

Supporting Information

Reductant-Free Synthesis of Silver

Nanoparticles-Doped Cellulose Microgels for

Catalyzing and Product Separation

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Total number of pages: 6 (S1-S6)

Total number of figures: 5 (Figure S1-Figure S5)

Total number of tables: 1 (Table S1)

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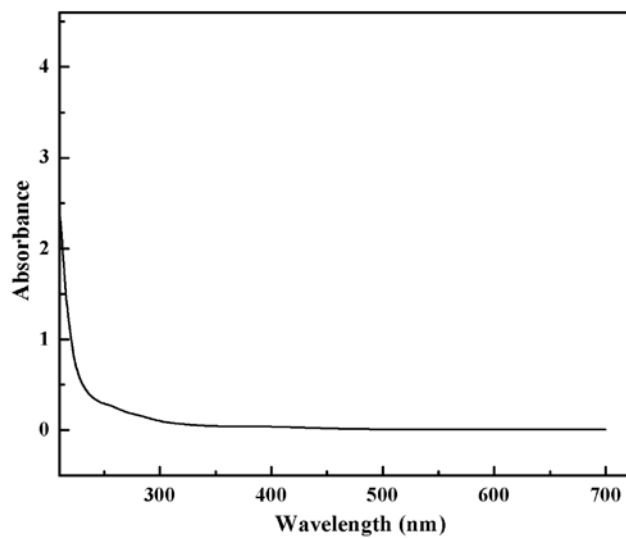


Figure S1. UV-vis spectrum of carboxymethylcellulose sodium.

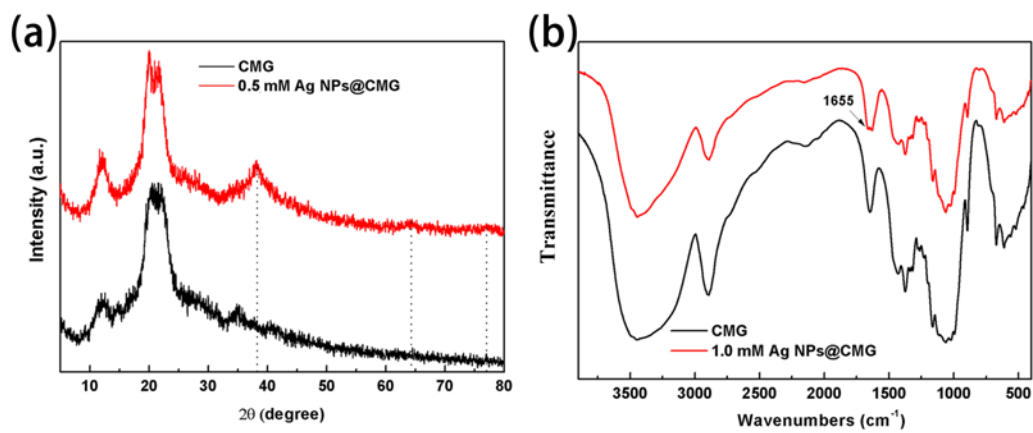


Figure S2. XRD patterns (a) and FTIR spectra (b) of CMG and Ag NPs@CMG nanohybrids.

