ELECTRONIC SUPPORTING INFORMATION (*ESI*)

Synthesis of Late Transition-Metal Nanoparticles by Na Naphthalenide Reduction of Salts and Their Catalytic Efficiency

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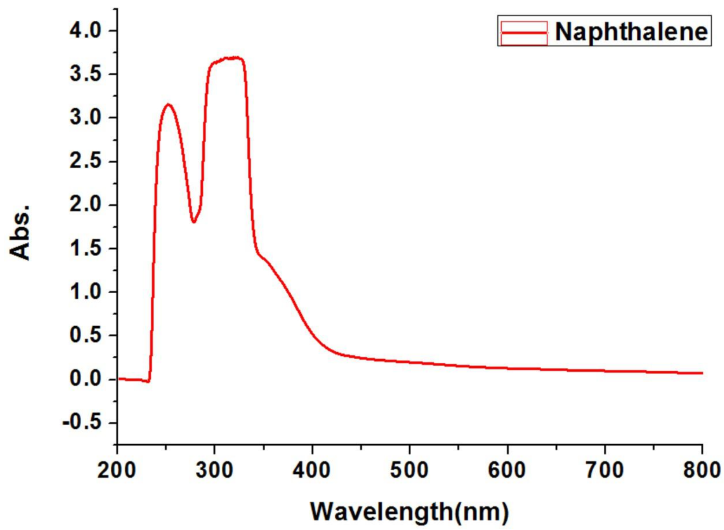


Figure S1. UV-vis. spectrum of naphthalene.

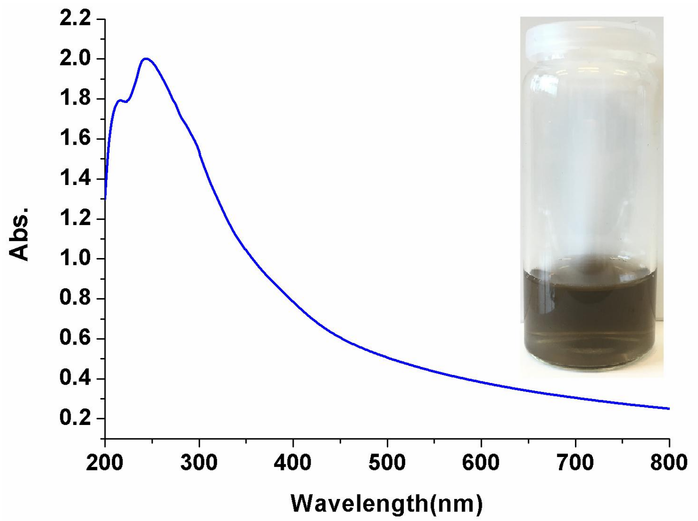


Figure S2. UV-vis. spectrum of pure PdPEG nanoparticles.

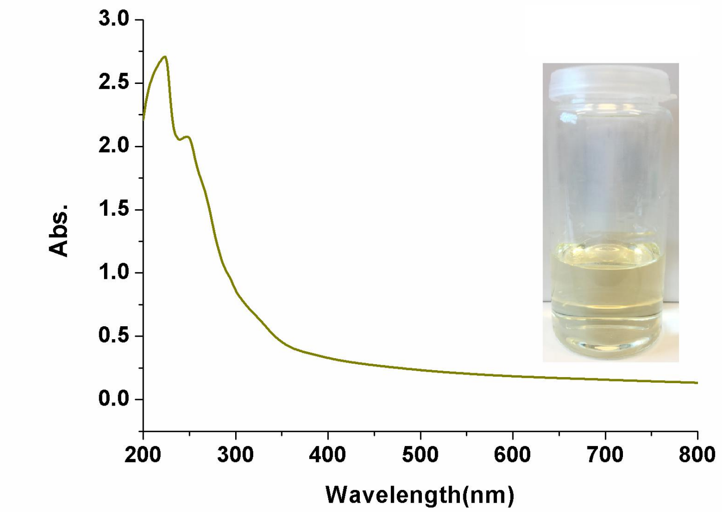


Figure S3. UV-vis. spectrum of pure CuPEG nanoparticles.

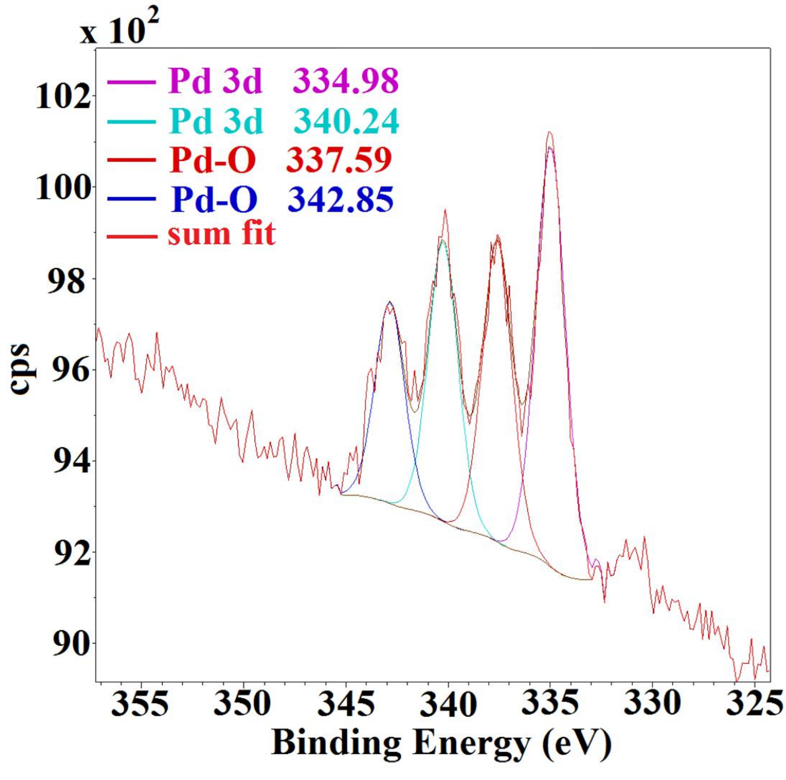


Figure S4. X-ray photoelectron spectroscopy (XPS) of pure PdPEG nanoparticles.

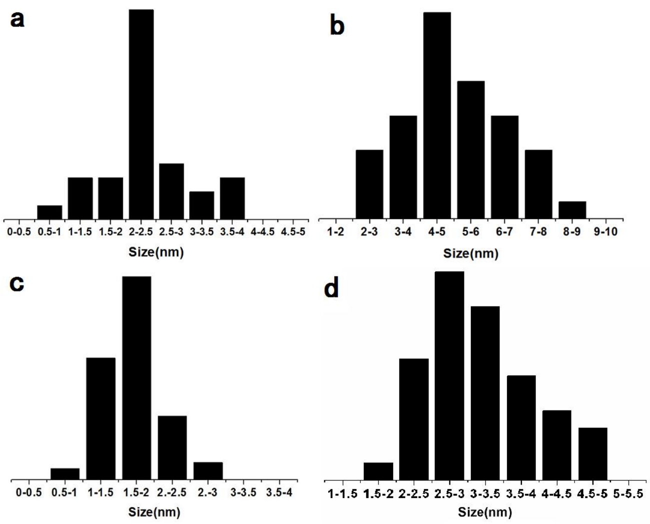


Figure S5. Size distribution of MPEG: a: AuPEG; b: AgPEG; c: PdPEG; d: CuPEG.

