Supplementary Materials

Enhanced catalytic performance by copper nanoparticle-graphene based composite

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Table S1. Effect of copper source on the coupling of imidazole with iodobenzene.

Entry	Copper Source	Yield (%)
1	None	No reaction
2	Cu-metal	12
3	CuI	32
4	$CuCl_2$	29
5	$Cu(OAc)_2$	37
6	Cu-G composite (6 % Cu)	72
7	Cu-G composite (13 % Cu)	98
8	Cu-C composite (7 % Cu)	58
9	Cu-C composite (14 % Cu)	80

Table S2. The effect of different reaction parameters on the Cu-G (13 % Cu) composite catalyzed O-arylation reaction of iodobenzene and phenol.[a]

Entry	Solvent	Base	Temp. (^{0}C)	Yield (%)[b,c]
1	Methanol	Cs_2CO_3	reflux	22
2	CAN	Cs_2CO_3	100	34
3	DMF	Cs_2CO_3	100	70
4	Toluene	Cs_2CO_3	100	12
5	**DMSO**	**Cs_2CO_3**	**100**	**98**
6	DMSO	K_2CO_3	100	78
7	DMSO	K_3PO_4	100	45
8	DMSO	KOH	100	34
9	DMSO	$KOBu^t$	100	23
10	DMSO	Na_2CO_3	100	59
11	DMSO	Et_3N	100	09
12[d]	DMSO	Cs_2CO_3	Room temp.	14
13	DMSO	Cs_2CO_3	60	47

[a]Reaction conditions: Cu-G catalyst (0.05 g), iodobenzene (1 mmol); phenol (1 mmol); base (2 mmol); solvent (10 mL); Time (12 h) open air. [b]Yield determined by GC. [c]Products were identified by GC–MS. [d]Reaction time 24 h.

Table S3. Screening of different solvents and bases for *N*-arylation of imidazole with iodobenzene.

Entry	**Base**	**Solvent**	**Temperature (^{0}C)**	**Time (h)**	**Yield (%)[b,c]**
1	K_2CO_3	DMSO	100	7	89
2	**Cs_2CO_3**	**DMSO**	**100**	**7**	**94**
3	K_3PO_4	DMSO	100	12	78
4	Et_3N	DMSO	100	12	52
5	KOH	DMSO	100	12	49
6	Cs_2CO_3	DMF	100	7	84
7	Cs_2CO_3	NMP	100	7	78
8	Cs_2CO_3	CAN	100	7	70
9	Cs_2CO_3	THF	100	12	32
10	Cs_2CO_3	Toluene	100	18	12
11	Cs_2CO_3	DMSO	Room temp.	24	No reaction
12	Cs_2CO_3	DMSO	50	12	39
13	Cs_2CO_3	DMSO	70	12	58

[a]Reaction conditions: Cu-G catalyst (0.05 g), iodobenzene (1 mmol); imidazole (1.2 mmol); base (2 mmol); solvent (10 mL); [b] Yield determined by GC. [c] Products were identified by GC–MS.

