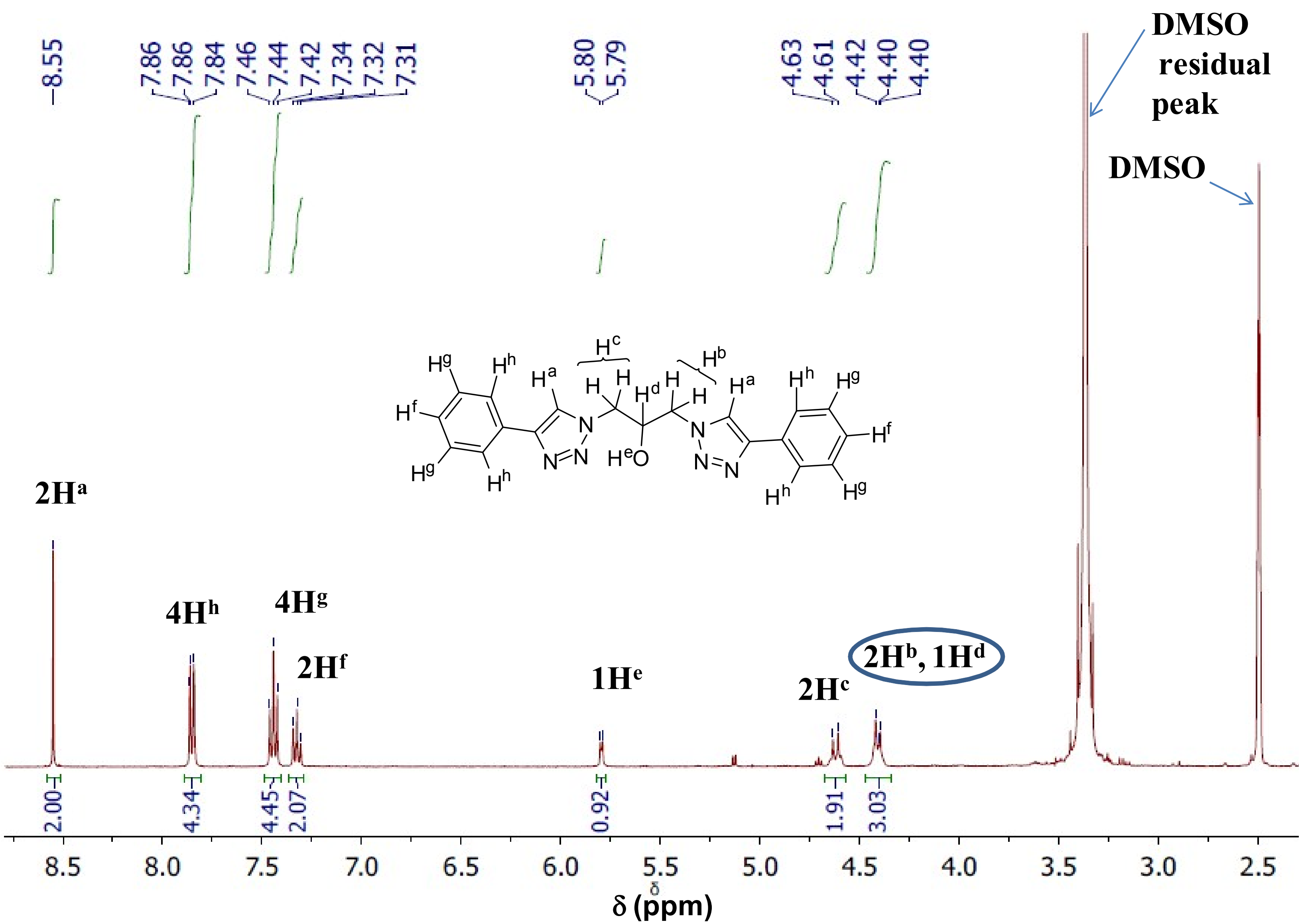


**Figure S9.** $^{1}H$ NMR spectrum of 1,3-bis(5-phenyl-1H-1,2,3-triazol-1-yl) propan-2-ol**.**

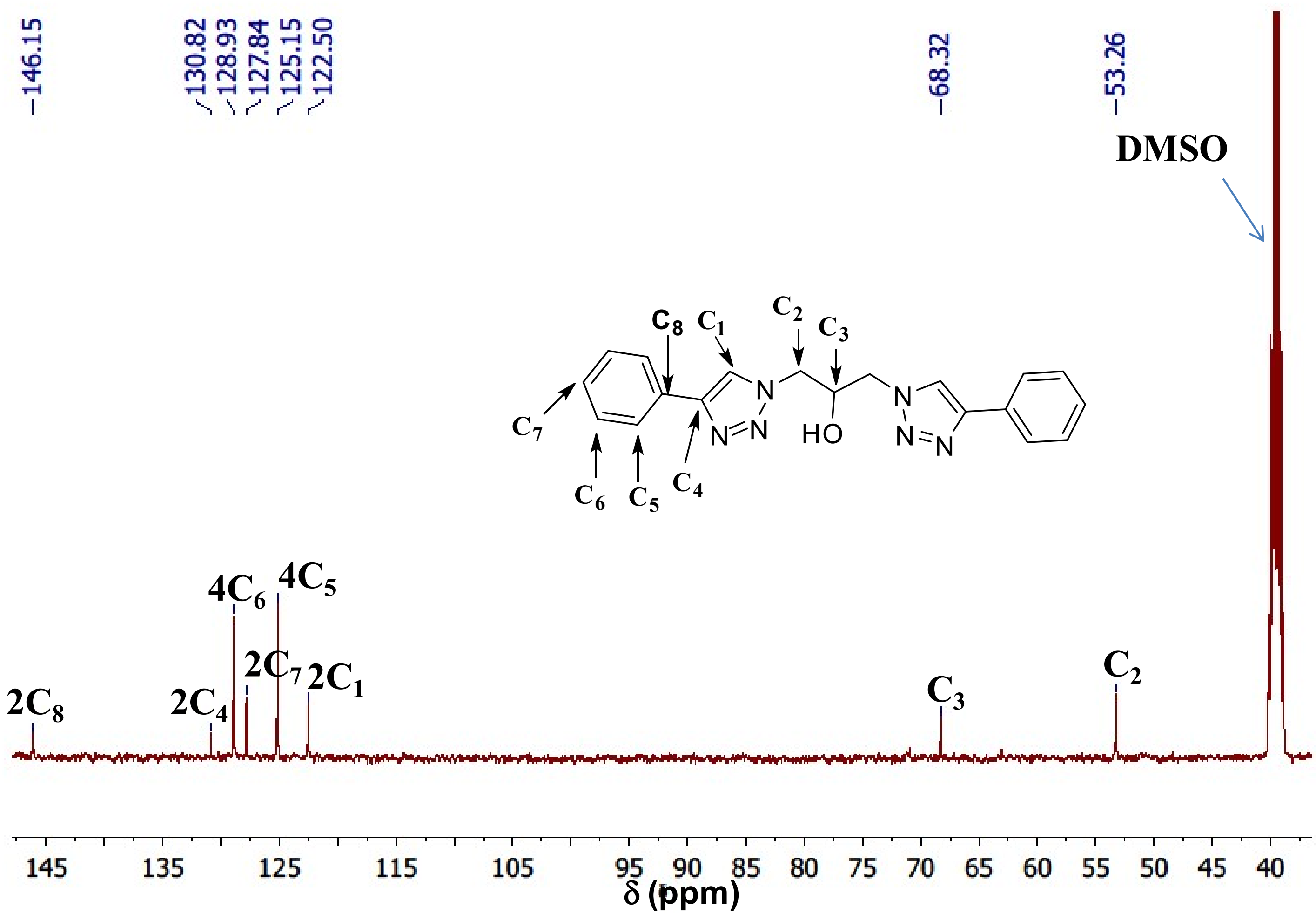