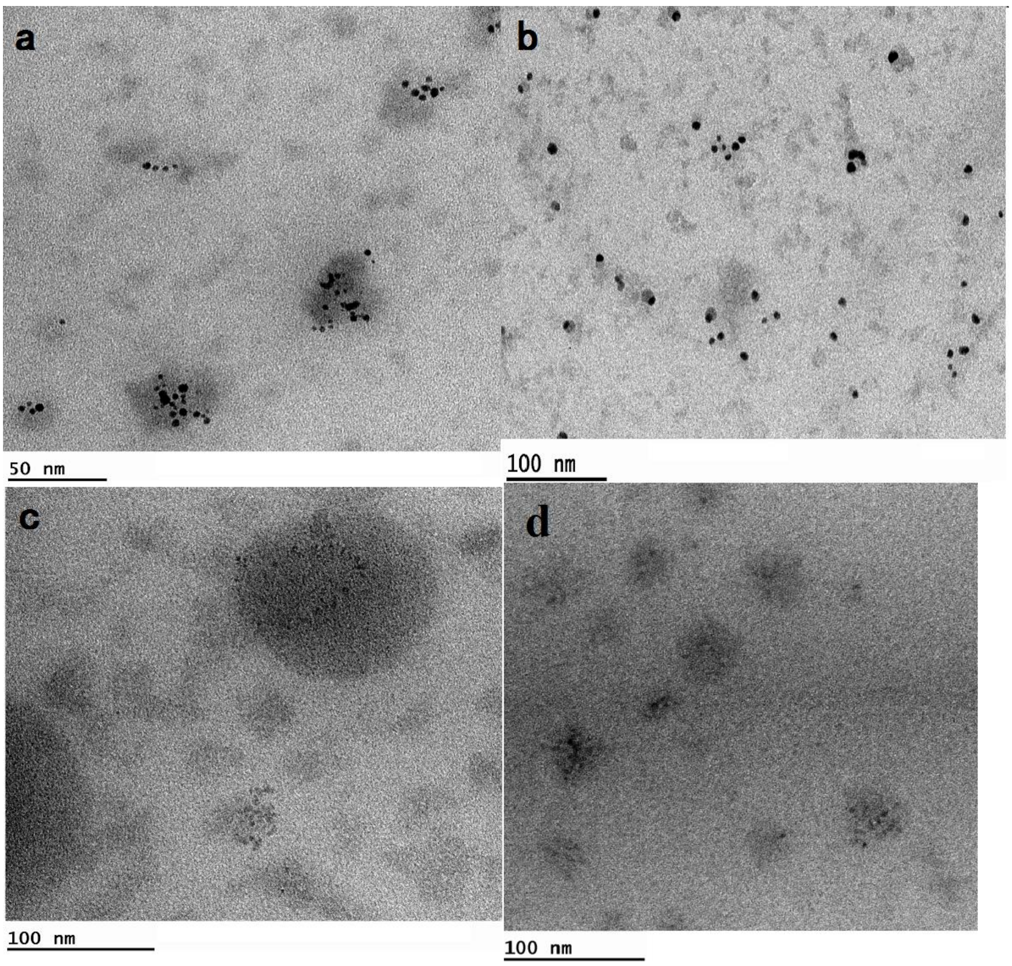
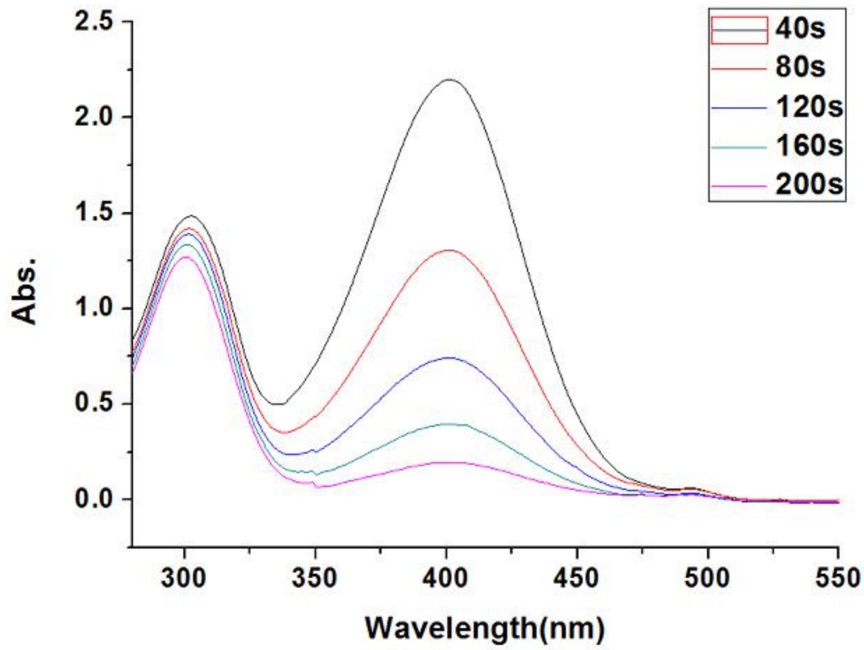


Figure S6. TEM of MPEG-1 (without purification): a: AuPEG-1; b: AgPEG-1; c: PdPEG-1; d: CuPEG-1.

UV-vis. spectrum of the 4-NP reduction and reaction rate (k_{app})



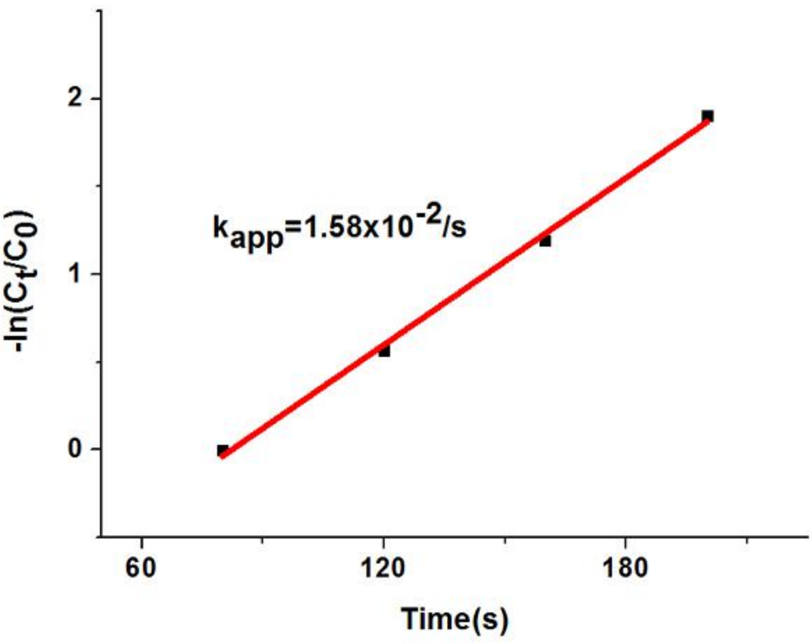


Figure S7. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by AuPEG (top); consumption rate of 4-NP: $-\ln(C_t/C_0)$ vs reaction time (bottom, R^2 = 0.9963).