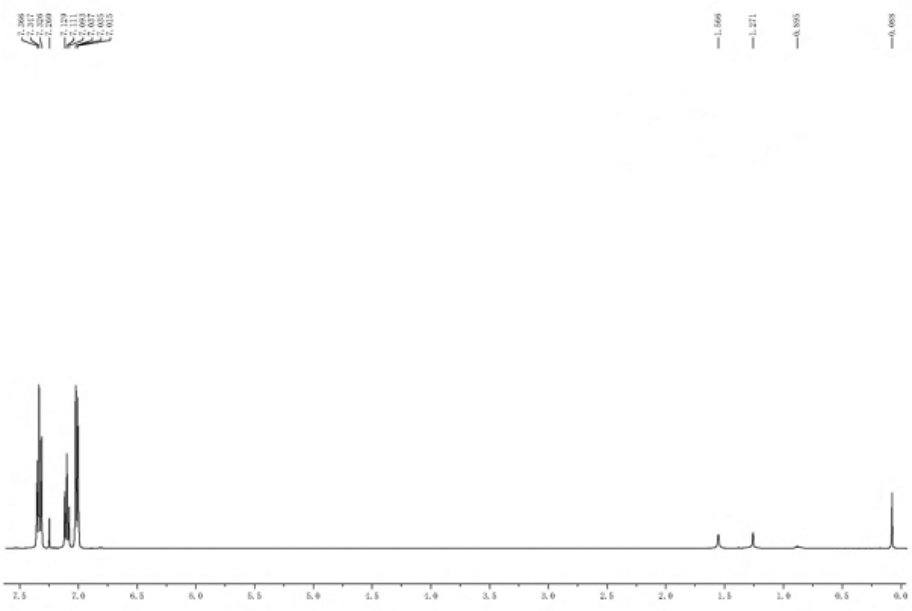

Figure S1. ^{1}H-NMR spectrum of Diphenylether

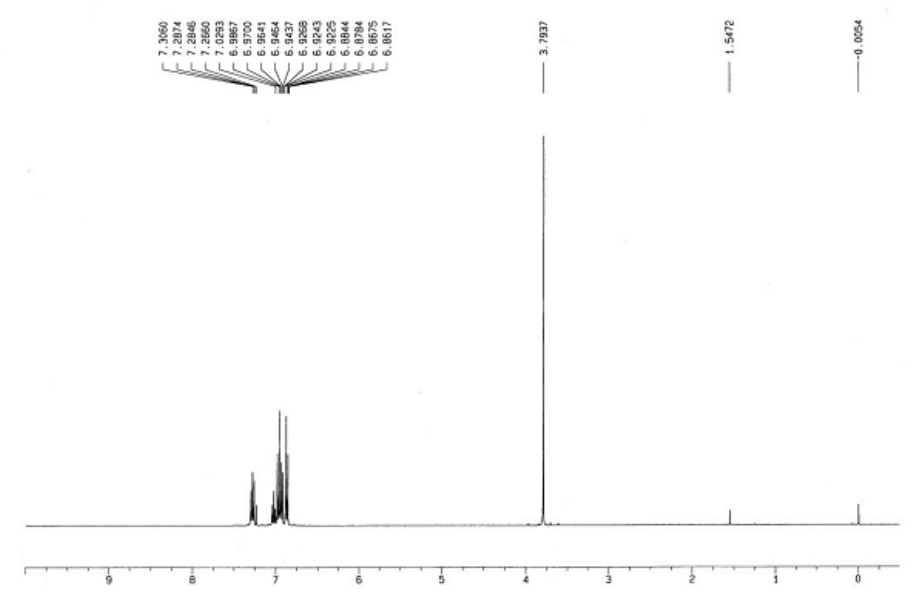

Figure S2. ^{1}H-NMR spectrum of 4-Methoxy-diphenylether

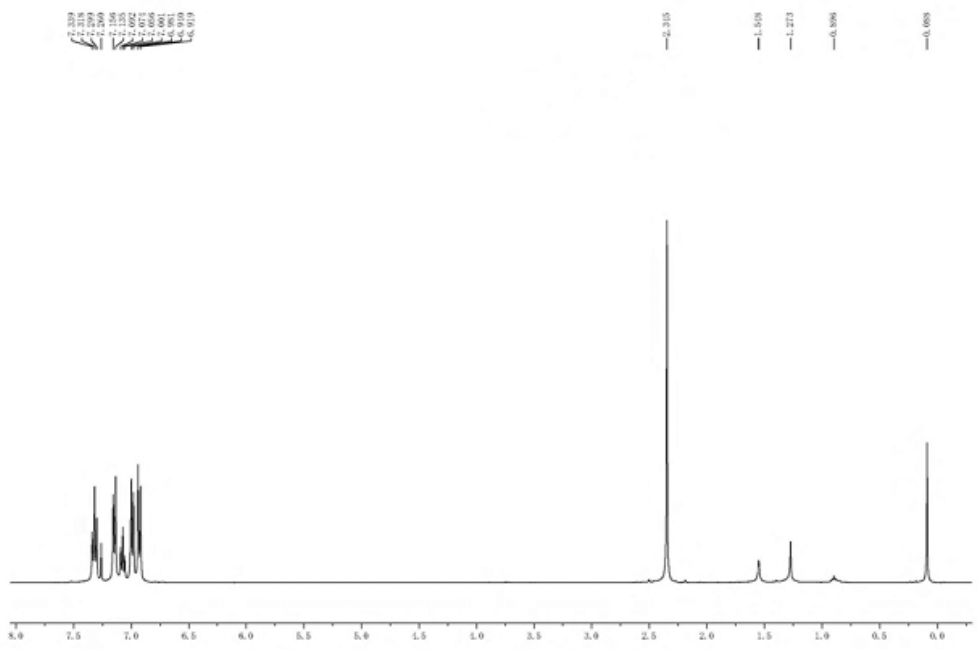

Figure S3. ^{1}H-NMR spectrum of 4-Methyl-diphenylether

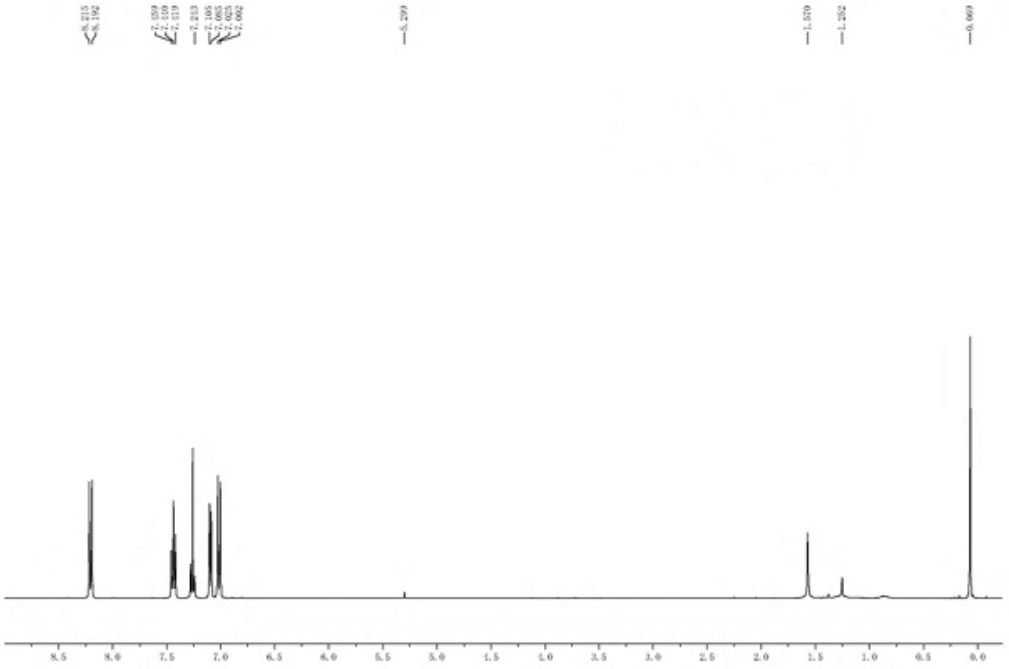

Figure S4. ^{1}H-NMR spectrum of 4-Nitro-diphenylether

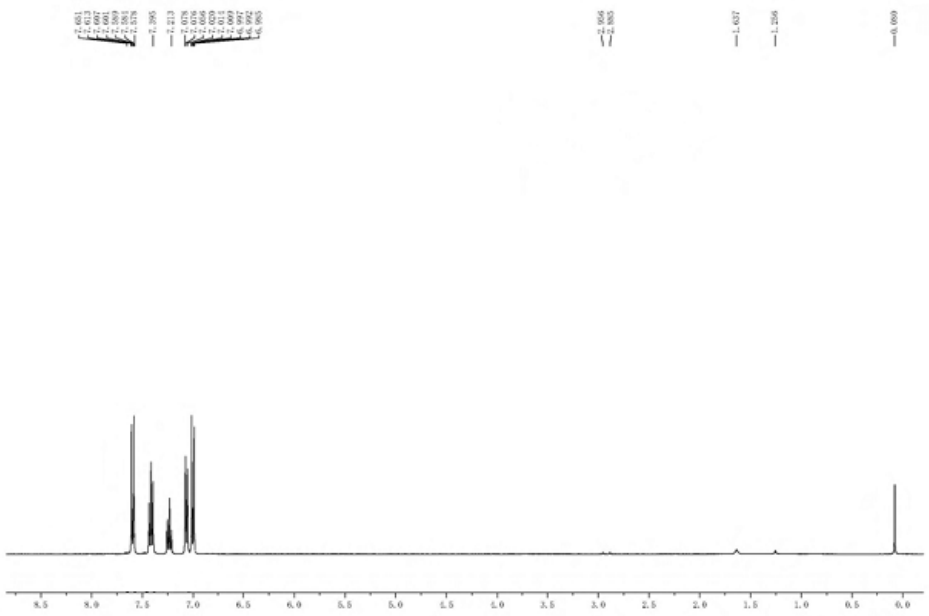

Figure S5. ^{1}H-NMR spectrum of 4-Phenoxybenzonitrile

