Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

Reduction of aromatic nitro compounds catalysed by Biogenic CuO nanoparticles

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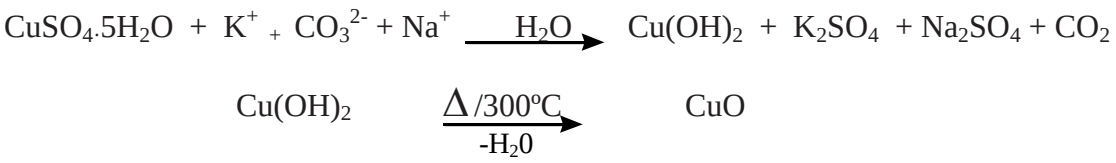
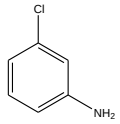


Scheme 1S: Plausible mechanism in synthesis of CuO nanoparticles by using peel of *Musa balbisiana*

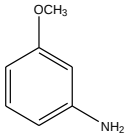
Scheme 2S. Spectroscopic analysis of isolated compounds

1) 3-chloroaniline



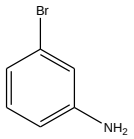
^{1}HNMR ($CDCl_3$, 300 MHz) δ: 7.08–7.03 (m, 1 H), 6.80-6.66 (m, 2H), 6.54-6.52 (m, 1H), 3.47 (s, 2H);
^{13}C NMR ($CDCl_3$, 75 MHz) δ: 147.6, 134.8, 130.3, 118.5, 114.9, 113.2
GC-MS (m/z %): 127.6 (M^+).

2) 3-Methoxyaniline



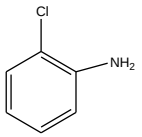
^{1}H NMR (CDCl3): δ 7.07 (dd, J = 8.1 Hz, 7.8 Hz, 1H); 6.33 (dd, J = 8.1 Hz, 2.4 Hz, 1H); 6.30 (dd, J = 7.8 Hz, 1.8 Hz, 1H); 6.25 (dd, J = 2.4 Hz, 2.4 Hz, 1H); 3.77 (s, 3H); 3.66 (bs, 2H).
^{13}C NMR ($CDCl_3$, 75 MHz) δ: 160.7, 147.2, 130.2, 108.2, 104.4, 101.4, 55.1.
GC-MS(m/z%):123 (M^+).

3) 3-Bromoaniline



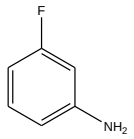
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.01-6.96 (t, 1H, J = 7.6 Hz), 6.86-6.80 (t, 2H, J = 8.5 Hz), 6.57 (d, 1H, J = 7.8 Hz), 3.67 (br s, 2H).
^{13}C NMR ($CDCl_3$, 75 MHz) δ: 150.4, 131.9, 123.5, 121.3, 115.8, 115.3
GC-MS (m/z%):172 (M^+).

4) 2-Chloro aniline



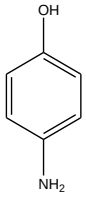
^{1}H NMR (300 MHz, $CDCl_3$): δ 7.15-7.30(m, 1H), 6.95-7.10(m, 1H), 6.57-6.75(m, 2H), 3.97(bs, 2H)
^{13}C NMR (75 MHz, $CDCl_3$): δ 142.6, 128.9, 127.2, 118.6, 118.5, 115.5,
GC-MS(m/z%): 127.6 (M^+)

5) 3-Fluoroaniline



^{1}H NMR (300 MHz, $CDCl_3$) δ: 6.98 (t, 1H, J = 7.6 Hz), 6.42-6.80 (t, 2H, J = 8.5 Hz), 6.17 (d, 1H, J = 7.8 Hz), 3.77 (br s, 2H).
^{13}C NMR ($CDCl_3$, 75 MHz) δ: 163.4, 149.9, 131.2, 111.6, 105.8, 104.3
GC-MS(m/z%): 111 (M^+)

6) 4-Aminophenol



^{1}H NMR (300 MHz, DMSO-d_6): δ 8.95(bs, 1H), 6.31-6.39(m, 4H), 4.00(bs, 2H).
^{13}C NMR (75 MHz, DMSO-d_6): δ 148.2, 140.2, 115.4, 115.3.
GC-MS(m/z %):110 $(M+H)^+$.