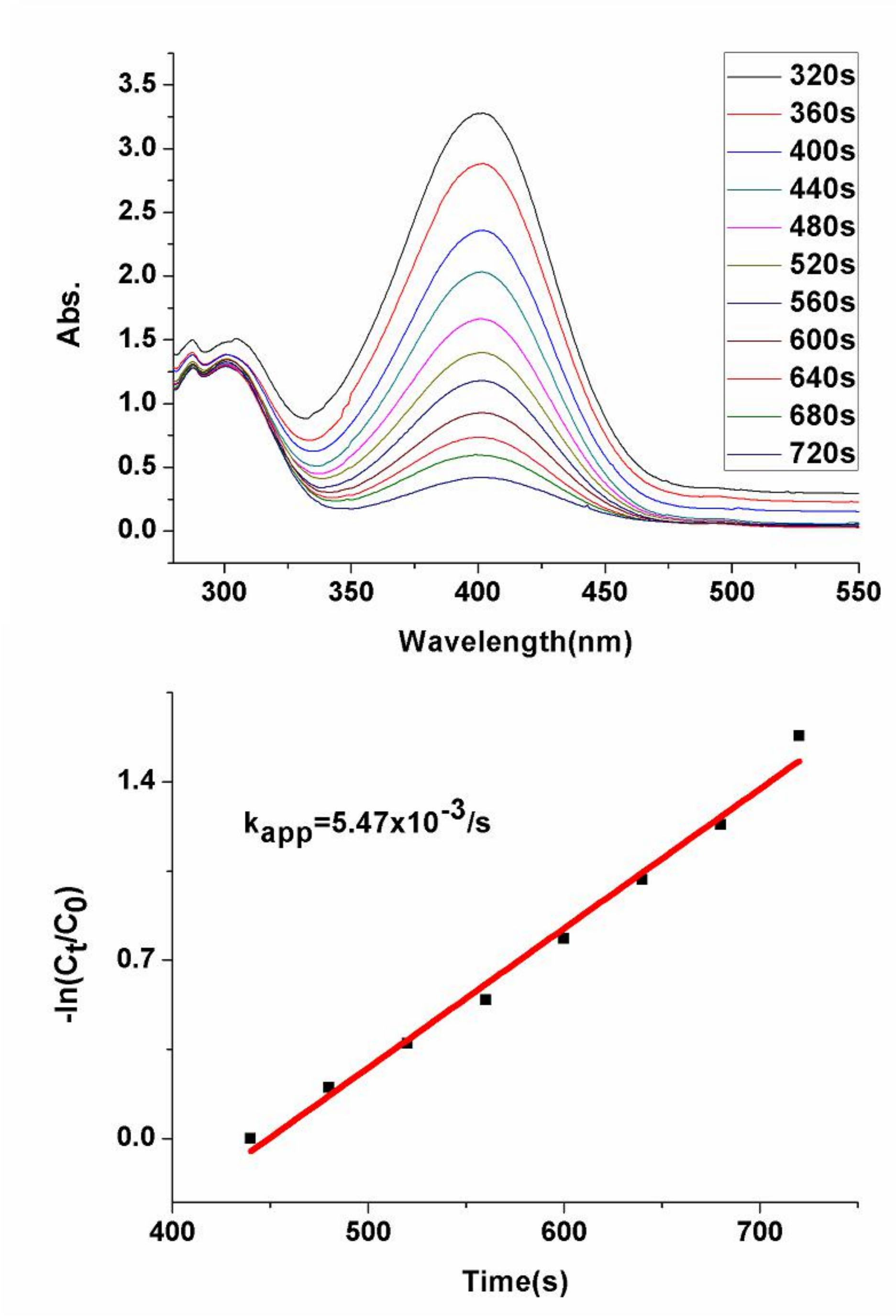


Figure S8. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by AuPEG-1 (top); consumption rate of 4-NP: $-\ln(C_t/C_0)$ vs reaction time (bottom, R^2 = 0.9883).

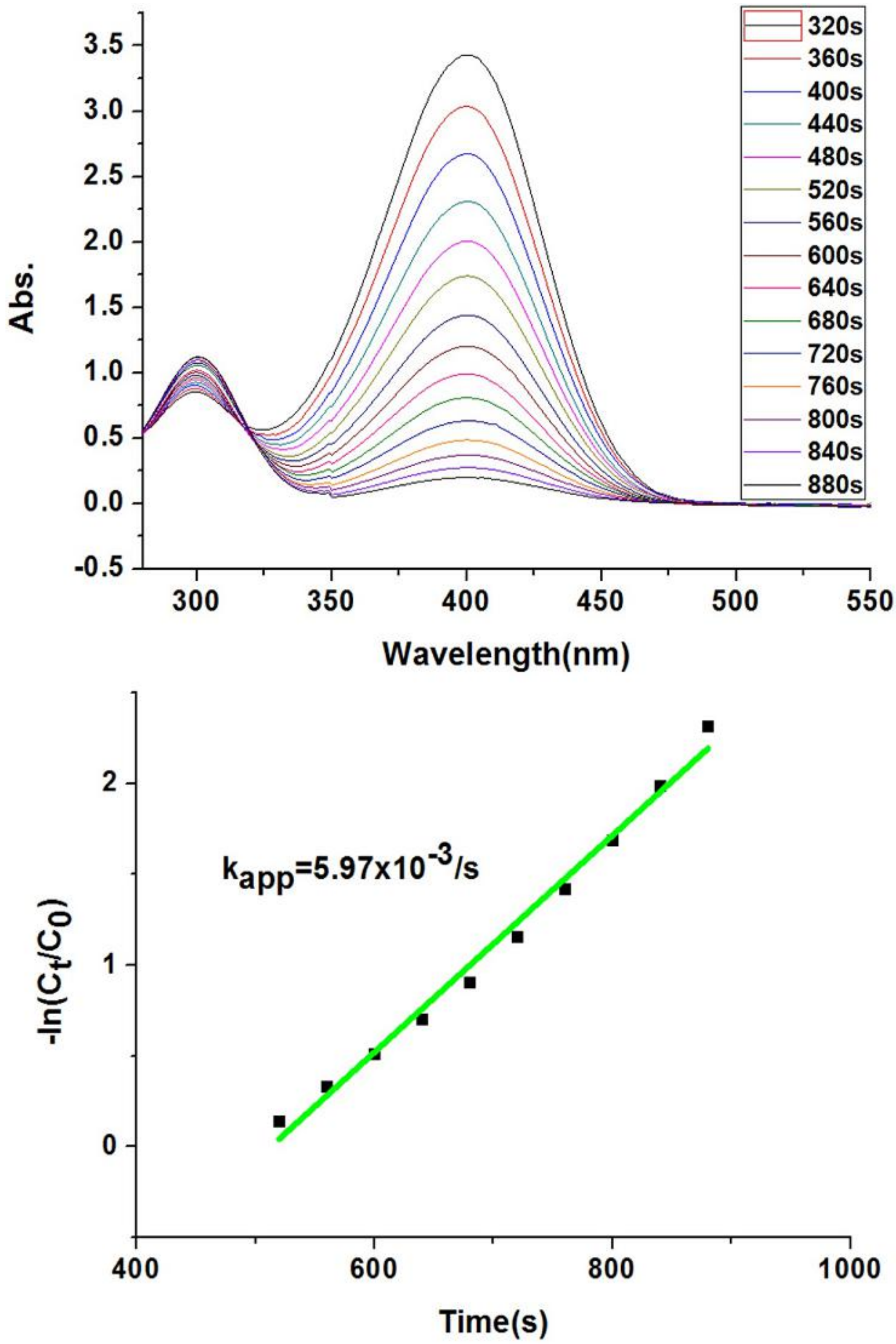
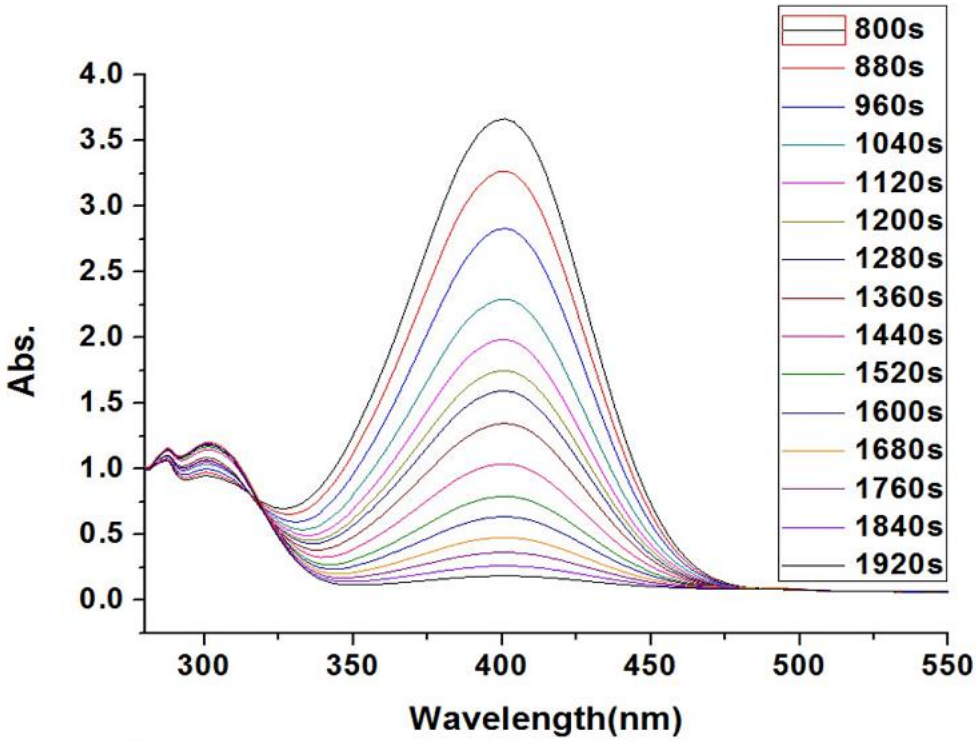


Figure S9. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by AgPEG (top); consumption rate of 4-NP: -ln(C_t/C_0) vs reaction time (bottom, R^2 = 0.9882).



