Supporting Information

Facile Synthesis of $CuCr_2O_4$ Spinel Nanoparticles: A Recyclable Heterogeneous Catalyst for One Pot Hydroxylation of Benzene

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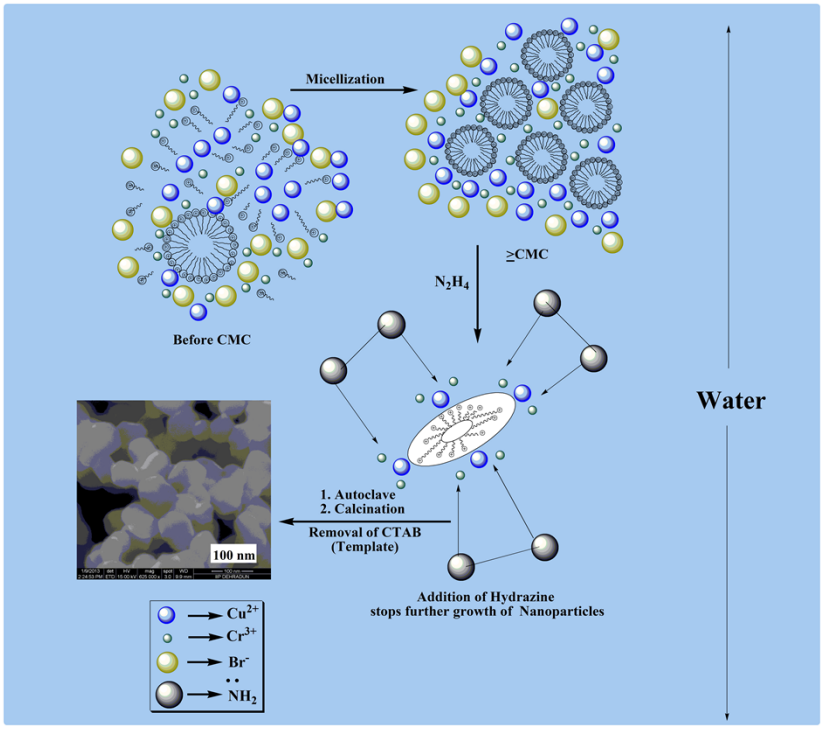

Scheme S1. Formation of $CuCr_2O_4$ Spinel Nanoparticles Catalyst.