**Figure S10.** $^{13}C$ NMR spectrum of 1,3-bis(5-phenyl-1H-1,2,3-triazol-1-yl) propan-2-ol.

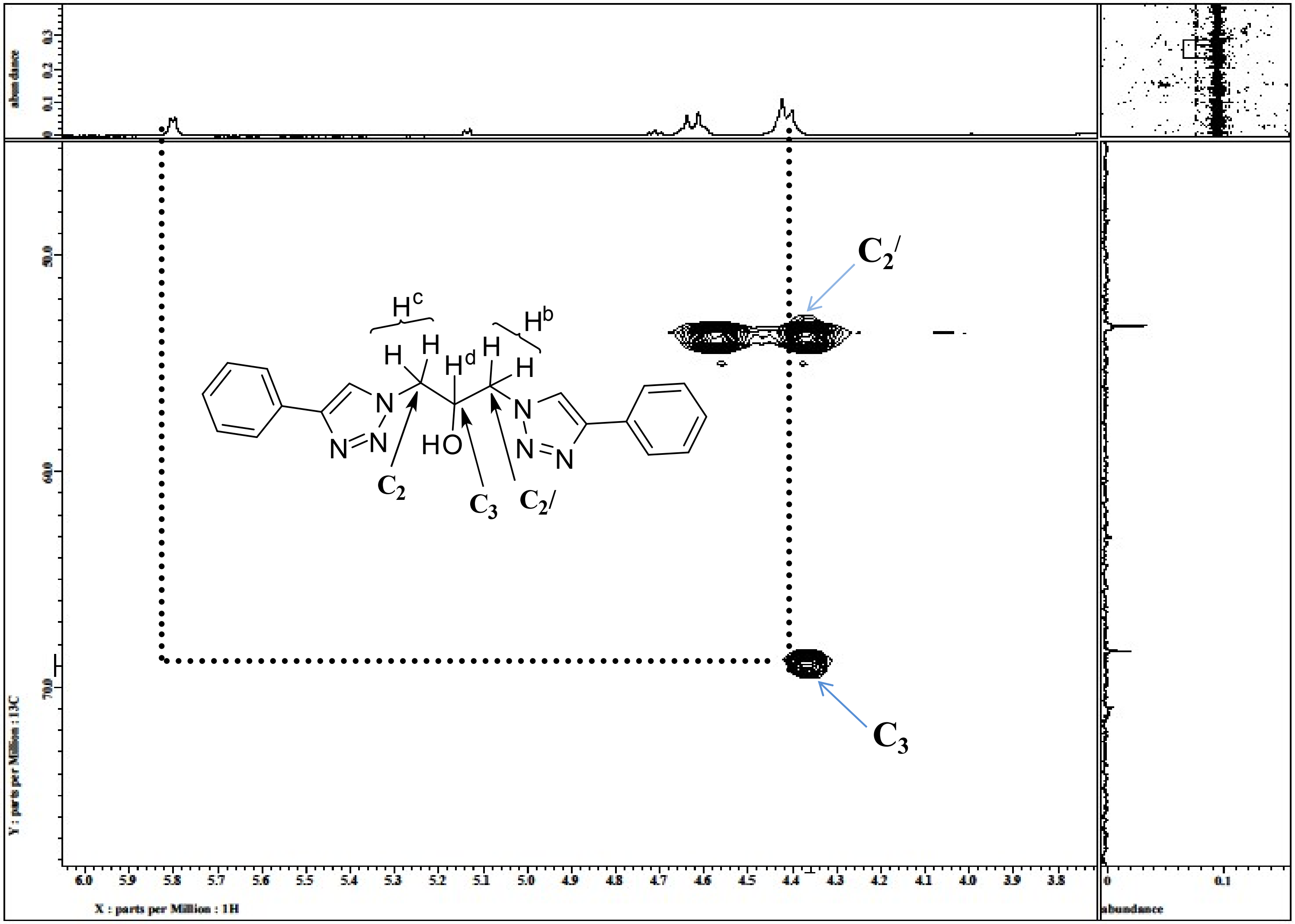


**Figure S11.** $^{1}H$-$^{13}C$ HETCOR NMR spectrum of 