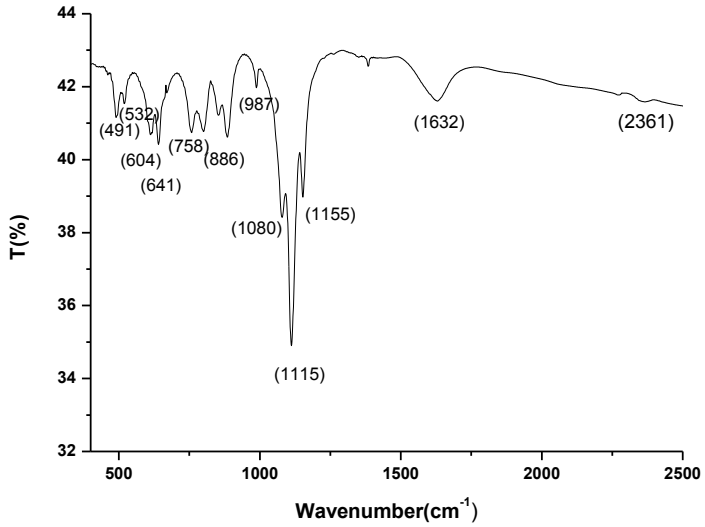


Figure1S: FT-IR spectra of CuO nanoparticles synthesised by *Musa balbisiana*

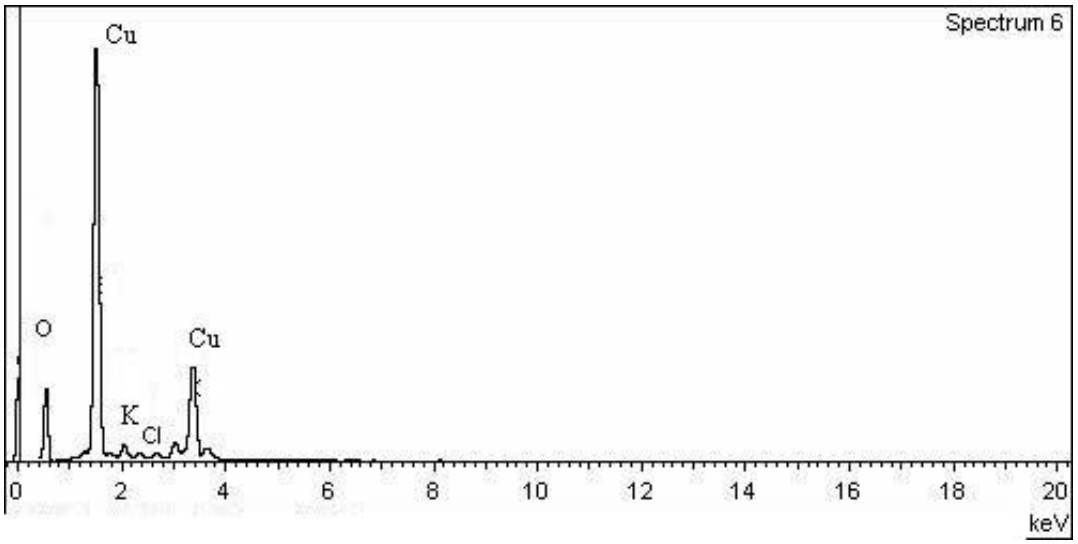


Figure 2S: EDX spectra of CuO nanoparticles.