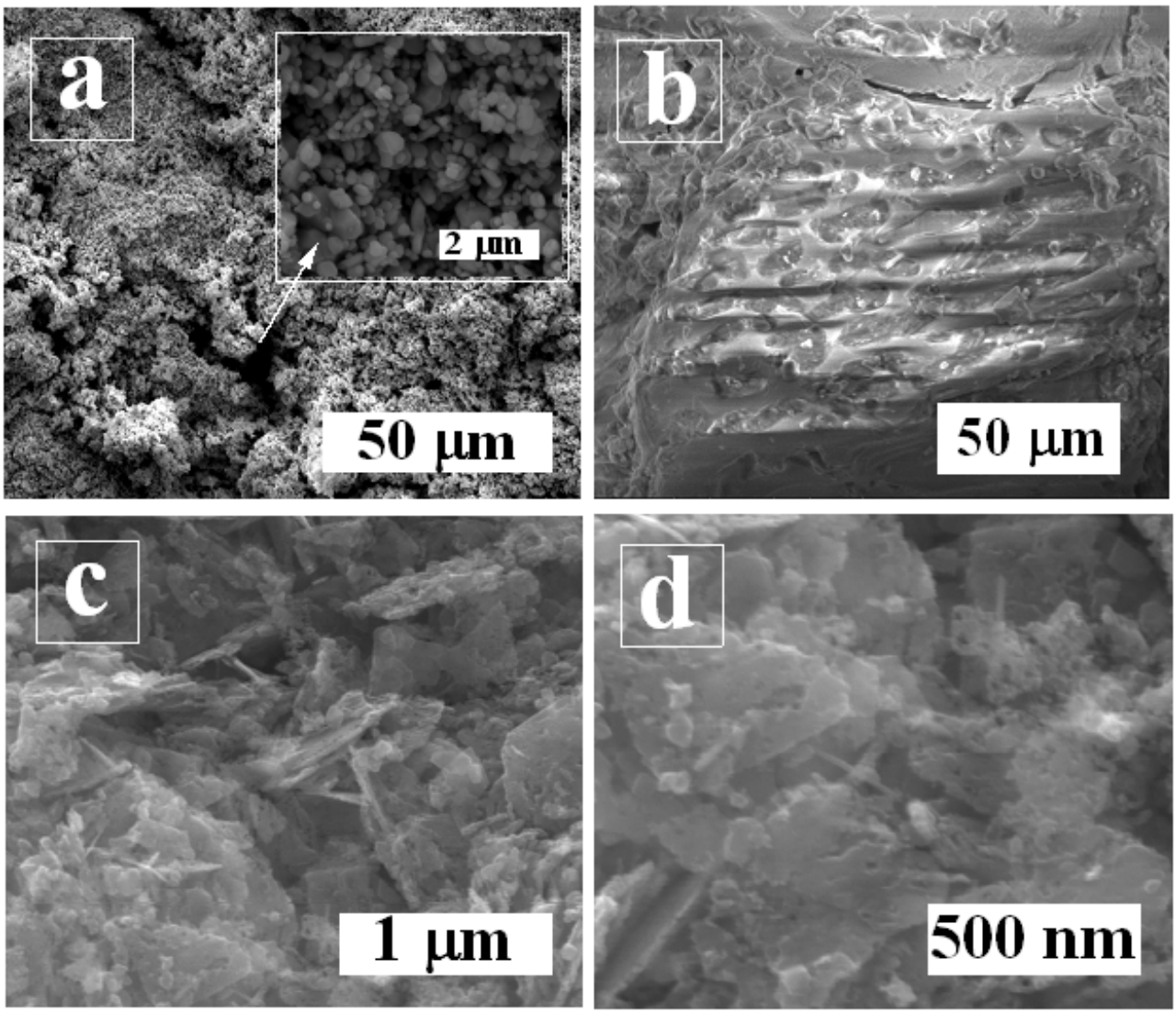

Figure S1. SEM images of Cu-Cr catalyst prepared by (a) impregnation method, (b) co-precipitation method and that of commercial catalyst at (c) low and (d) high resolution.

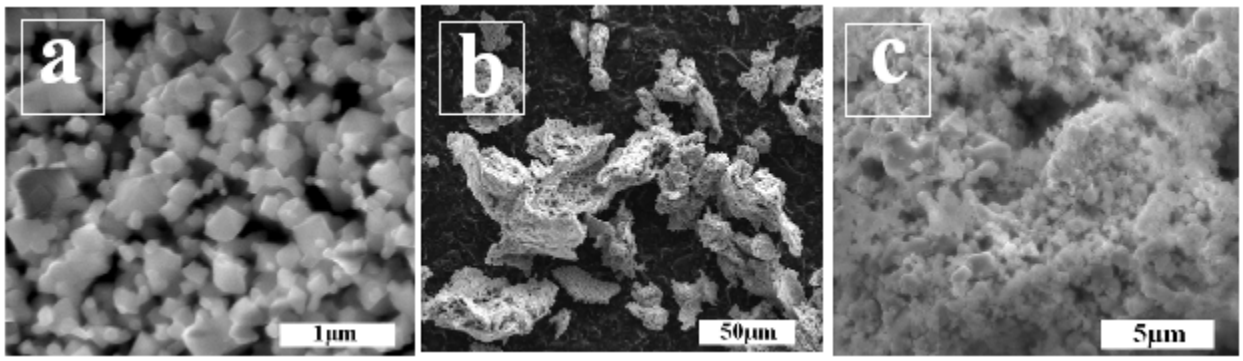

Figure S2. SEM image of the Cu-Cr samples without using (a) NH_4OH solution, (b) CTAB, (c) hydrazine.