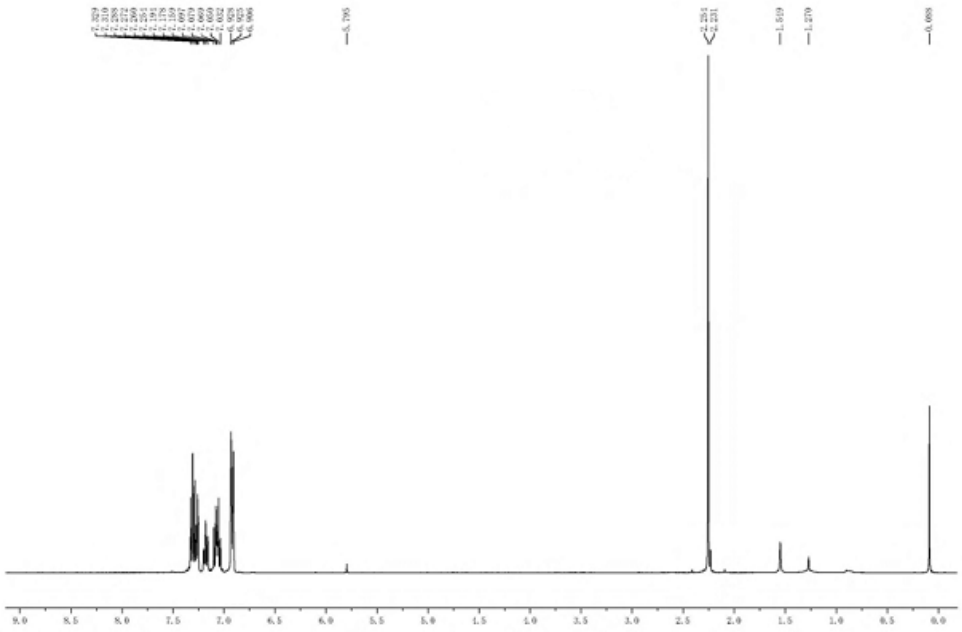

Figure S6. ^{1}H-NMR spectrum of 2-Methyl-diphenylether

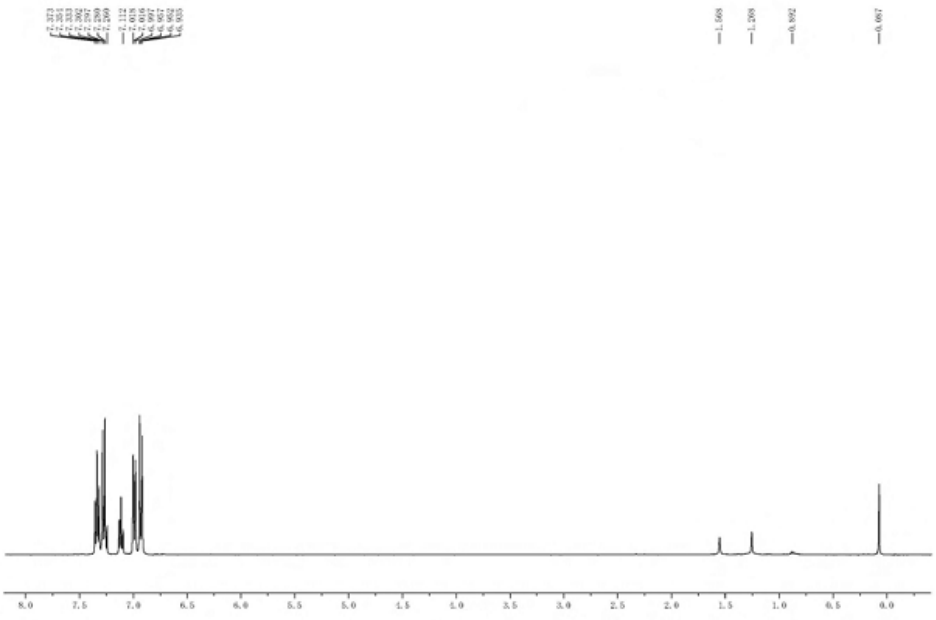

Figure S7. ^{1}H-NMR spectrum of 4-Chloro-diphenylether

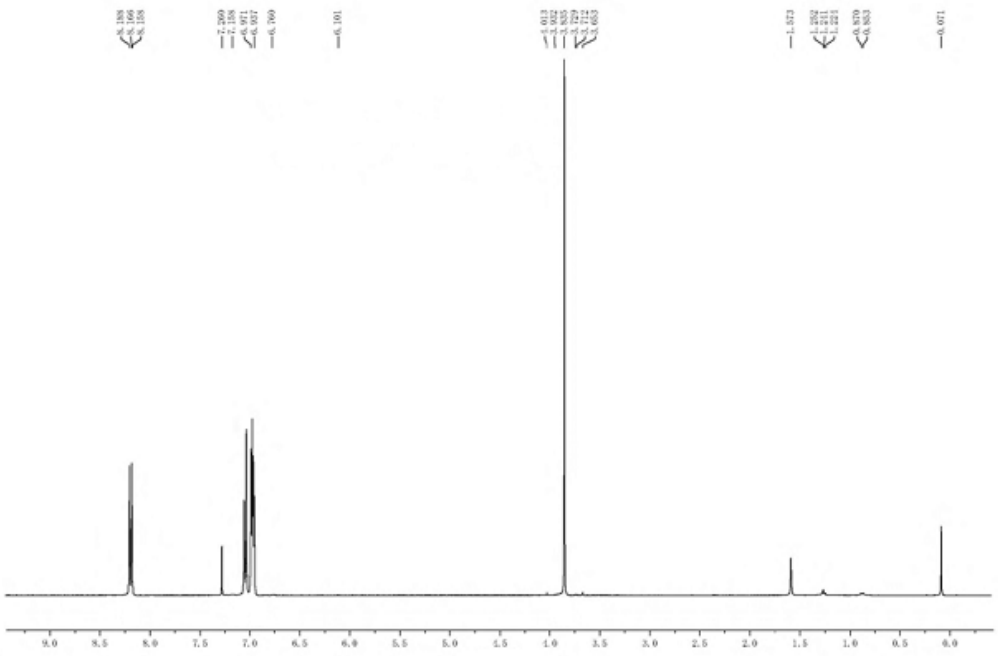

Figure S8. ^{1}H-NMR spectrum of 1-(4-nitrophenoxy)-4-methoxybenzene

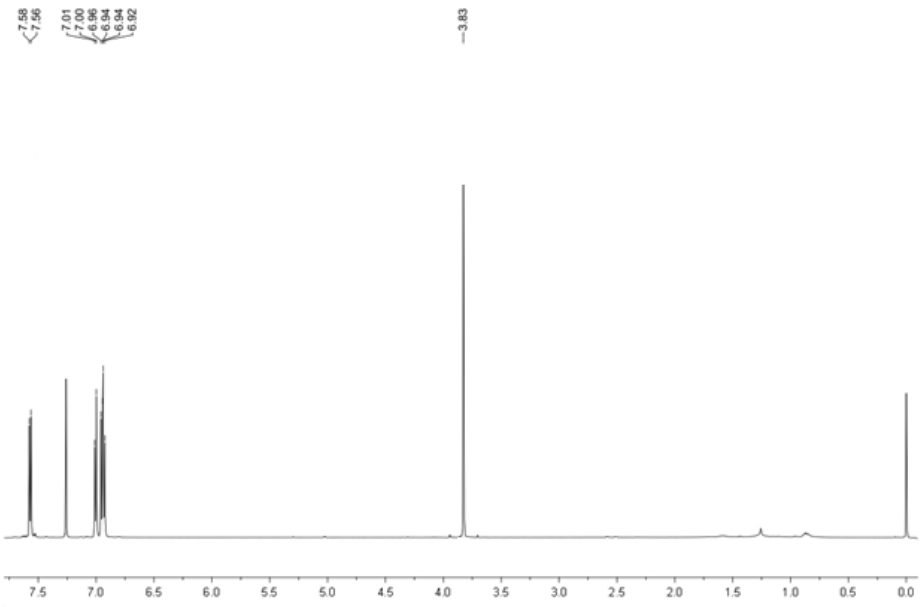

Figure S9. ^{1}H-NMR spectrum of 4-Cyano-4-methoxy-diphenylether

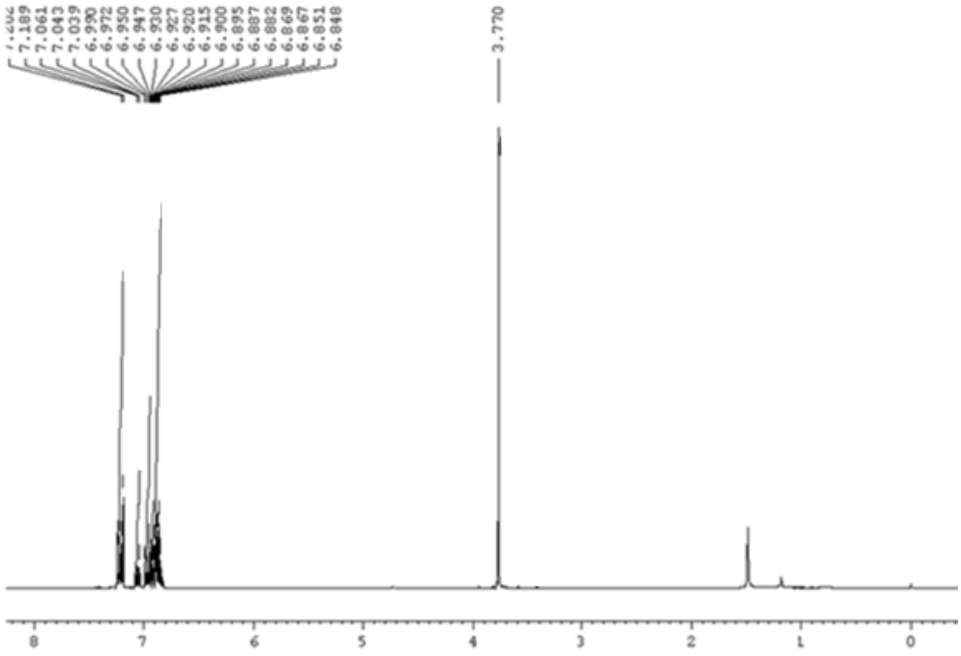

Figure S10. ^{1}H-NMR spectrum of 2-Methoxy-diphenylether