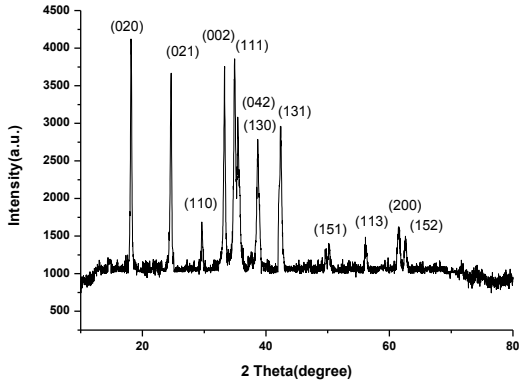


Figure 3S: XRD spectrum of CuO nanoparticles when synthesised by K_2CO_3

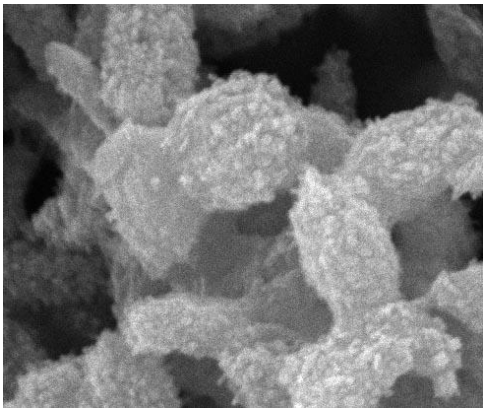


Figure 4S: SEM image of CuO nanoparticles when synthesized by K_2CO_3

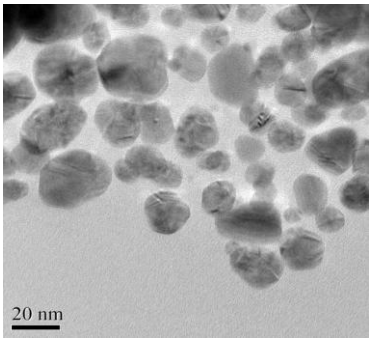


Figure 5S: TEM image of CuO nanoparticles when synthesized by K_2CO_3

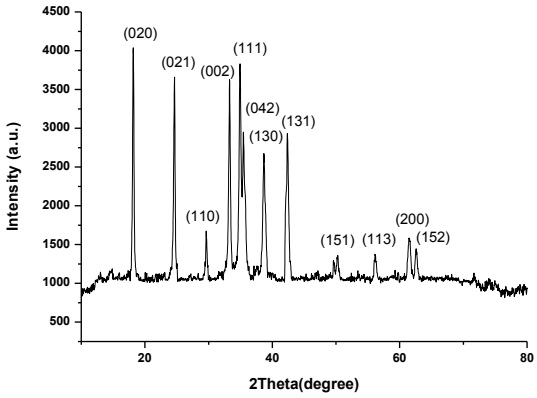


Figure 6S: XRD spectrum of CuO nanoparticles when synthesised by Na_2CO_3

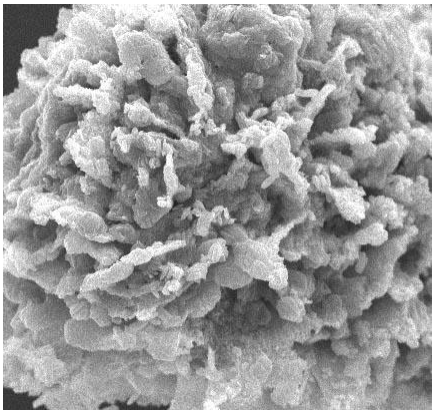