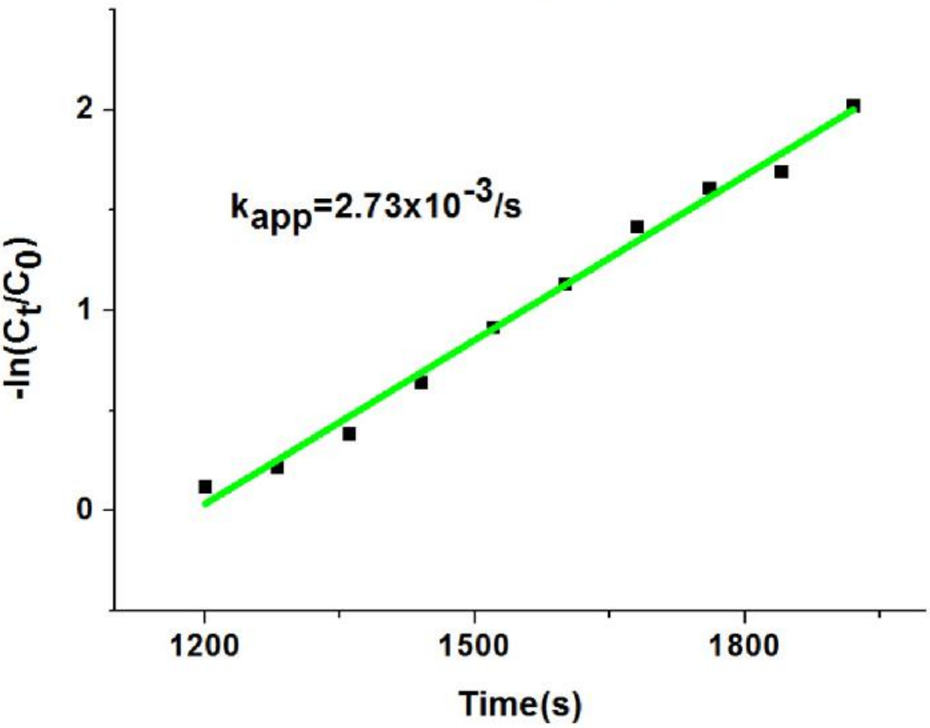


Figure S10. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by AgPEG-1 (top); consumption rate of 4-NP: $-\ln(C_t/C_0)$ vs reaction time (bottom, R^2 = 0.9901).

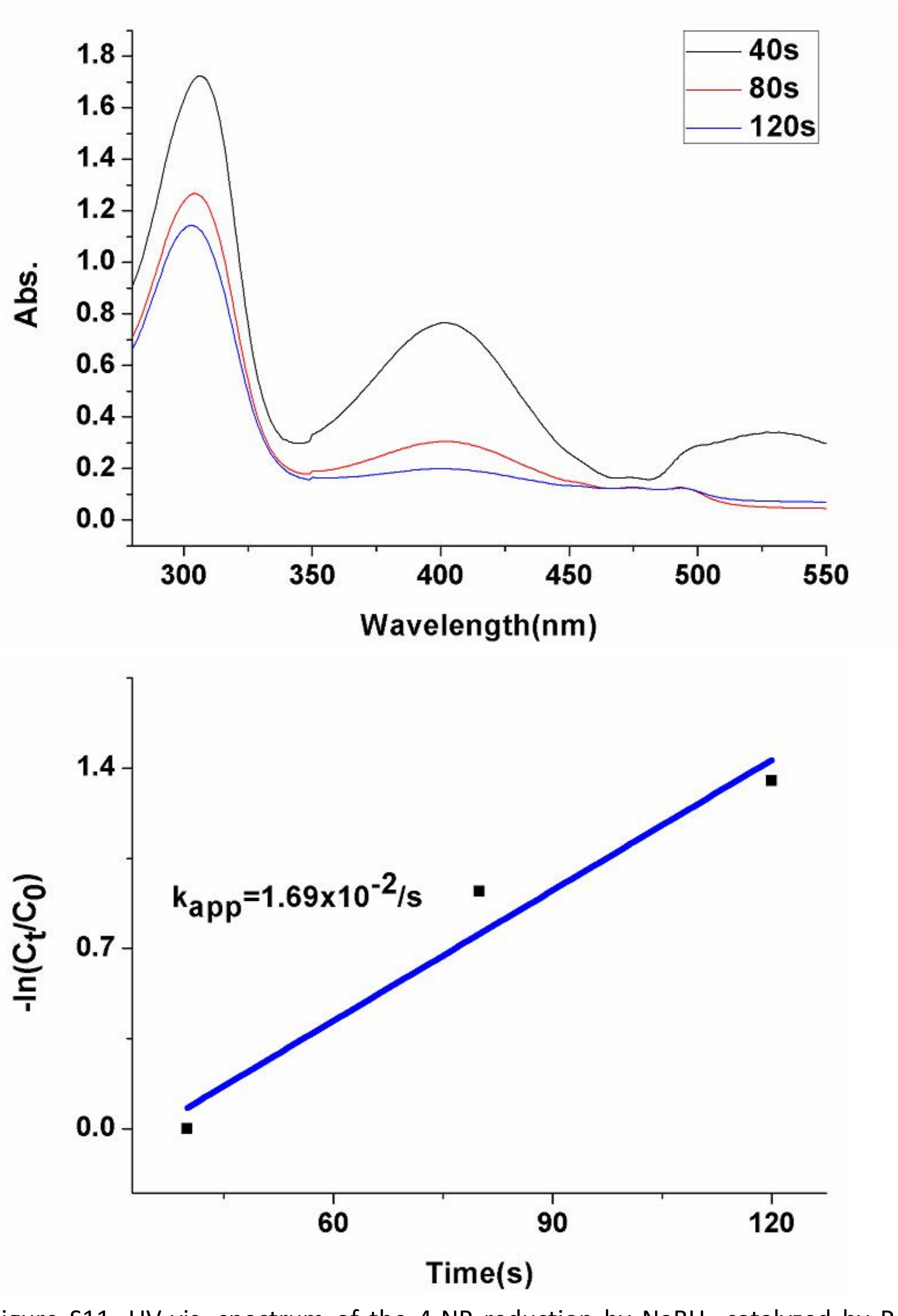
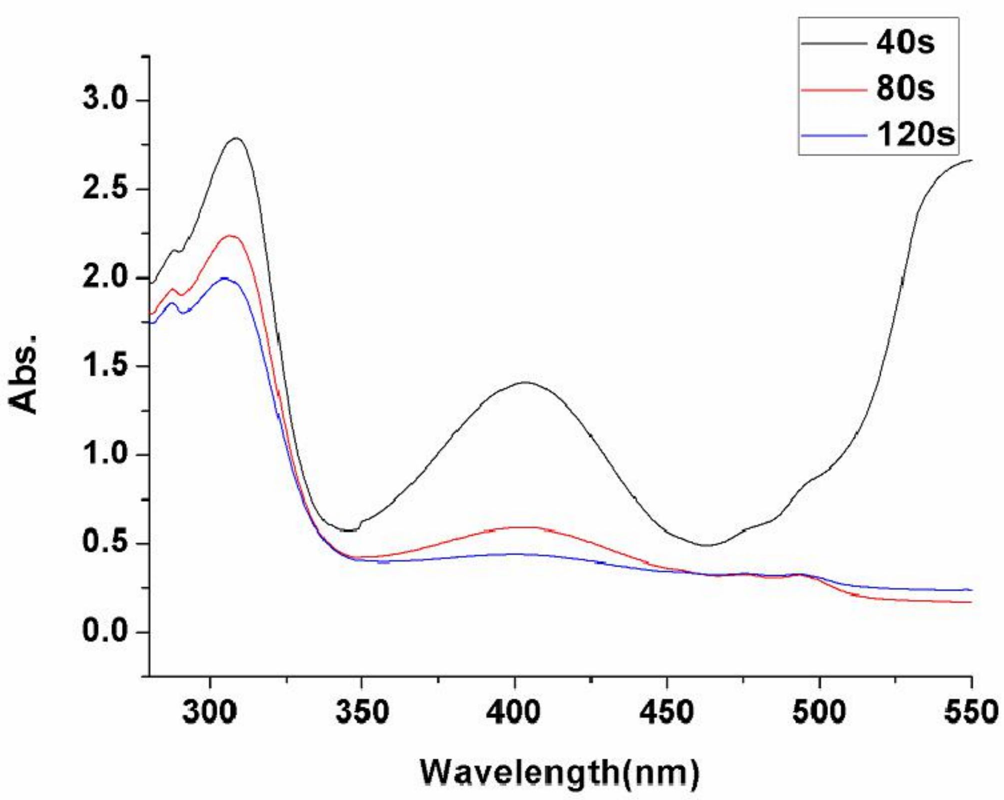


Figure S11. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by PdPEG (top); consumption rate of 4-NP: $-\ln(C_t/C_0)$ vs reaction time (bottom, R^2 = 0.9157).