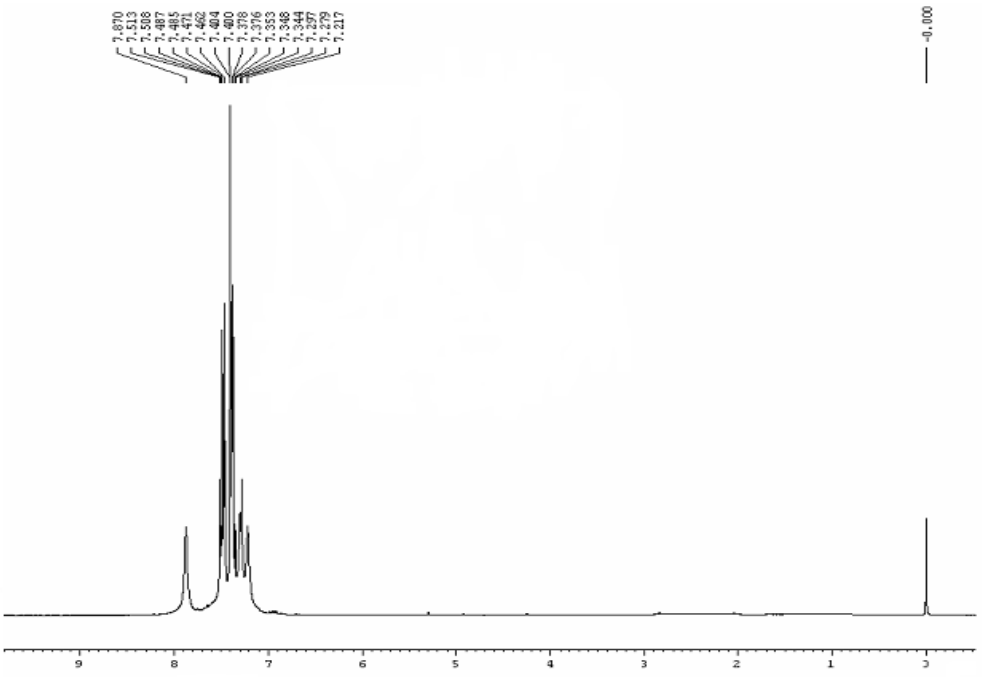

Figure S11. ^{1}H-NMR spectrum of 1-phenyl-1H-imidazole

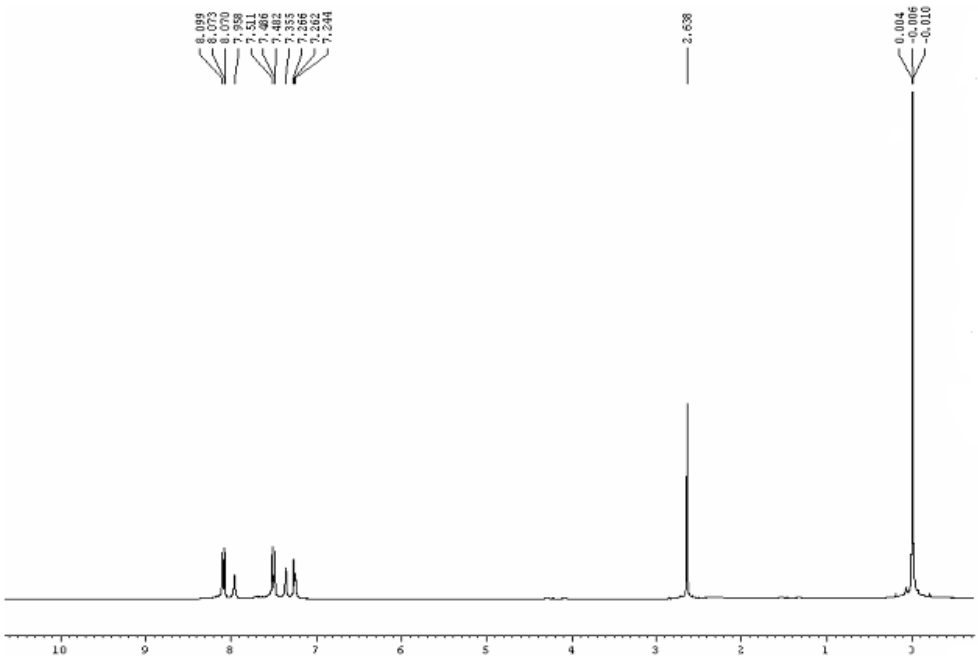

Figure S12. ^{1}H-NMR spectrum of 1-(4-(1H-Imidazol-1-yl)phenyl)ethanone

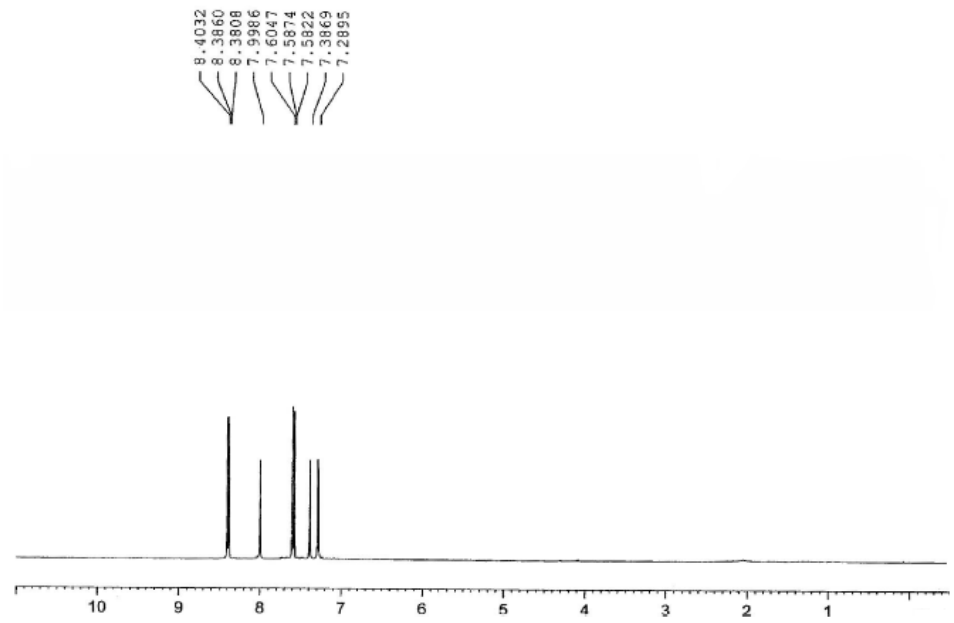

Figure S13. ^{1}H-NMR spectrum of 1-(4-Nitrophenyl)-1H-imidazole

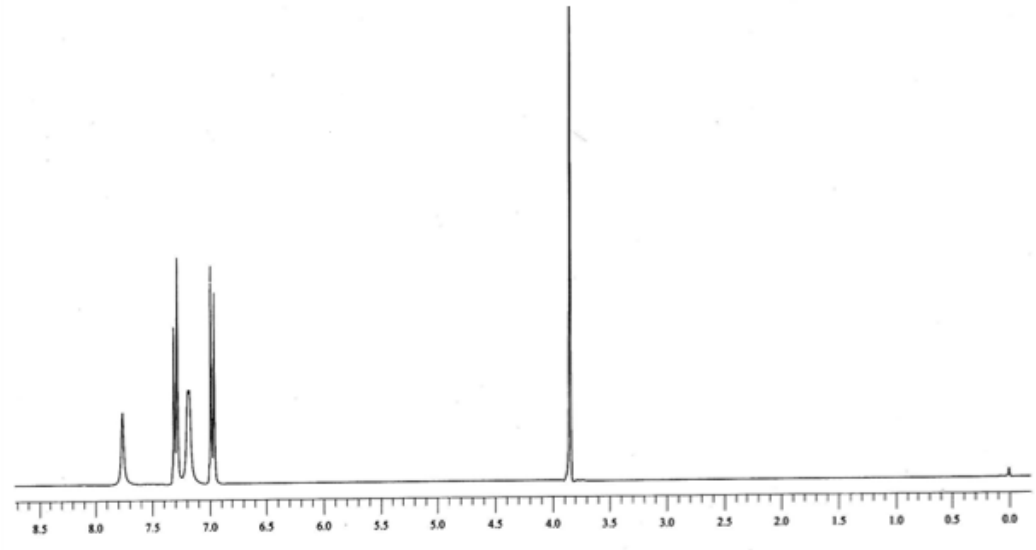

Figure S14. ^{1}H-NMR spectrum of 1-(4-Methoxyphenyl)-1H-imidazole

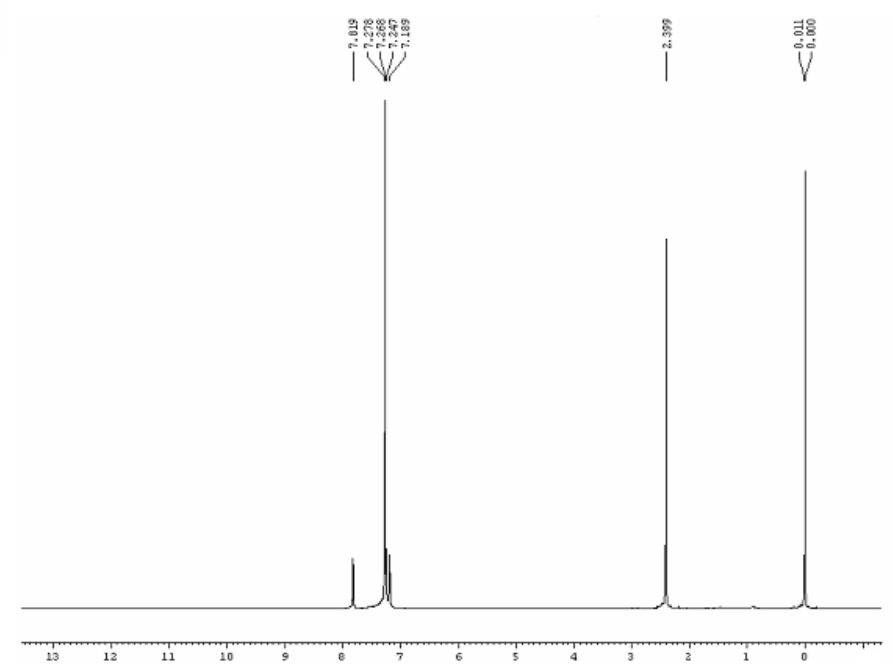