1,3-bis(5-phenyl-1H-1,2,3-triazol-1-yl) propan-2-ol**.**

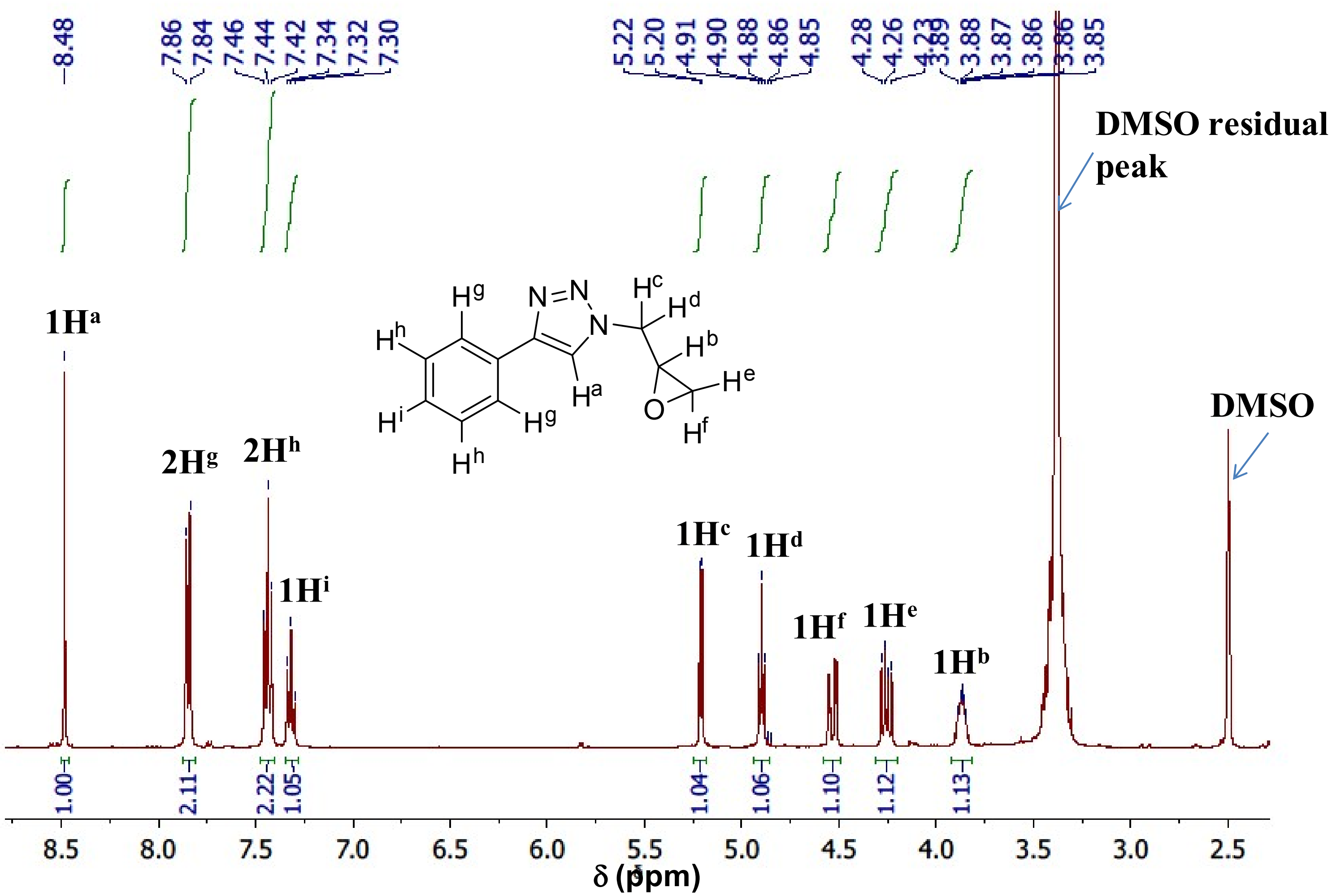


**Figure S12.** $^{1}H$ NMR spectrum of 1-(oxiran-2-ylmethyl)-4-phenyl-1H-1,2,3-triazole.