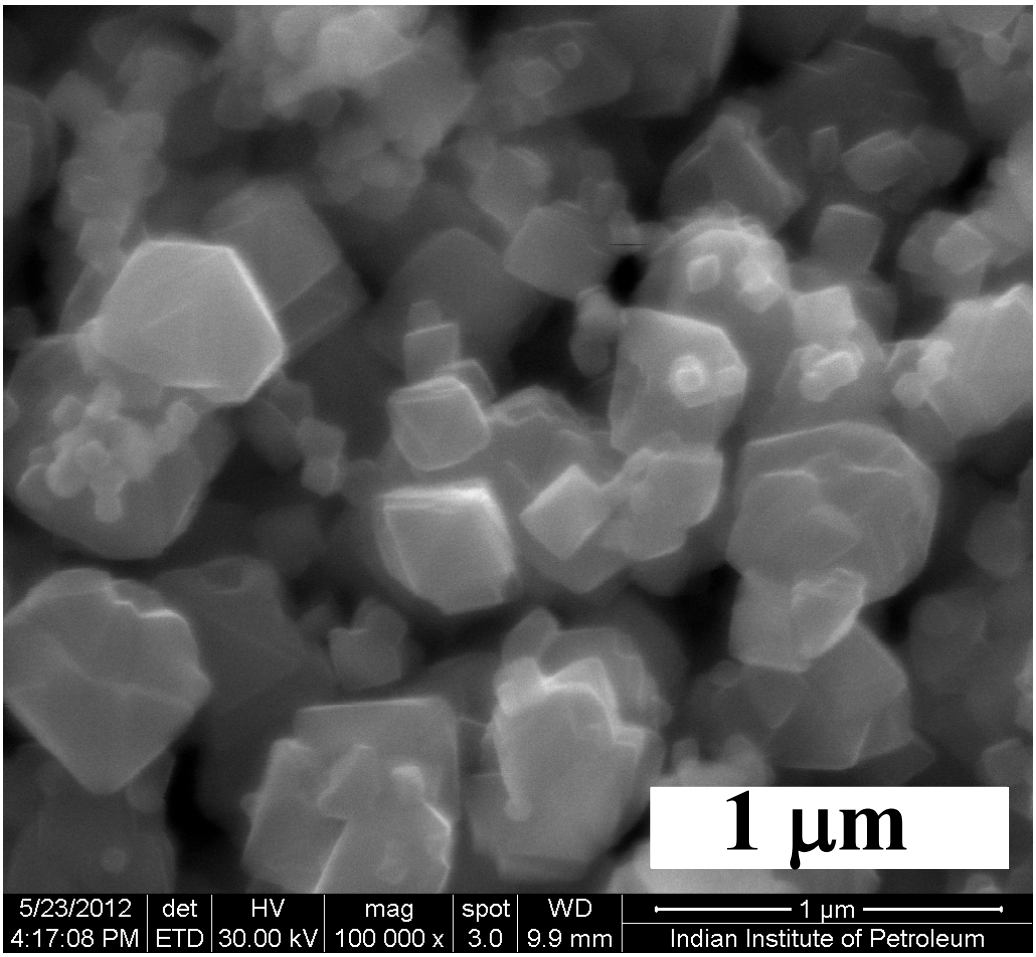

Figure S3. SEM image of the Cu-Cr samples prepared non-hydrothermally.

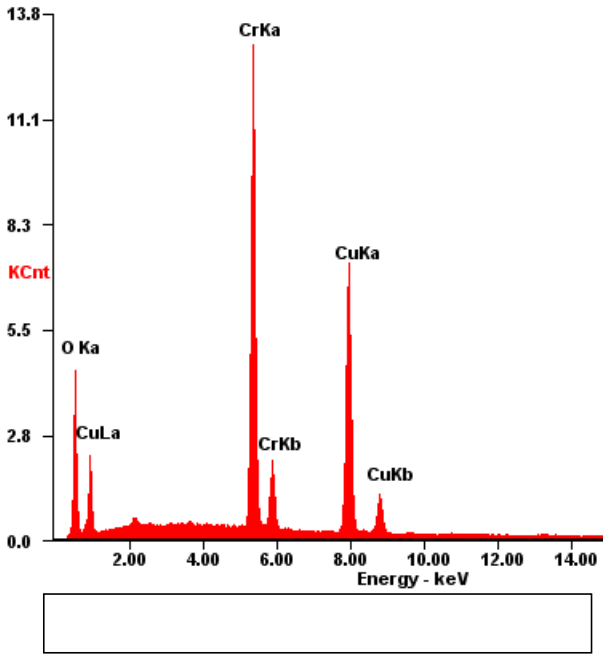

Figure S4. EDAX of the $CuCr_2O_4$ spinel nanoparticles catalyst.

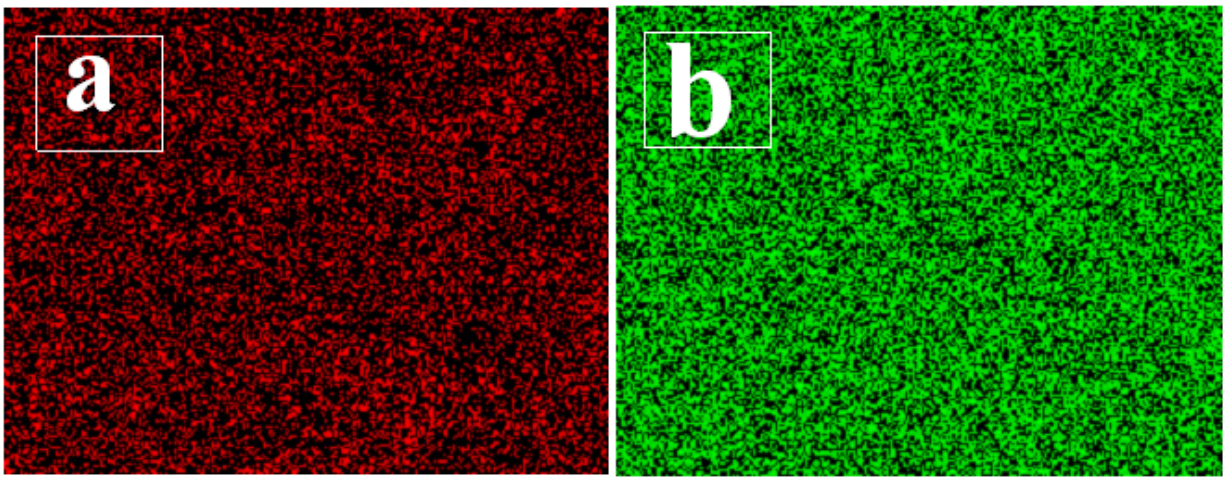

Figure S5. Elemental mapping of (a) Cu and (b) Cr atoms in the $CuCr_2O_4$ spinel nanoparticles catalyst.