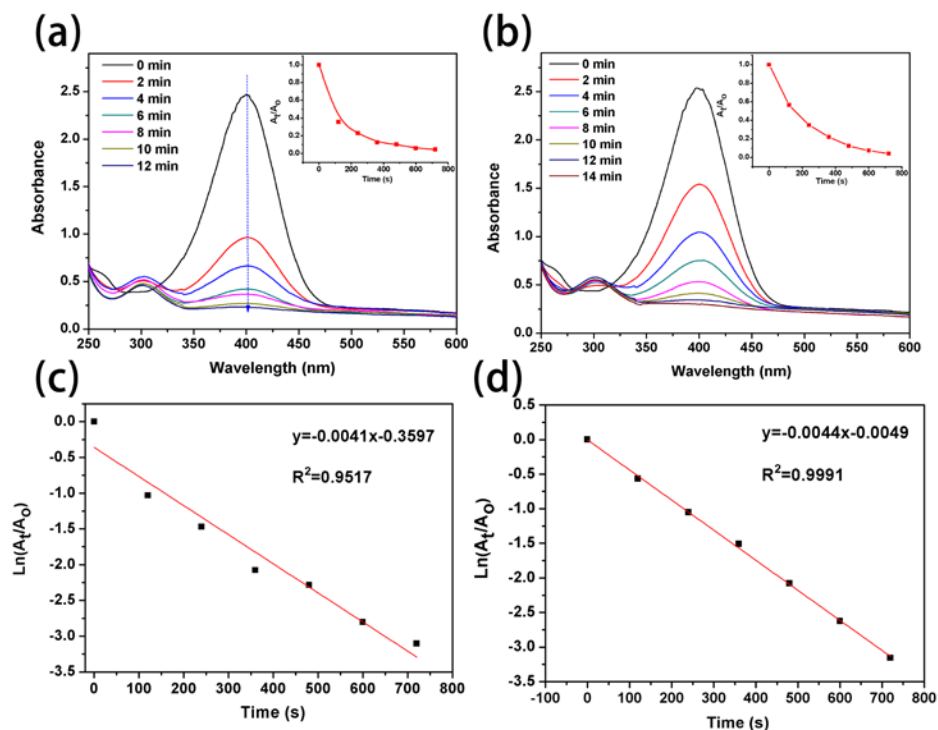


Figure S3. UV-visible spectra of the reduction of 4-NP catalyzed with 0.2 mM (a) and 1.0 mM (b) Ag NPs@CMG nanohybrids and plot of A_t/A_0 against time (inset) respectively and plot of $\ln(A_t/A_0)$ against time (0.2 mM, c; 1.0 mM, d).

The catalytic activities of the 0.2 mM and 1.0 mM Ag NPs@CMG nanohybrids were evaluated and the process of the catalytic reactions was monitored by UV-vis spectroscopy. As depicted in Figure S3a-b, for 0.2 mM Ag NPs@CMG nanohybrids catalyzed reaction, the conversion reaches 95.6 % after 12 min and the conversion reaches 95.8 % after 12 min for 1.0 mM Ag NPs@CMG nanohybrids. Figure S3c-d show the plot of $\ln(A_t/A_0)$ versus reaction time. A good linear correlation of $\ln(A_t/A_0)$ versus time is obtained, which is consistent with the pseudo-first-order kinetics behavior. The pseudo-first-order rate constant k calculated from the slope is $4.1 \times 10^{-3} \text{ s}^{-1}$ and $4.4 \times 10^{-3} \text{ s}^{-1}$ for 0.2 mM and 1.0 mM Ag NPs@CMG nanohybrids respectively. These results indicate that the 0.2 mM and 1.0 mM Ag NPs@CMG nanohybrids also exhibit desirable catalytic activity.

Table S1. Comparison of various catalysts for reduction of 4-NP

Samples	Temp. (K)	Size of metal NP (nm)	NaBH ₄ /4-NP/ metal NP (Molar ratio)	K(10 ⁻³ s ⁻¹)	TOF (h ⁻¹)	Reference
AgNPs/SiO ₂ NWs	298	20±5	1500/25/1	2.5	59.79	1
Au/PDDA/NCC	298	2.95±0.06	36585/37/1	5.1	212	2
Ag/Au/BNPs	298	16±2	-	5.1	38	3
Pd/Au/MCA	298	3.5	1760/20/1	4.7	142.5	4
Au/CNC	298	10-30	9720/30/1	2.1	109	5
Ag/Fe ₃ O ₄ @NFC	298	21.1	4200/42/1	33	157.0	6
Ag NPs@CMG	298	8	14400/48/1	3.4	230.4	This work

Fabrication of Ag NPs@bulk gel

At first, the cellulose bulk gel was prepared according to our previous work.⁷ 100 g of aqueous solution with 7 wt% NaOH and 12 wt% urea was precooled to -12 °C. Then, 2 g (2 wt%) of cellulose was added immediately to the precooled solvent and stirred vigorously for 5 min at room temperature. After degasification, 20 g of the viscous cellulose solution was casted and coagulated in 5 wt% H₂SO₄ and regenerated for 12 h at room temperature. The cellulose bulk gel was washed with running water and deionized water to remove all soluble substances. The same amount of AgNO₃ solution was added into the beaker with the bulk gel. The same concentration alkali with deionized water was added into the beaker. Subsequently, this system was stirred for 24 h at room temperature. The resultant Ag NPs@bulk gel was filtered and washed with deionized water to remove the residual chemical reagents.