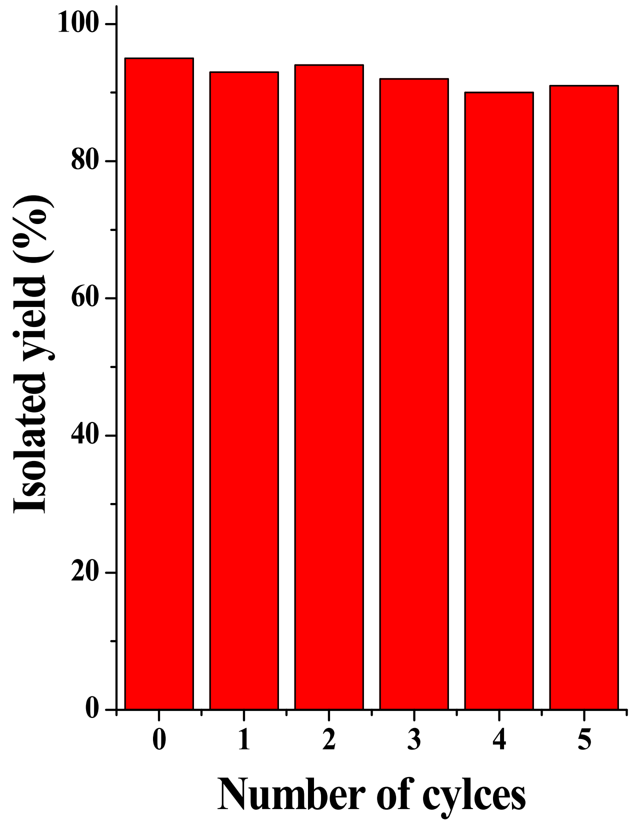


**Figure S13.** Catalytic performance of Cu(10%)/Meso-ZSM-5 during the multi-component reactions of phenyl acetylene, styrene oxide and sodium azide.