Supplementary Material (ESI) for Green Chemistry

Supporting Information

Platinum nanoparticles using wood nanomaterials: green synthesis, shape control and catalytic activity for *p*-nitrophenol reduction

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Catalysis studies: The catalysts were isolated through centrifugation for three times against water. The supernatant fluids were collected and analyzed by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP) (Varian 710 ES). The loading amount of Pt was calculated through this way: the added quantity of Pt subtracted the quantity of Pt in the supernatant fluids. In a typical process, the aqueous solutions of *p*-nitrophenol (1.3 mM) and sodium borohydride ($NaBH_4$) (0.42 M) were freshly prepared. 6 ml of milli-Q water was mixed with 1 ml of *p*-nitrophenol solution under magnetic stirring in a 20 ml glass bottle. The color of the solution changed from colorless to yellow immediately when 1 ml of $NaBH_4$ solution was added. Then, 2 ml of Pt-based catalyst was injected into the system (4.5×10^{-4} M), and 1 ml of the mixed solution was quickly filtered over a 0.22 um filter before the measurements. 0.8 ml filtrates and 2 ml water was taken into a quartz cuvette to continuously measure the UV-vis absorption spectra and the absorption peak value versus time at 400 nm. In our experiment, samples were collected at selected contact times and filtered, so the absorbance value of the filtrates could hardly be interfered with by the wood nanofibers supported Pt NPs. The catalysts were isolated through centrifugation for three times against water at the end of the reaction and used for the reuse test.

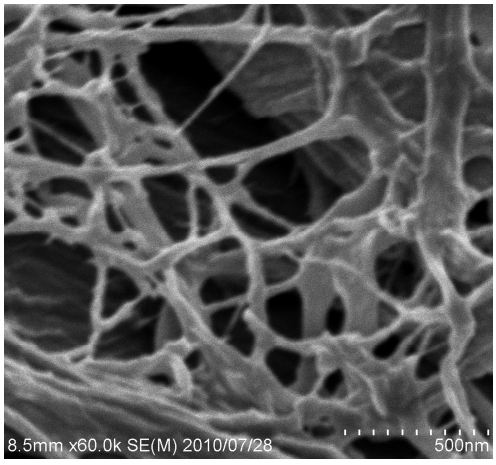

Fig. S1 SEM image of wood nanomaterials.