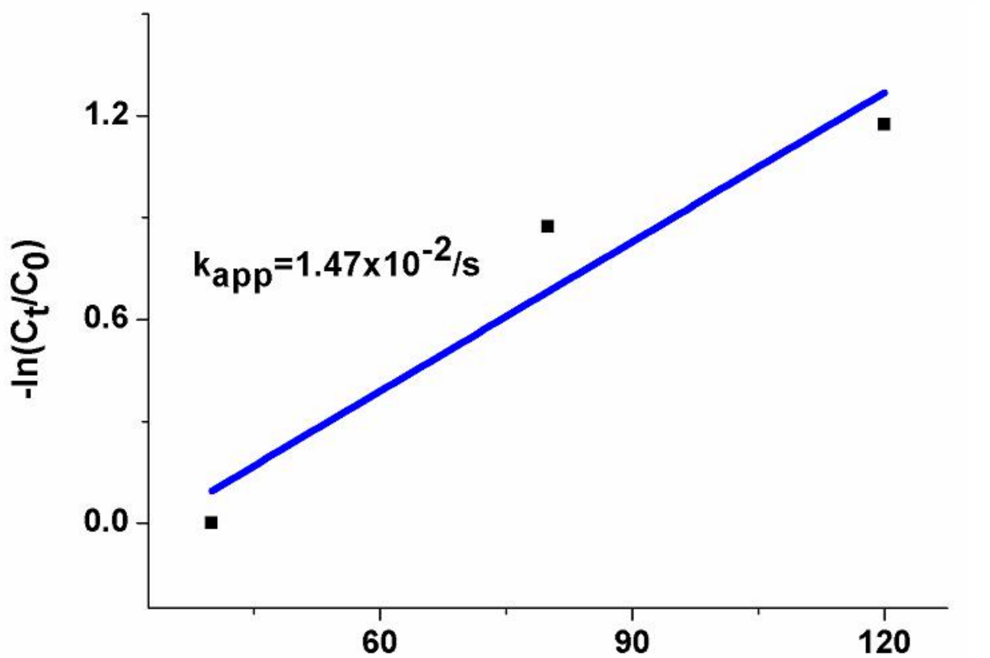
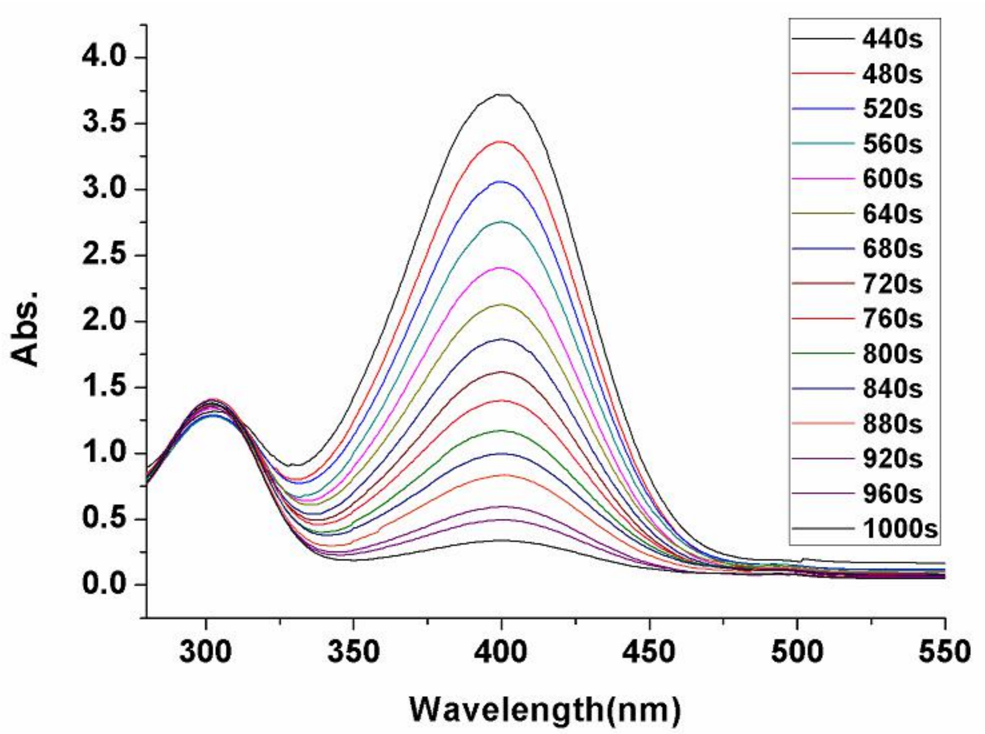


Figure S12. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by PdPEG-1 (top); consumption rate of 4-NP: $-\ln(C_t/C_0)$ vs reaction time (bottom, R^2 = 0.8538)



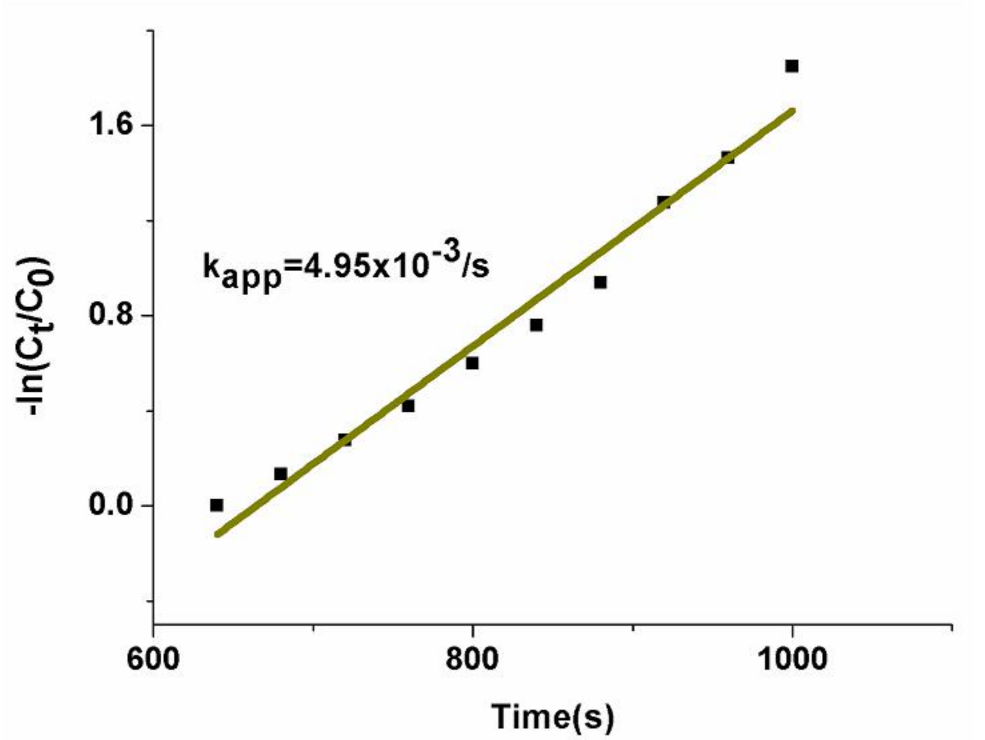


Figure S13. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by CuPEG (top); consumption rate of 4-NP: -ln(C_t/C_0) vs reaction time (bottom, R^2 = 0.9698).