Figure S15. ^{1}H-NMR spectrum of 1-(4-Methylphenyl)-1H-imidazole

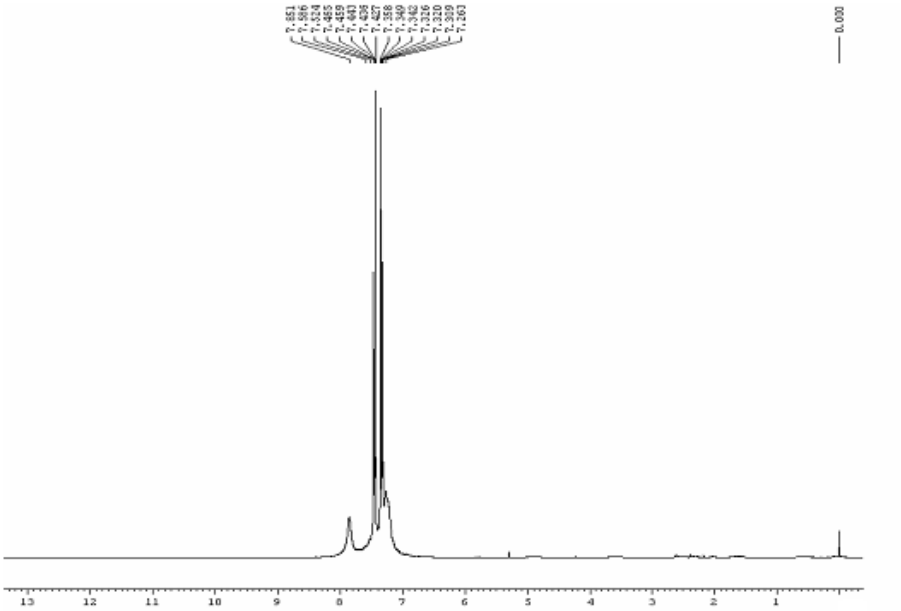

Figure S16. ^{1}H-NMR spectrum of 1-(4-Chlorophenyl)-1H-imidazole

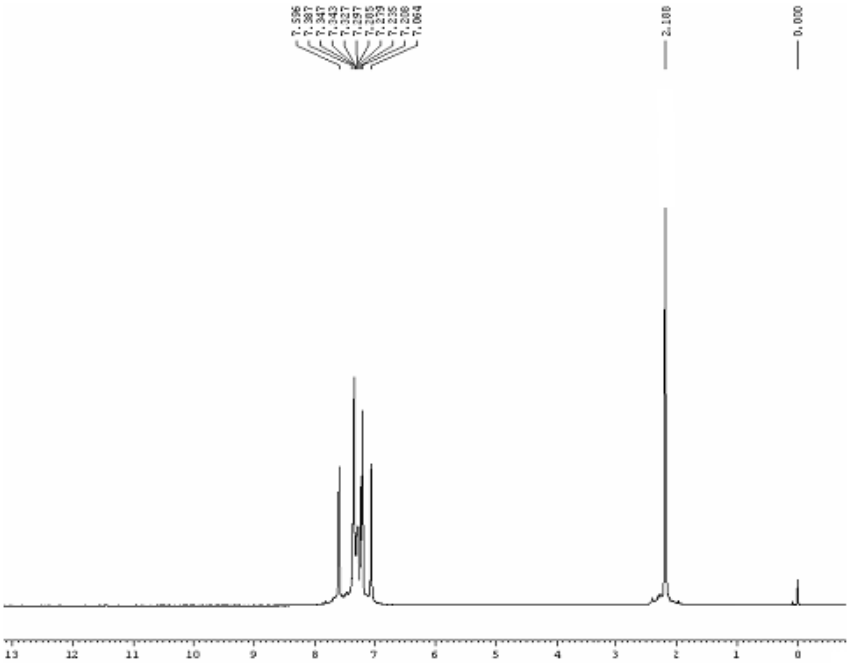

Figure S17. ^{1}H-NMR spectrum of 1-o-Tolyl-1H-imidazole

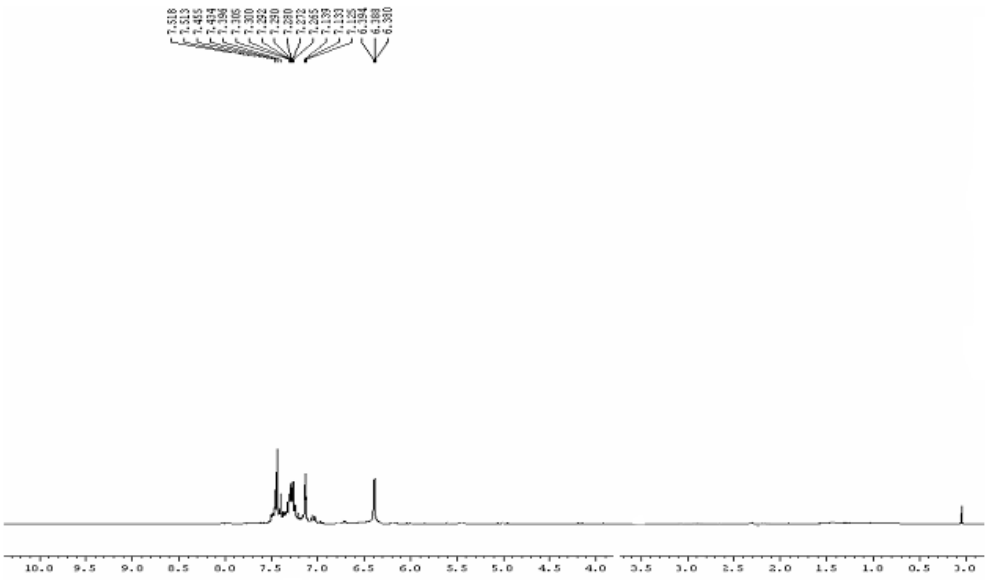

Figure S18. ^{1}H-NMR spectrum of 1-phenyl-1H-pyrrole

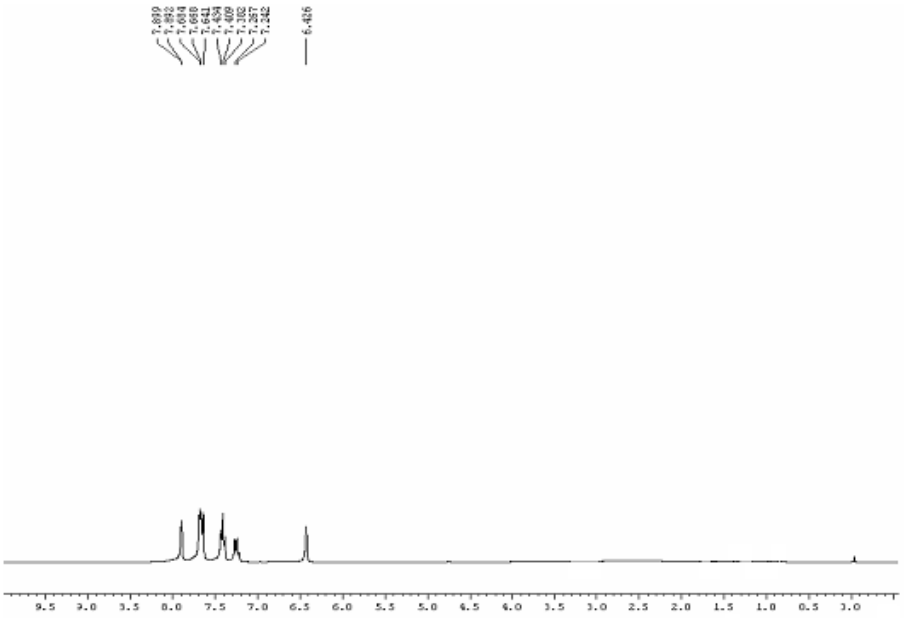

Figure S19. ^{1}H-NMR spectrum of 1-phenyl-1H-pyrazole