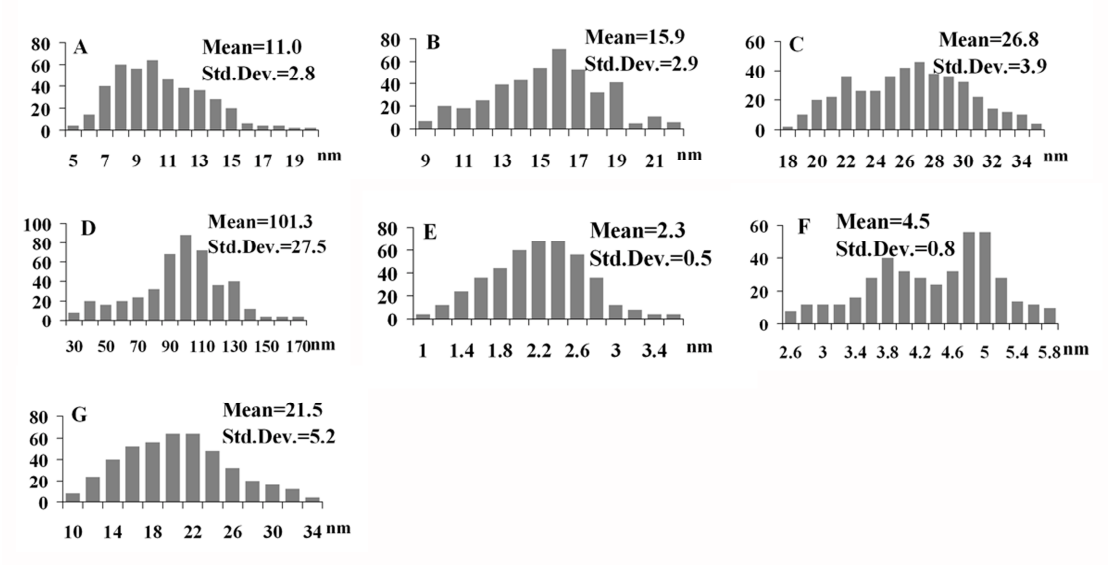

Fig. S2 Typical particle diameter histograms for Pt NPs. Spectra A-E indicate Pt NPs obtained with different H_2PtCl_6 amount without the adjustment of pH value: (A) 0.4 mM, (B) 0.6 mM, (C) 2.0 mM, (D) 4.0 Mm and (E) 0.1 mM. (F) Pt NPs obtained by reduction of 0.4 mM H_2PtCl_6 at pH value of 4.1. (G) spherical Pt nanoclusters obtained by reduction of 0.4 mM H_2PtCl_6 at pH value of 11.3.

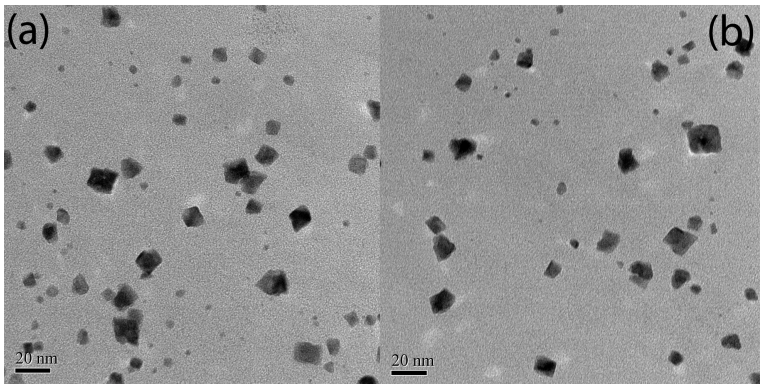

Fig. S3 TEM images of wood nanomaterials supported cubic Pt NPs obtained by reduction of 0.4 mM H_2PtCl_6 at (a) pH value of 2.6, (b) pH value of 2.3. The scale bar is 20 nm.

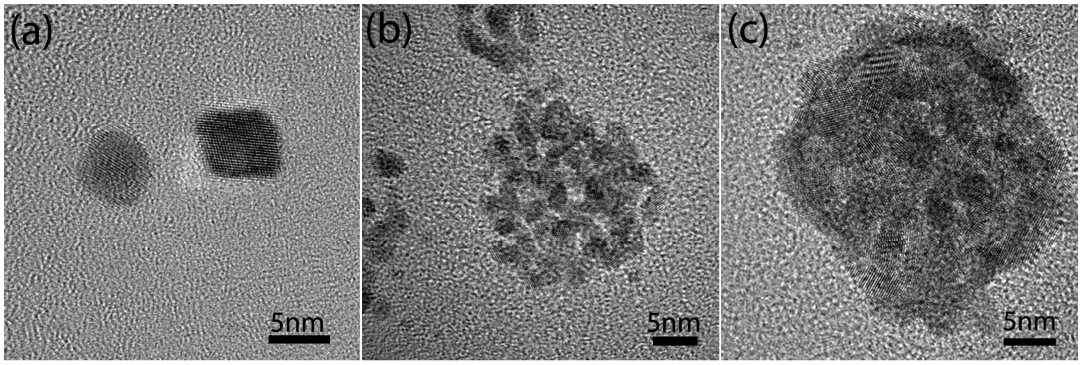

Fig. S4 HRTEM images of (a) cubic Pt NPs obtained by reduction of 0.4 mM H_2PtCl_6 without the adjustment of pH value. (b) Pt nanoclusters obtained by reduction of 0.4 mM H_2PtCl_6 at pH value of 4.1. (c) Pt nanoclusters obtained by reduction of 0.4 mM H_2PtCl_6 at pH value of 11.3.