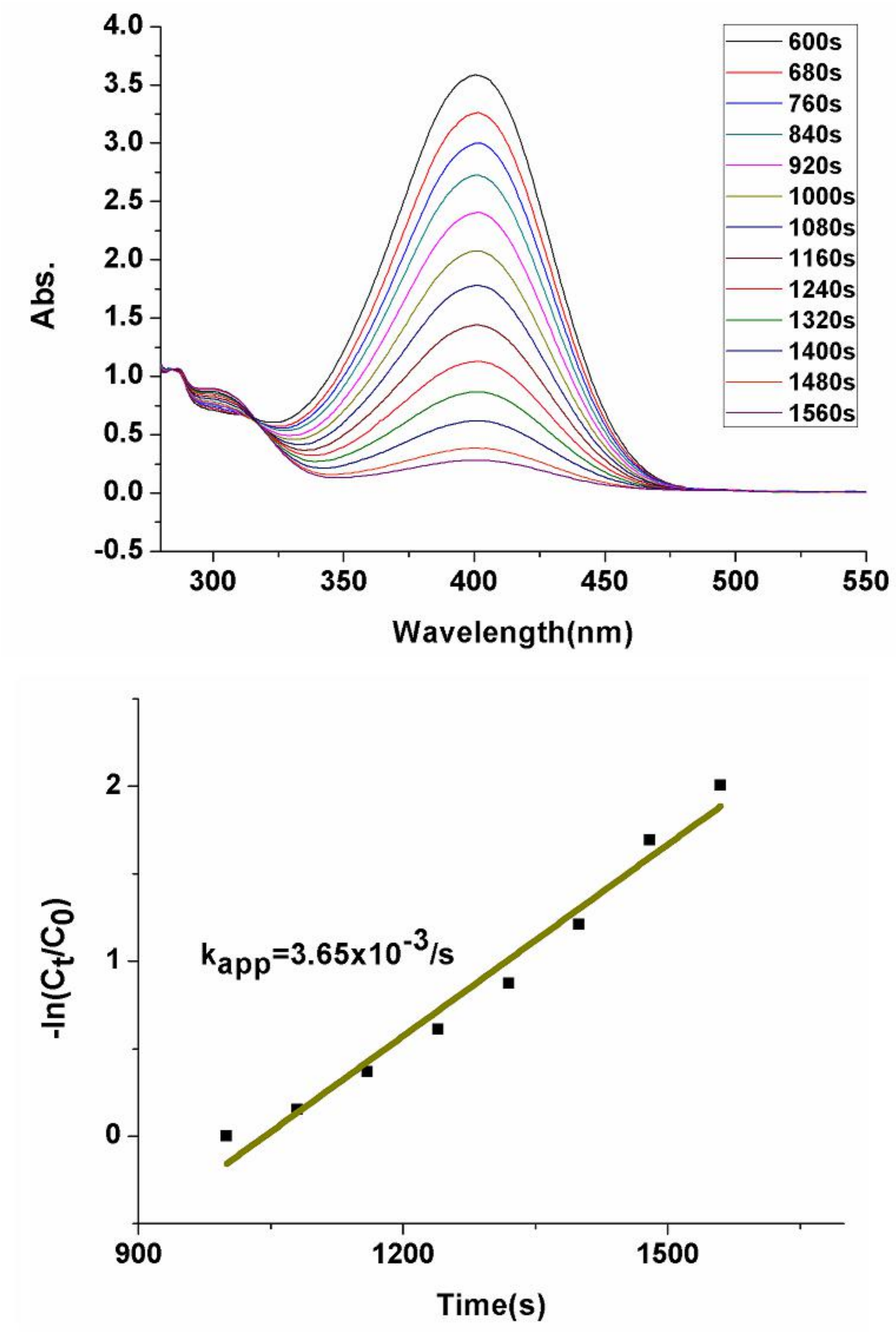


Figure S14. UV-vis. spectrum of the 4-NP reduction by $NaBH_4$ catalyzed by CuPEG-1 (top); consumption rate of 4-NP: $-\ln(C_t/C_0)$ vs reaction time (bottom, $R^2 = 0.9711$).

^1H, ^{13}C NMR, ESI-MS and CV of *p*-bis (cobalticinium-1,2,3-triazolylmethyl) benzene.

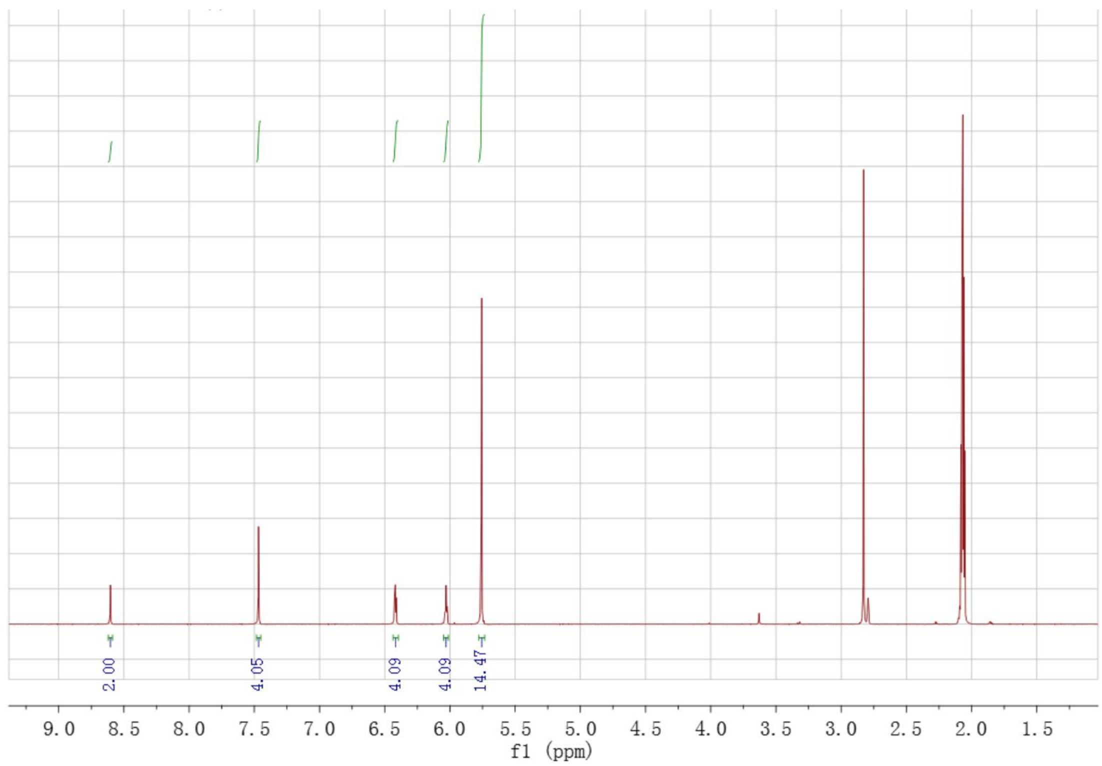


Figure S15. ^1H NMR spectrum of *p*-bis (cobalticinium-1,2,3-triazolylmethyl) benzene. ^1H NMR (300 MHz, Acetone) δ 8.60 (s, 2H), 7.47 (s, 4H), 6.44 – 6.40 (m, 4H), 6.05 – 6.01 (m, 4H), 5.76 (s, 14H).