Figure 7S: SEM image of CuO nanoparticles when synthesized by Na_2CO_3

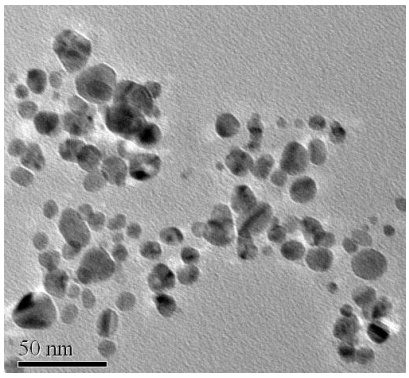


Figure 8S: TEM image of CuO nanoparticles when synthesized by Na_2CO_3

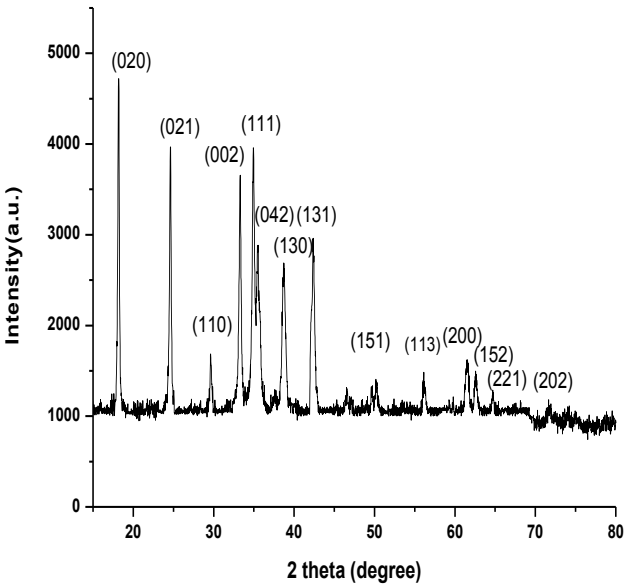


Figure 9S: XRD spectrum of CuO catalyst after 5 recycle

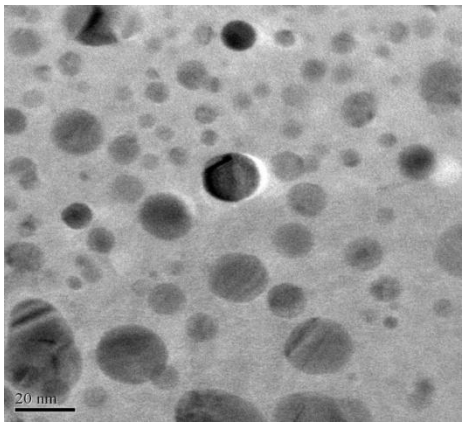


Figure 10S: TEM image after 5 recycle of CuO nanocatalyst

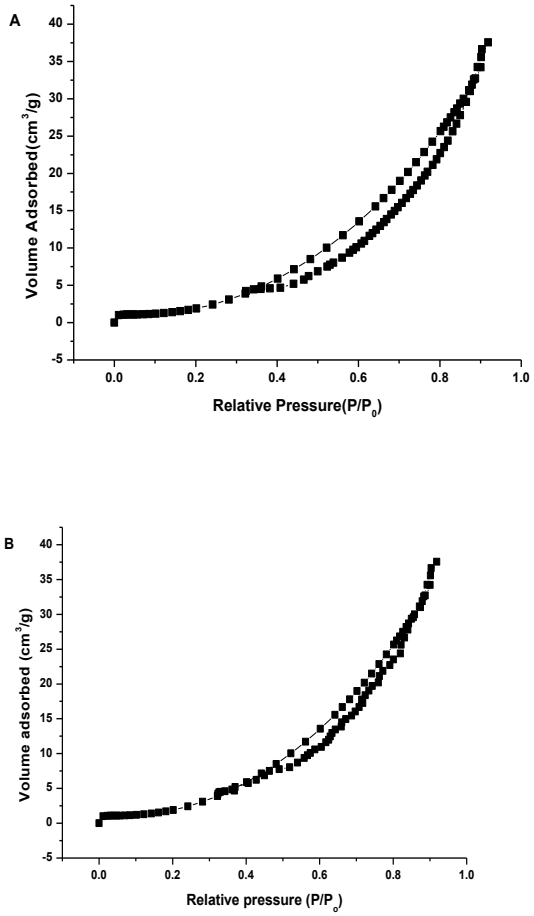


Figure 11S: The stacking pattern of N_2 adsorption desorption curves (A) fresh catalyst (B) after 5^{th} cycle