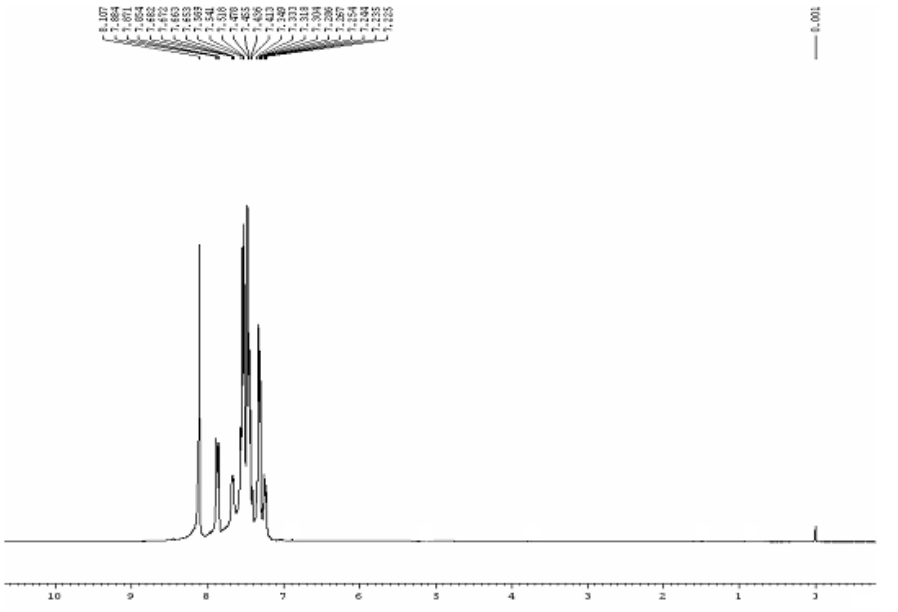

Figure S20. ^{1}H-NMR spectrum of 1-phenyl-1H-benzimidazole

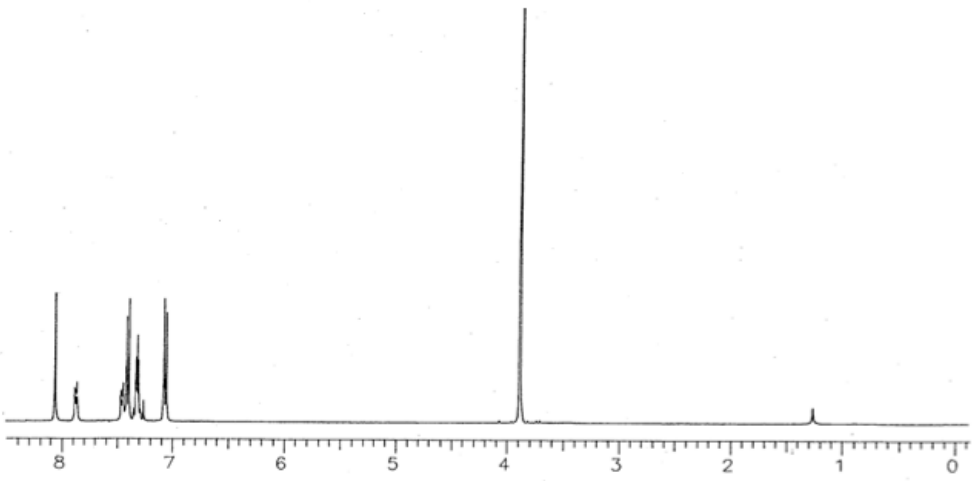

Figure S21. ^{1}H-NMR spectrum of 1-(4-Methoxyphenyl)-1H-benzimidazole

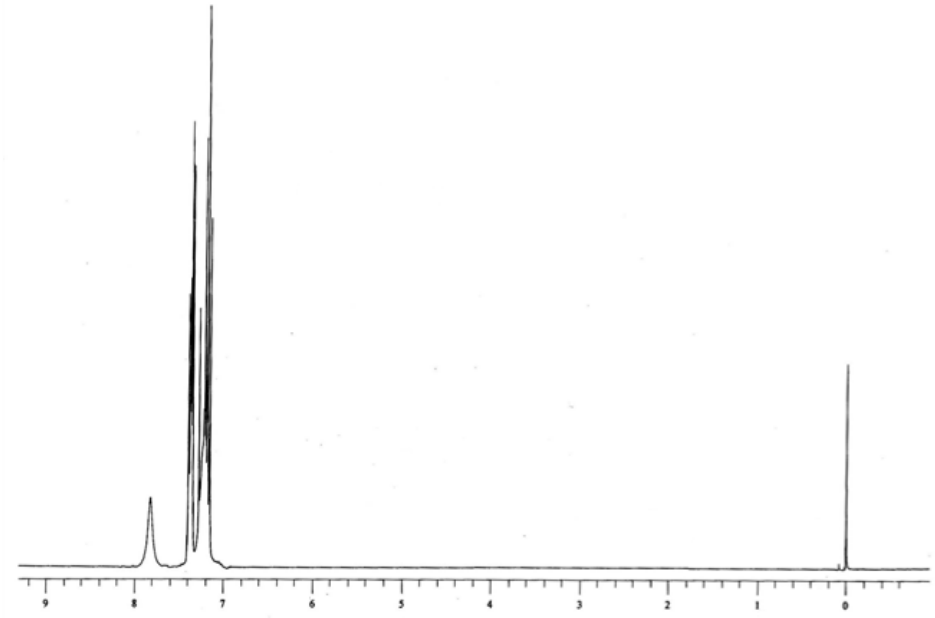

Figure S22. ^{1}H-NMR spectrum of 1-(4-Fluorophenyl)-1H-imidazole

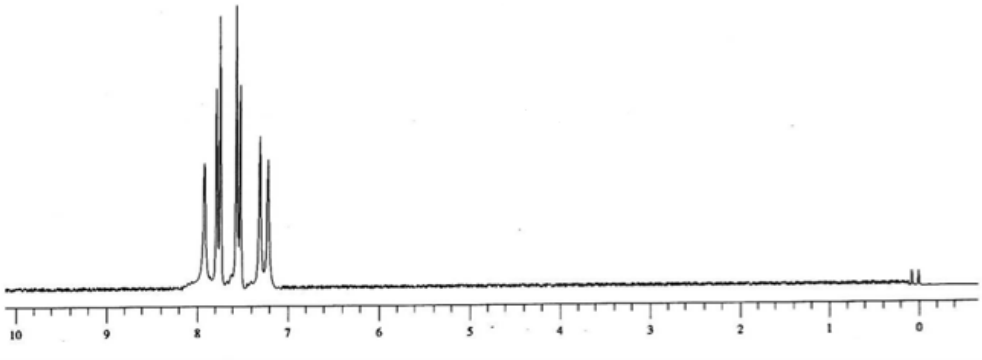

Figure S23. ^{1}H-NMR spectrum of 1-(4-Trifluoromethylphenyl)-1H-imidazole

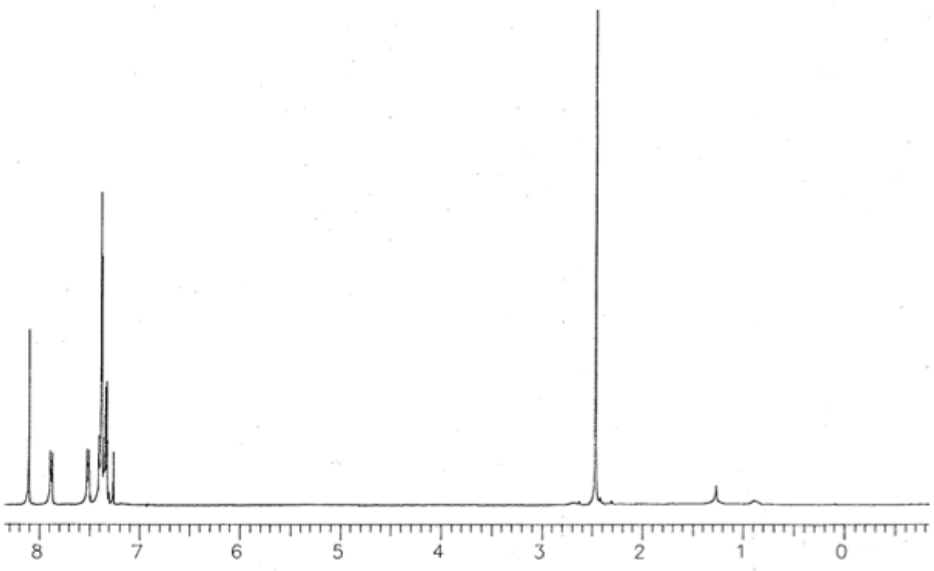