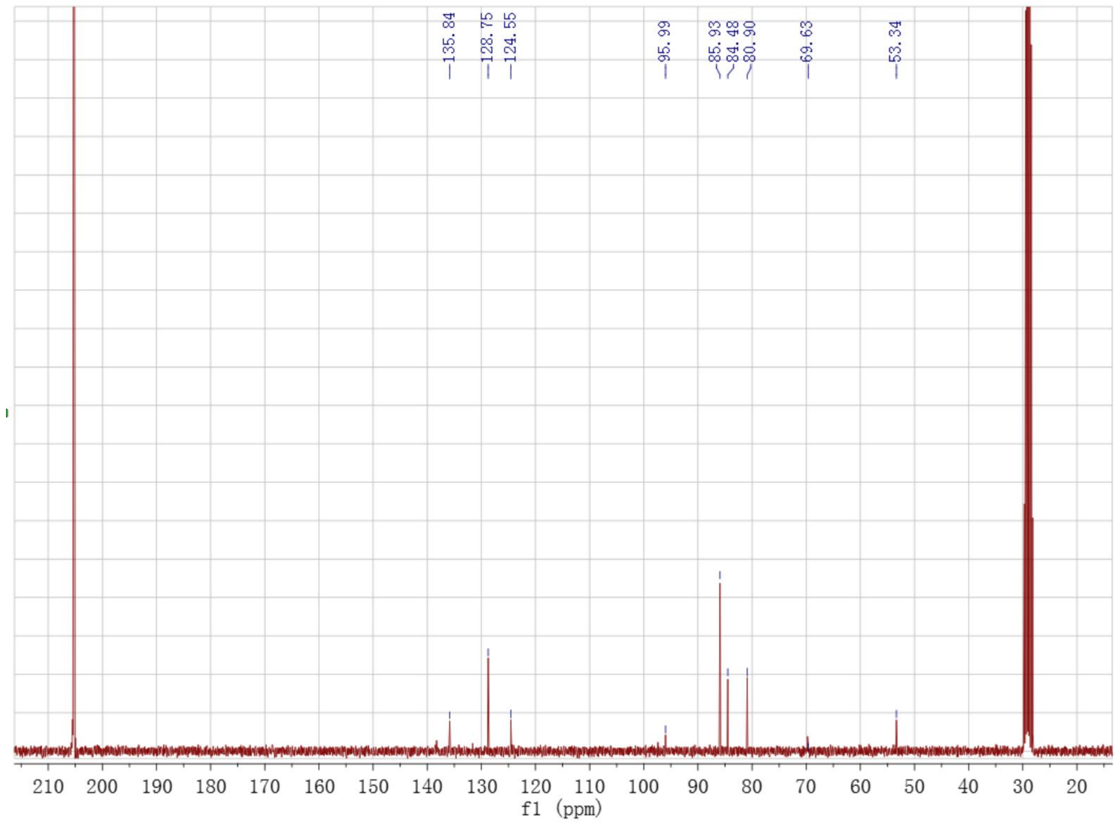


Figure S16. ^{13}C NMR spectrum of *p*-bis (cobalticinium-1,2,3-triazolylmethyl) benzene. ^{13}C NMR (76 MHz, Acetone) δ 135.84 (s), 128.75 (s), 124.55 (s), 95.99 (s), 85.93 (s), 84.48 (s), 80.90 (s), 69.76 – 69.50 (m), 53.34 (s).

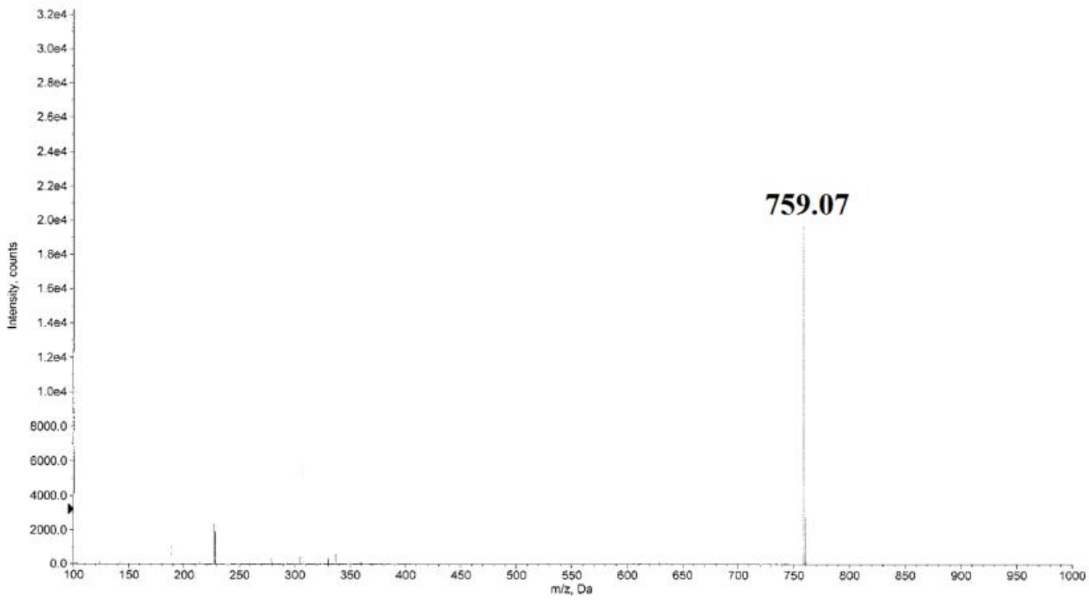


Figure S17. ESI-MS of *p*-bis (cobalticinium-1,2,3-triazolylmethyl) benzene. (759.07 Da= *p*-bis (cobalticinium-1,2,3-triazolylmethyl) benzene – PF_6^-)

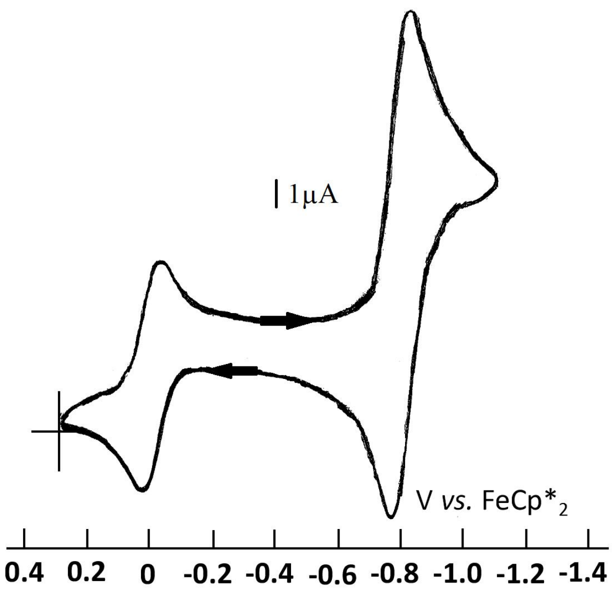


Figure S18. CV of decamethylferrocene reference and the first wave of *p*-bis (cobalticinium-1,2,3-triazolylmethyl) benzene. Internal reference: $FeCp^*_2$; Solvent: DMF; 298 K; reference electrode: Ag; working and counter electrodes: Pt; scan rate: 0.2 V/s^{-1}; supporting electrolyte: [*n*-Bu_4N][PF_6] (1 M).

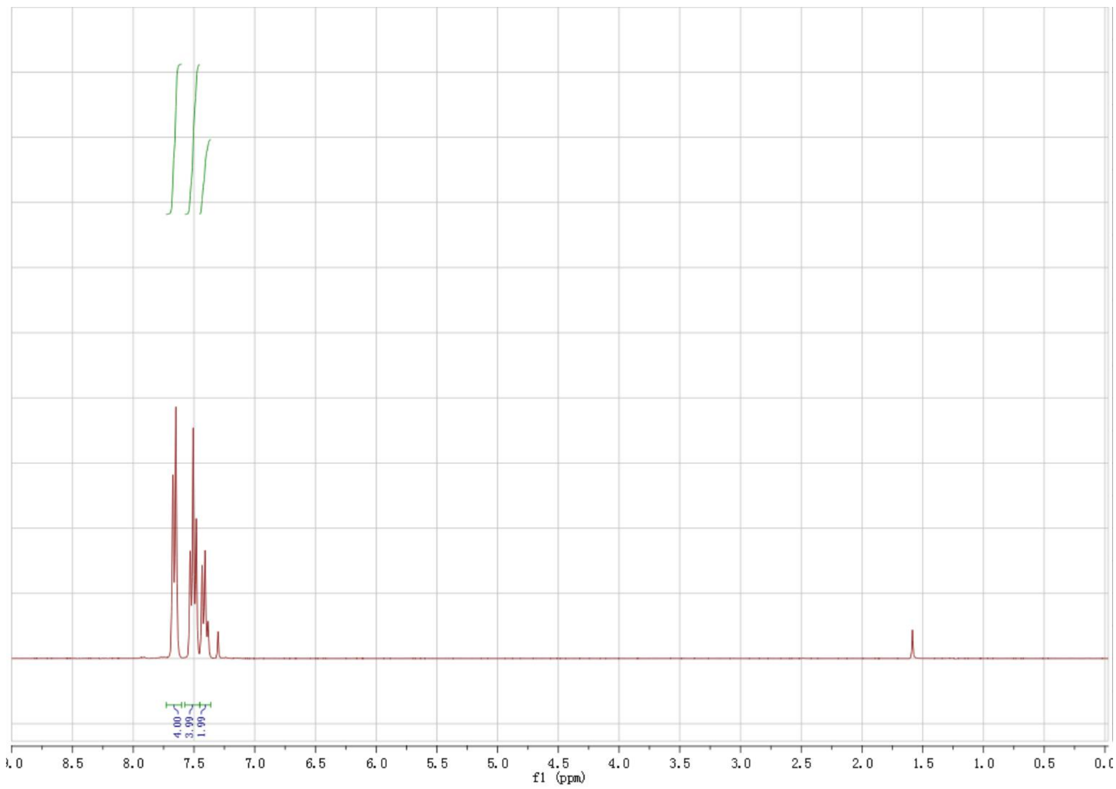


Figure S19. ^1H NMR spectrum of Biphenyl.