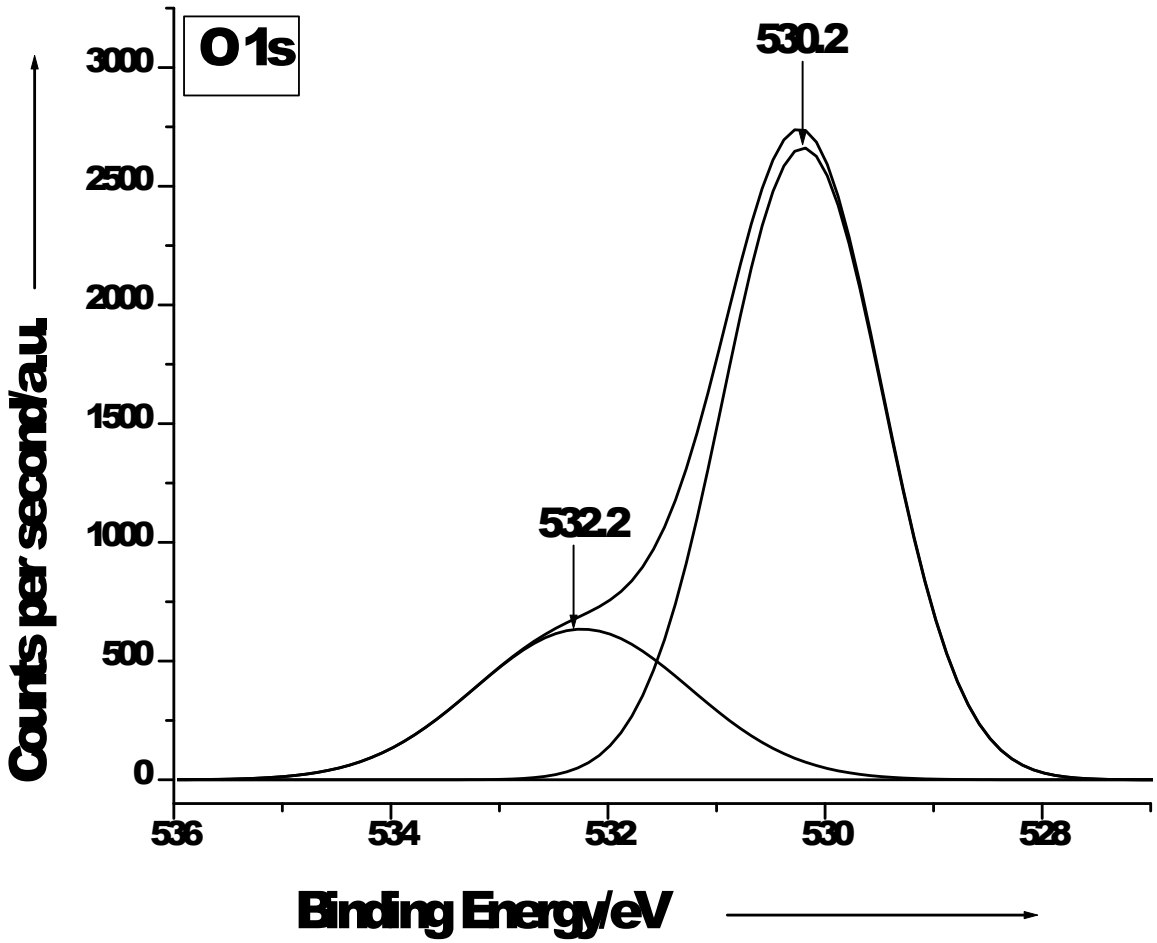

Figure S6. O1s core level spectra of $CuCr_2O_4$ nano particles catalyst.