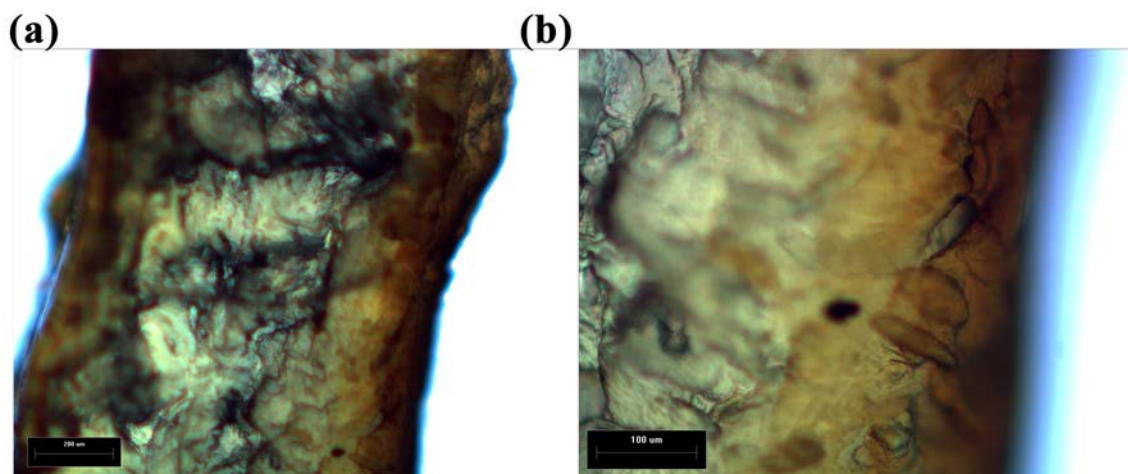


Figure S4. Optical microscope photographs of the section of Ag NPs@bulk gel at low (a, scale bar = 200 μm) and high (b, scale bar = 100 μm) magnifications.

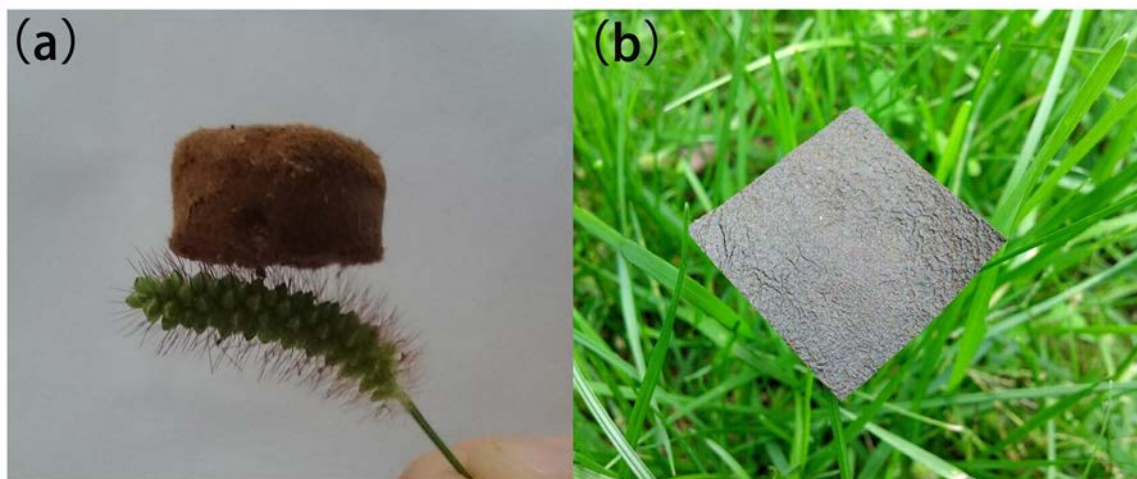


Figure S5. Digital photographs of Ag NPs@CMG aerogel (a) and film (b).

References

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