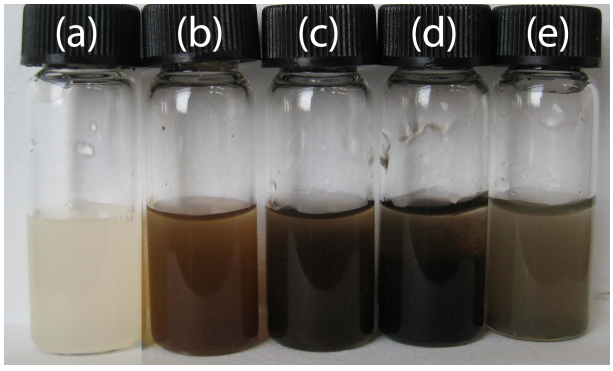

Fig. S5 Photograph of wood nanomaterial supported Pt NPs obtained with different H_2PtCl_6 amount: images a-e indicate initial data of (a) bare natural wood suspension, (b) 0.4 mM, (c) 0.6 mM, (d) 2.0 mM and (e) 4.0 mM, respectively.

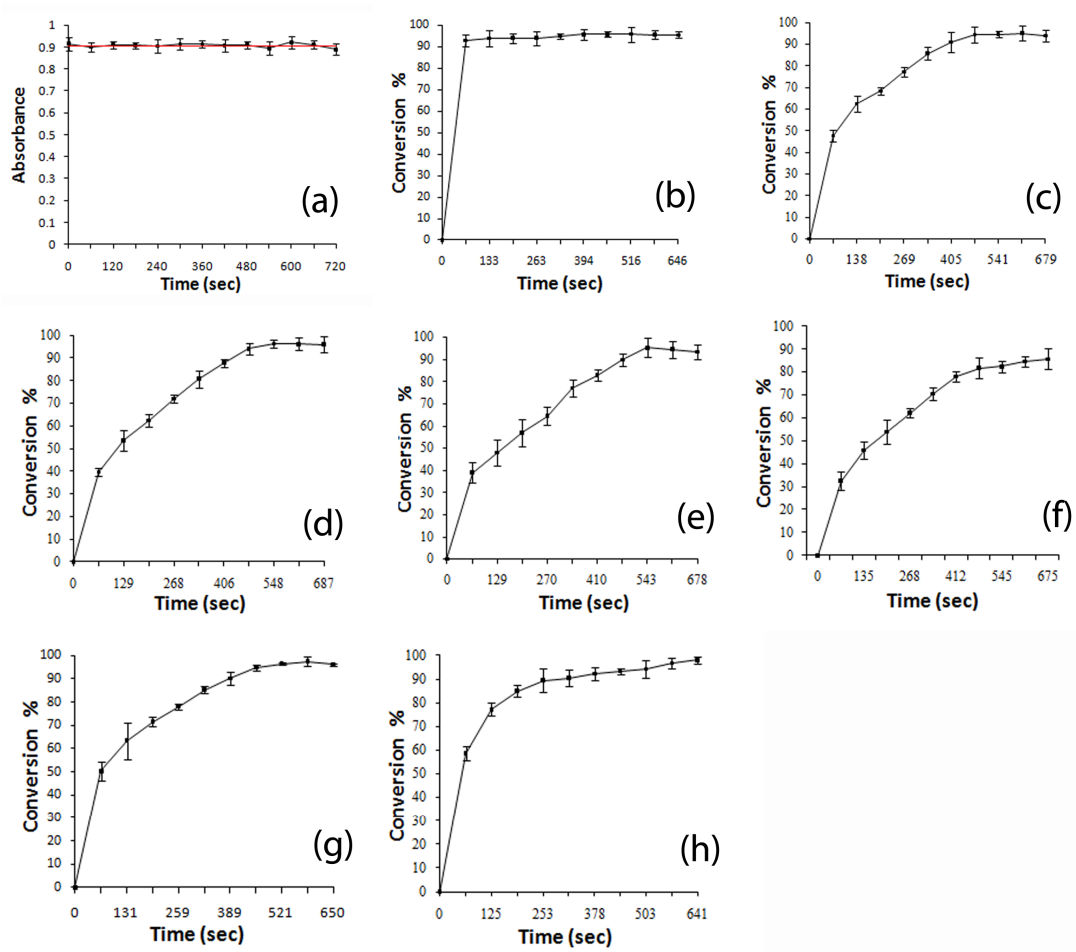

Fig. S6 (a) Time dependent absorbance of *p*-nitrophenol in the presence of unloaded wood nanomaterials (the same amount as used for the test of 15.9±2.9 nm Pt NPs loaded catalyst); red line represents the absorbance of *p*-nitrophenol solution solely, σ =0.017. Spectra b-h indicate catalytic activities of the wood nanomaterials supported Pt NPs in the