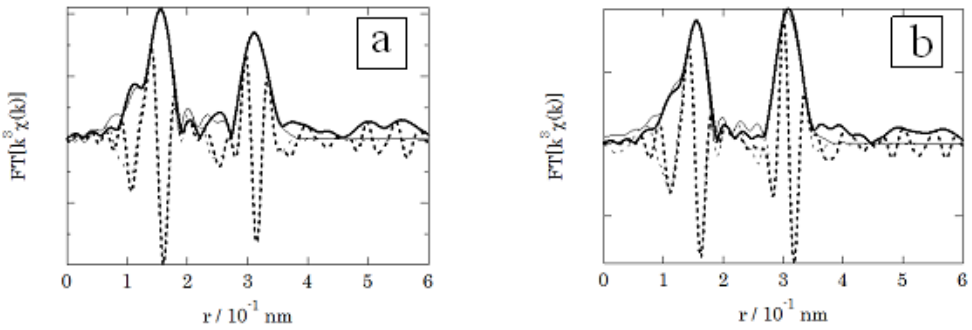

Figure S7. Fourier Transform of Cu-K edge EXAFS spectra of a) fresh catalyst and b) spent catalyst (after 5 recycles). Amplitude: solid curves; imaginary part: dotted curves; observed data: thick curves; fitting data: thin curves.

Fresh Catalyst					**Spent Catalyst (After 5 recycles)**				
No.	**Path**	**CN**	**R**	**DW**	**No.**	**Path**	**CN**	**R**	**DW**
1	feff0001	4.00	1.886	1.683e-002	1	feff0001	4.00	1.885	1.309e-002
2	feff0002	4.00	3.140	2.198e-002	2	feff0002	4.00	3.139	1.707e-002
3	feff0003	4.00	3.245	9.406e-003	3	feff0003	4.00	3.243	7.311e-003
4	feff0004	8.00	3.362	2.948e-002	4	feff0004	8.00	3.368	2.293e-002
5	feff0005	8.00	3.458	9.499e-003	5	feff0005	8.00	3.464	7.379e-003
6	feff0006	4.00	3.523	3.152e-002	6	feff0006	4.00	3.529	2.450e-002
7	feff0007	4.00	3.536	8.558e-003	7	feff0007	4.00	3.542	6.647e-003
8	feff0008	8.00	3.538	2.230e-002	8	feff0008	8.00	3.544	1.731e-002
9	feff0009	8.00	3.541	1.231e-002	9	feff0009	8.00	3.547	9.572e-003
10	CuO	2.02	1.938	2.233e-003	10	CuO	2.33	1.939	2.933e-003

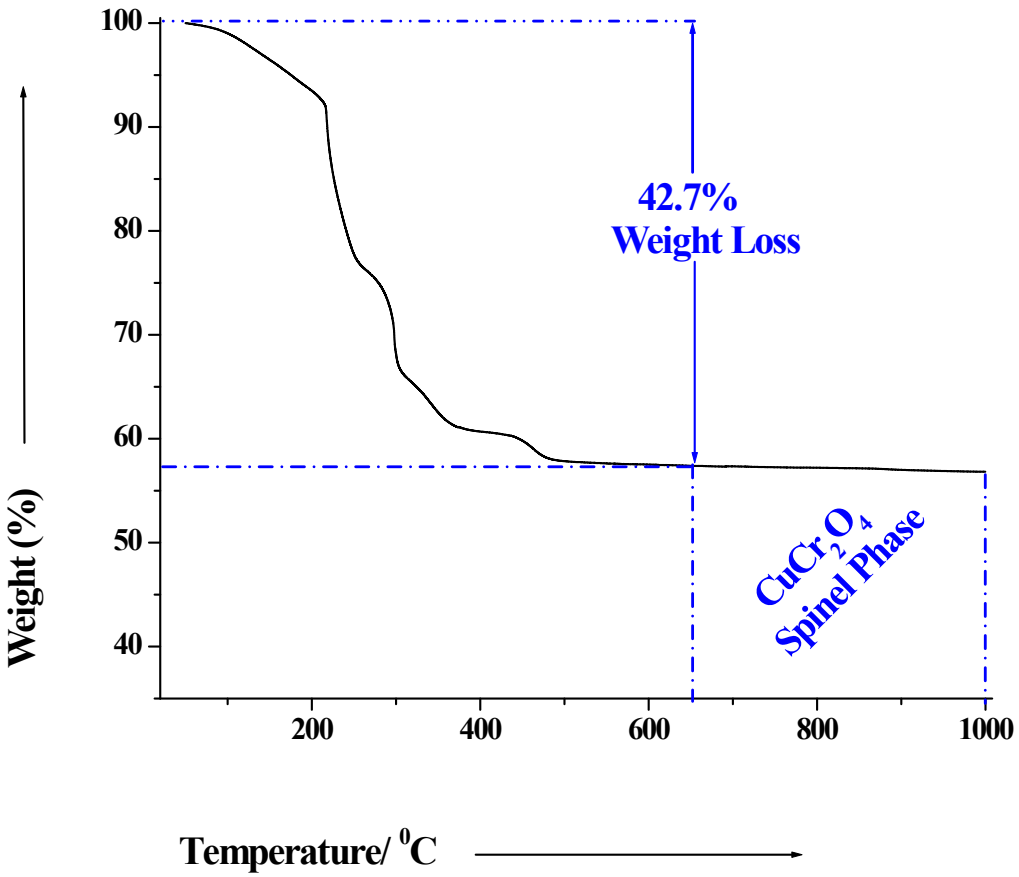

Figure S8. TGA analysis of uncalcined $CuCr_2O_4$ spinel nanoparticles catalyst.