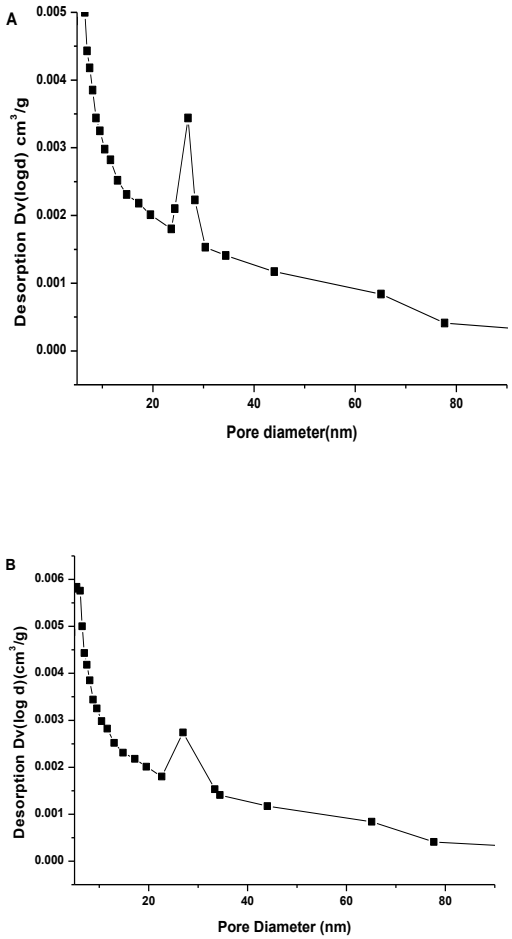
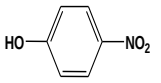
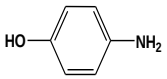
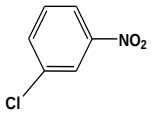
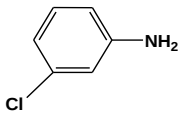
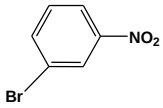
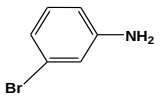
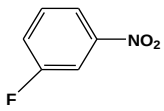
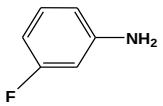
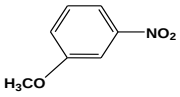
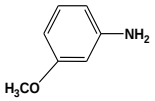
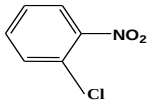
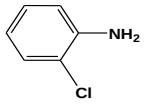


Figure 12S: BJH pore distribution curves of CuO nanoparticles (A) Fresh catalyst (B) After 5^{th} cycle

Table 1S: The rate constant of catalytic reduction 4-nitrophenol to 4-aminophenol in presence CuO nanoparticles

Conc. of nanoparticles (mol%)	Rate constant(min^{-1})	
	CuO	R^2
0.02	0.0781	0.9856
0.04	0.0811	0.9484
0.06	0.0825	0.9723
0.08	0.0850	0.9910
0.10	0.0885	0.9941

Table 2S**:** CuO catalyzed reduction of aromatic nitro to amino compounds when prepared from commercial K_2CO_3

Entry	Substrate	Product	Time (hr)[a]	Yield (%)[b]	TOF (h^{-1})[c]
1			1.00	95	950
2			2.00	82	410
3			1.80	80	444
4			2.50	80	320
5			2.30	74	322
6			2.00	75	375

[a] Reactions performed at 30 ◦C and monitored using TLC until all the aromatic nitro compounds was found to have been consumed.

[b] Isolated yield after column chromatography of the crude product with 2% standard deviation.

[c] TOF: Turn Over frequency