Figure S24. ^{1}H-NMR spectrum of 1-(4-Methylphenyl)-1H-benzimidazole

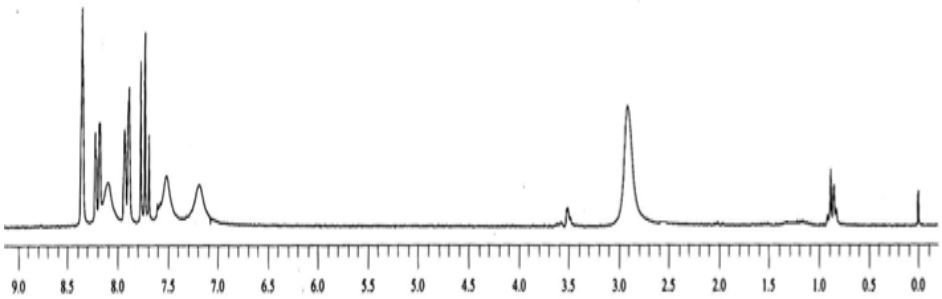

Figure S25. ^{1}H-NMR spectrum of 1-(3-nitrophenyl)-1H-imidazole

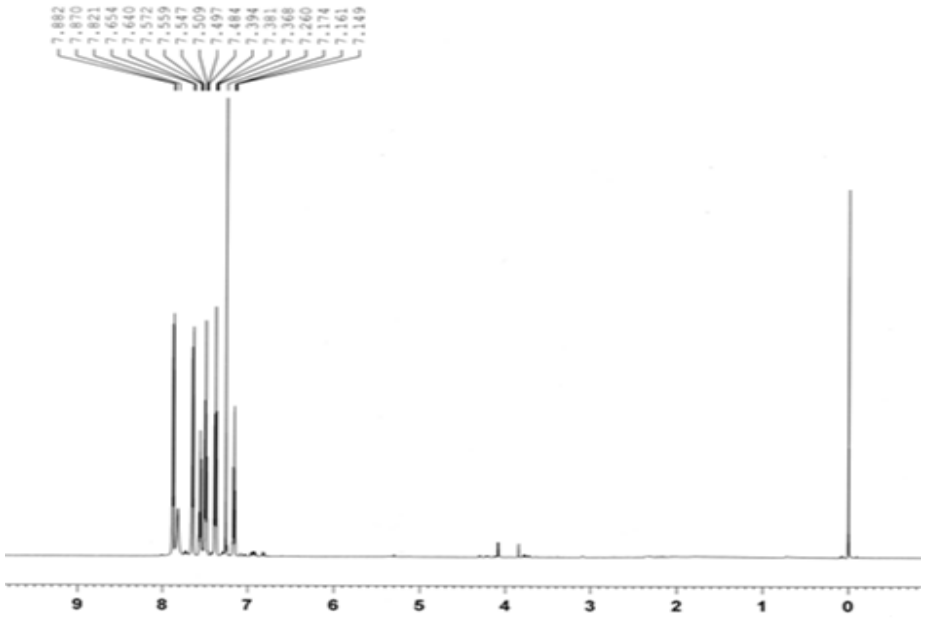

Figure S26. ^{1}H-NMR spectrum of N-Phenylbenzamide

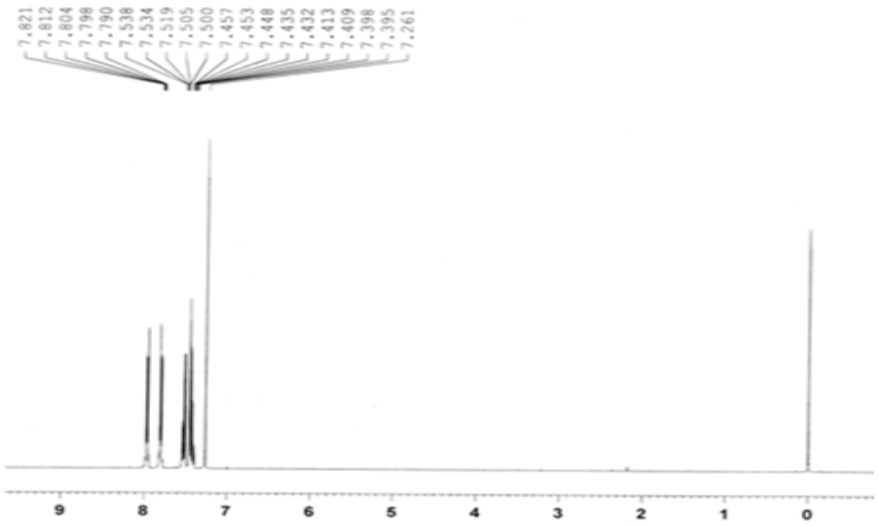

Figure S27. ^{1}H-NMR spectrum of 2-Phenylisoindoline-1, 3-dione

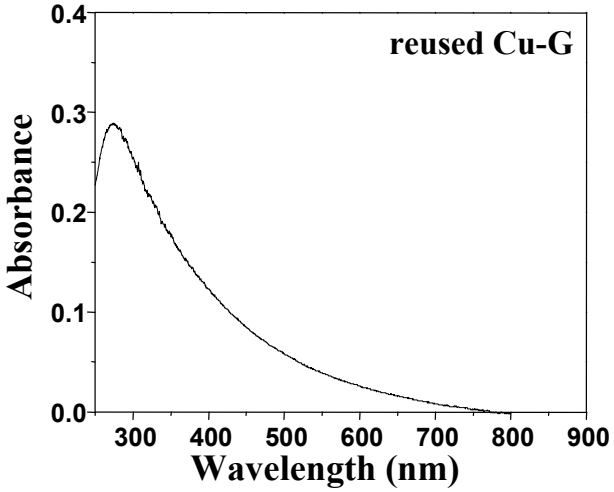

Figure S28. UV-visible spectra Cu-G composite after seven times reuse showing that it remains similar to as synthesized Cu-G.