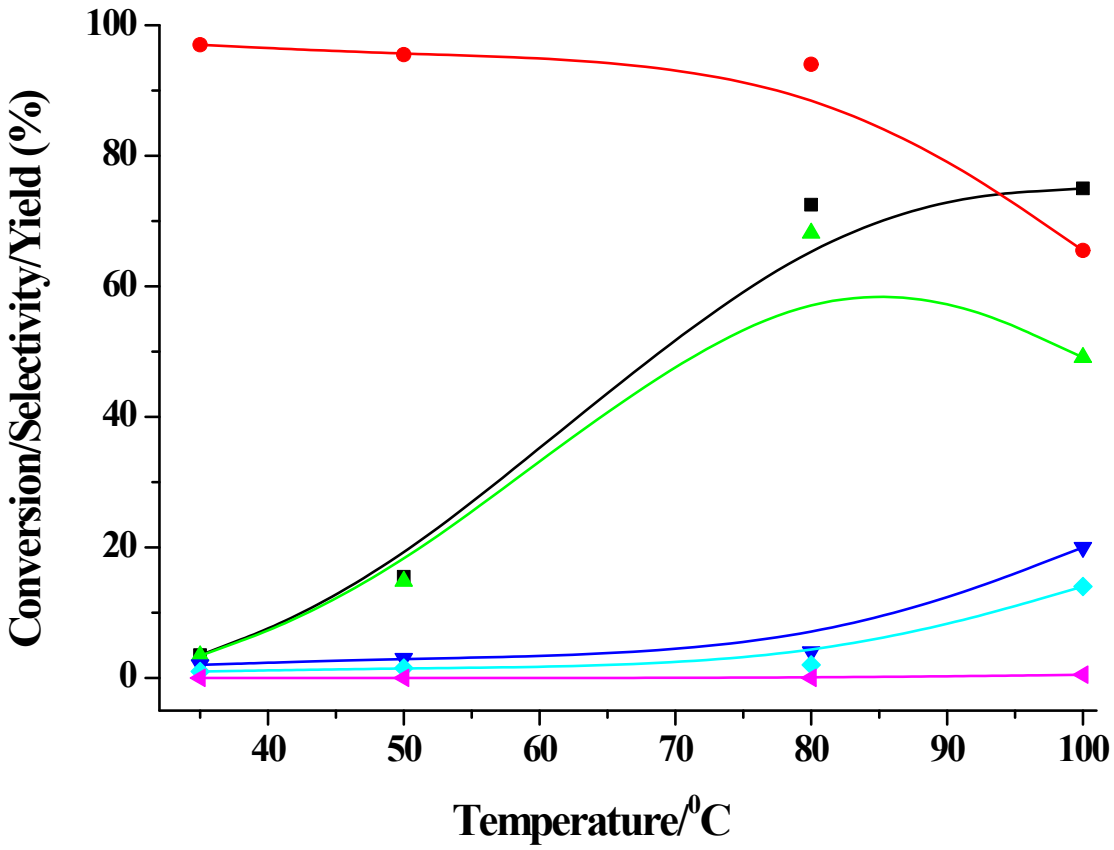

Figure S9. Effect of temperature on benzene hydroxylation.

[■] Conversion of benzene; [●] Selectivity to phenol; [▲] Yield of phenol; [▼]Selectivity to catechol [♦]Selectivity to hydroquinone; [◄]Selectivity to biphenyl.

Reaction Condition: benzene =1g; catalyst = 0.1g; benzene: H_2O_2 mole ratio =1:5; time= 12 h