^1H NMR (300 MHz, $CDCl_3$) δ 7.66 (d, J = 7.3 Hz, 4H), 7.57 – 7.45 (m, 4H), 7.41 (t, J = 7.3 Hz, 2H).

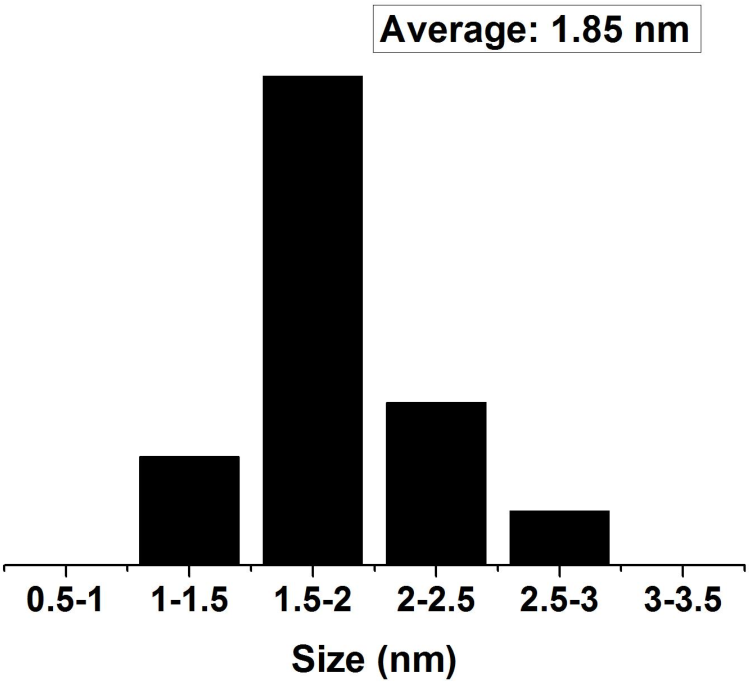


Figure S20. Size distribution of PdPEG@SBA-15.

Table S1. Recycling results of Suzuki reactions between phenylboronic acid and bromobenzene using 300 ppm of PdPEG@SBA-15 (ICP content:0.13%).

Catalytic runs	1st	2nd	3rd	4th
Yield (%)	96	85	80	65

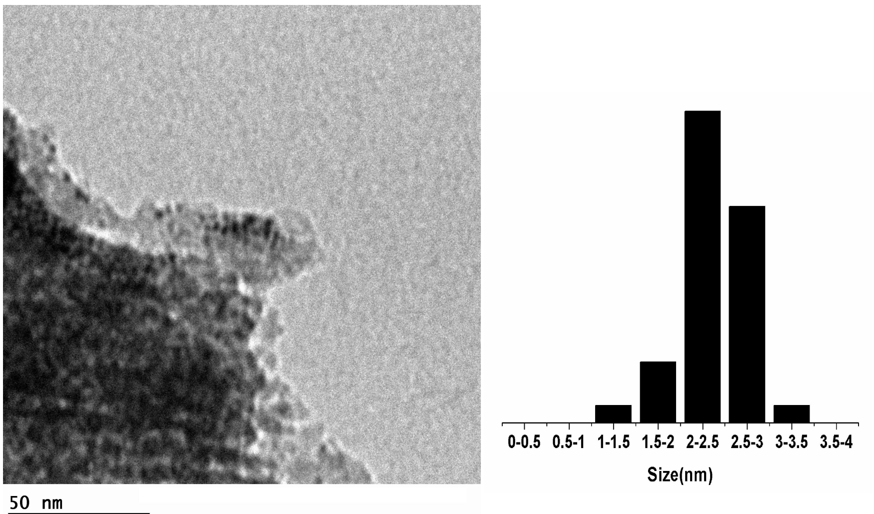


Figure S21. TEM image (left) and histogram (right) of PdPEG@SBA-15 after recycling.

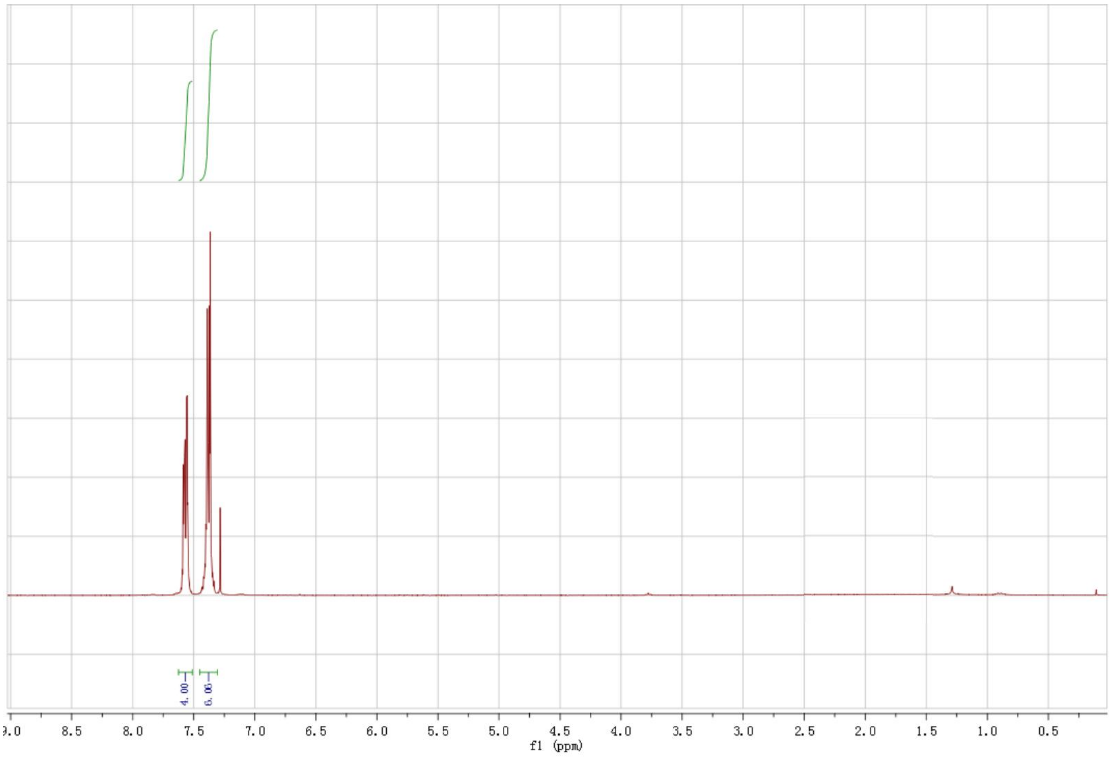


Figure S22. ^{1}H NMR spectrum of Diphenylacetylene.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.62 – 7.51 (m, 4H), 7.45 – 7.31 (m, 6H).

Table S2. Recycling results of Sonogashira reactions between iodobenzene, phenylacetylene using 1% of PdPEG@SBA-15 (ICP content:0.13 wt%) and 1% of CuPEG@SBA-15 (ICP content:0.06 wt%).

Catalytic runs	1^{st}	2^{nd}	3^{rd}	4^{th}
Yield (%)	95	92	85	70