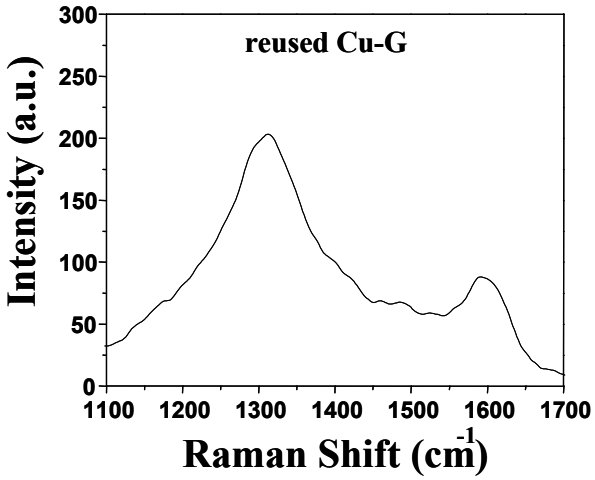

Figure S29. Raman spectra of Cu-G composite after seven times reuse, showing two well documented D and G bands at 1315 and 1600 cm^{-1} and band intensity ratio (I_D/I_G) of 2.35. Some shifting of D band is likely due to structural rearrangement of graphene.

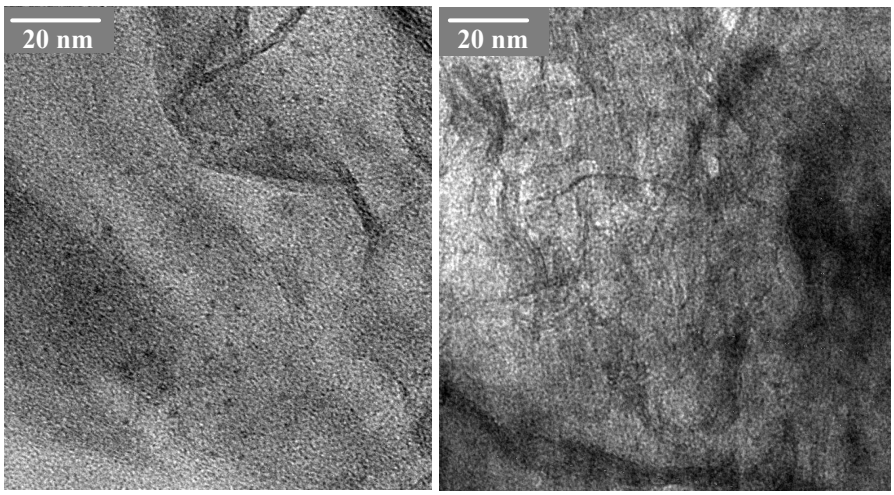

Figure S30. Representative TEM image of Cu-G composites after seven times reuse.