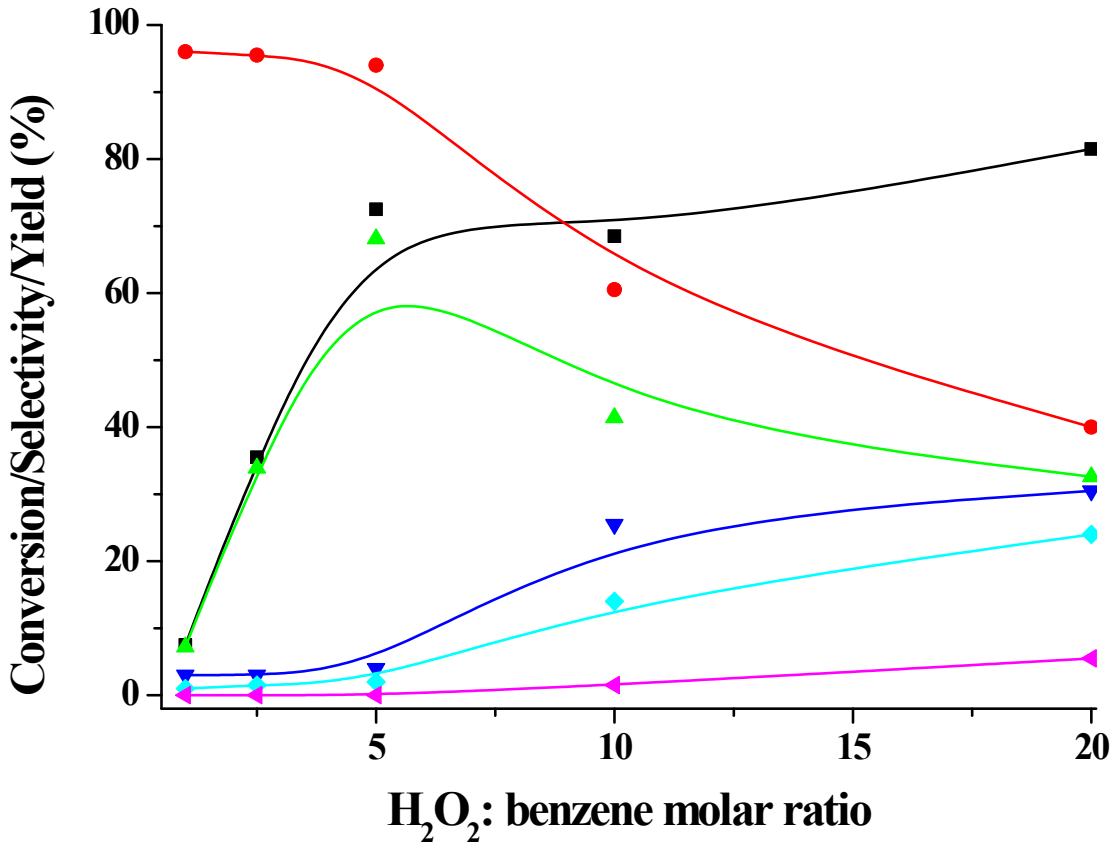

Figure S10. Effect of H_2O_2: benzene molar ratio on benzene hydroxylation.

[■] Conversion of benzene; [●] Selectivity to phenol; [▲] Yield of phenol; [▼]Selectivity to catechol [♦]Selectivity to hydroquinone; [◄]Selectivity to biphenyl.

Reaction Condition: benzene =1g; catalyst = 0.1g; temperature = 80 °C; time= 12 h.

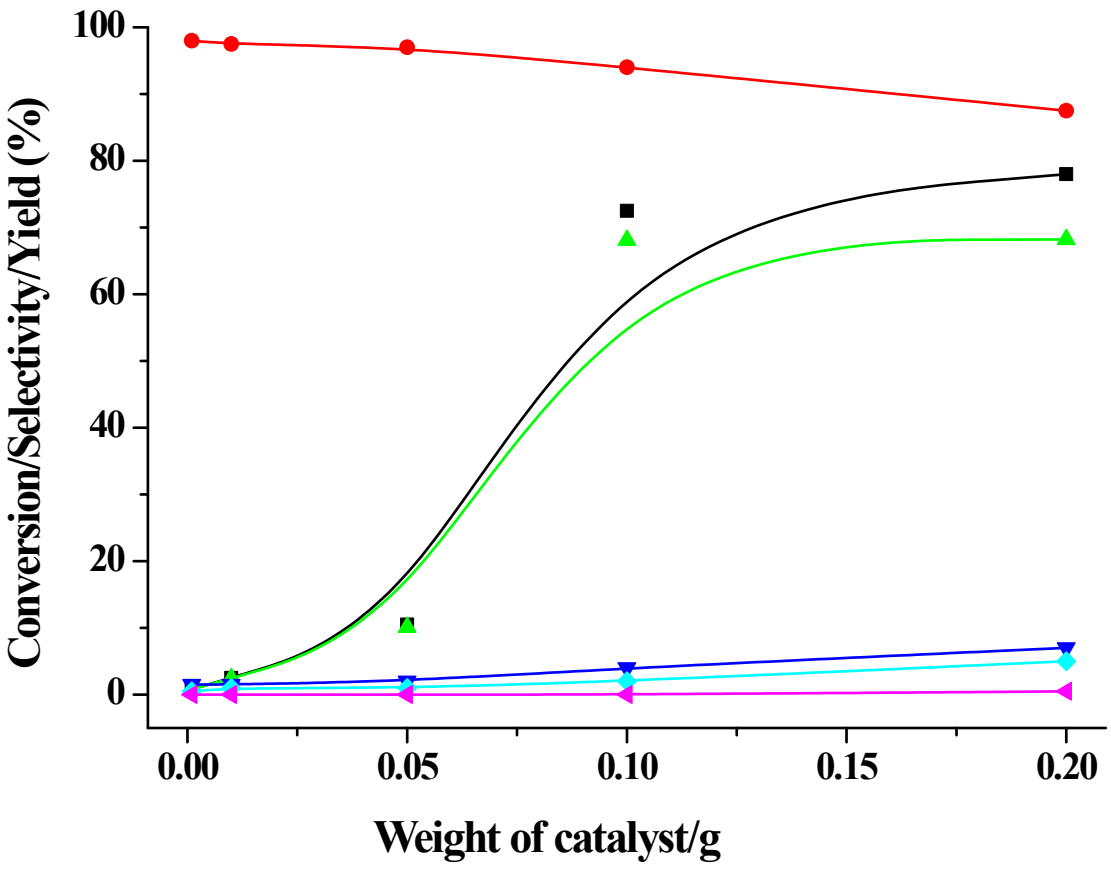

Figure S11. Effect of weight of catalyst on benzene hydroxylation.

[■] Conversion of benzene; [●] Selectivity to phenol; [▲] Yield of phenol; [▼]Selectivity to catechol [♦]Selectivity to hydroquinone; [◄]Selectivity to biphenyl.

Reaction Condition: benzene =1g; benzene: H_2O_2 mole ratio =1:5; temperature = 80 °C; time= 12 h.

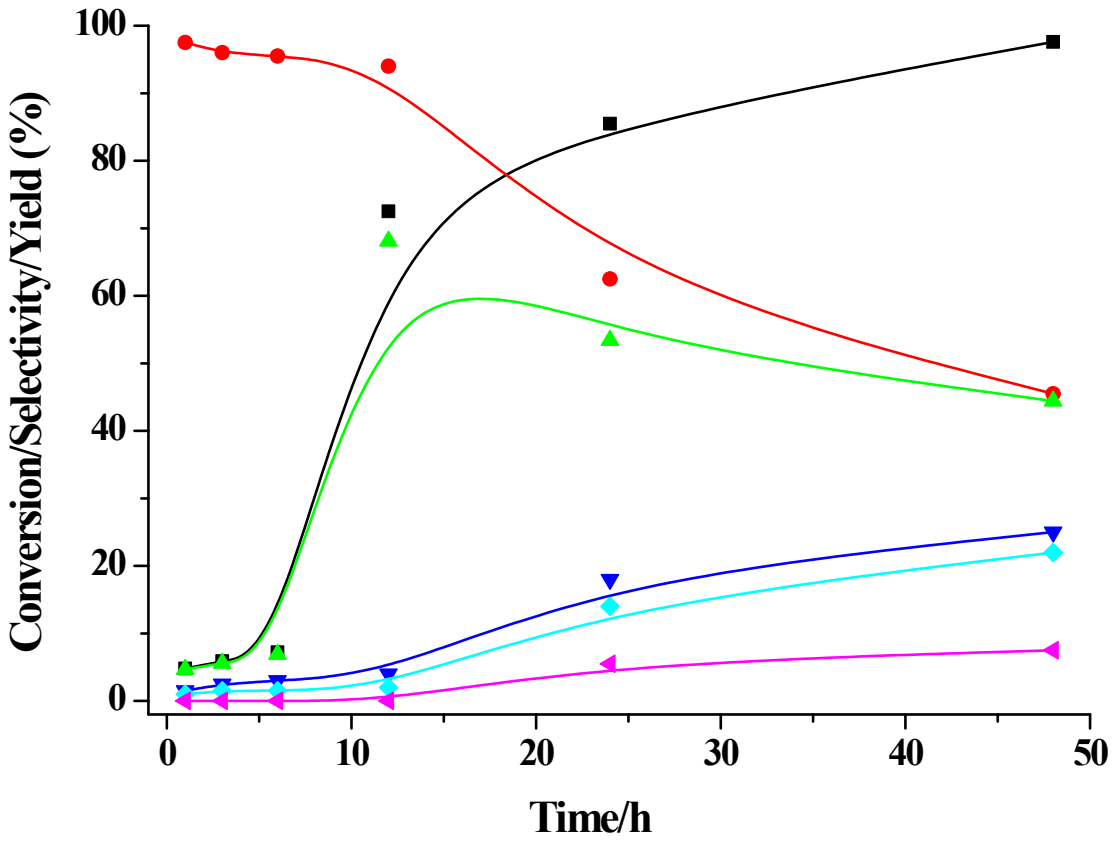

Figure S12. Effect of time on benzene hydroxylation.

[■] Conversion of benzene; [●] Selectivity to phenol; [▲] Yield of phenol; [▼]Selectivity to catechol [♦]Selectivity to hydroquinone; [◄]Selectivity to biphenyl.

Reaction Condition: benzene =1g; benzene: H_2O_2 mole ratio =1:5; temperature = 80 °C.