reduction of *p*-nitrophenol varying with sizes: (b) 2.3±0.5 nm, (c) 11.0±2.8 nm, (d) 15.9±2.9 nm, (e) 26.8±3.9 nm and (f) 101.3±27.5 nm; (g) 4.5±0.8 nm, (h) spherical Pt nanoclusters 21.5±5.2 nm. (Reaction temperature: 30 ^{o}C).

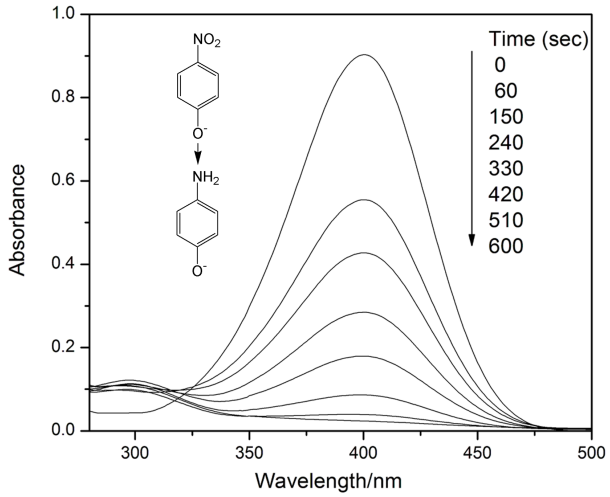

Fig. S7 Successive UV-vis spectra of the reduction of *p*-nitrophenol by cubic Pt NPs (15.9±2.9 nm) prepared with 0.6 mM H_2PtCl_6 without the adjustment of pH value.

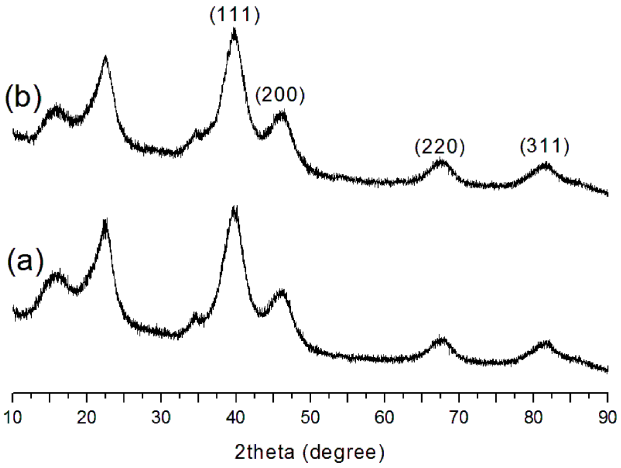

Fig. S8 X-ray diffraction patterns of wood nanomaterials supported cubic Pt NPs catalysts (15.9±2.9 nm) before and after the reduction of *p*-nitrophenol: (a) fresh. (b) after three cycles.

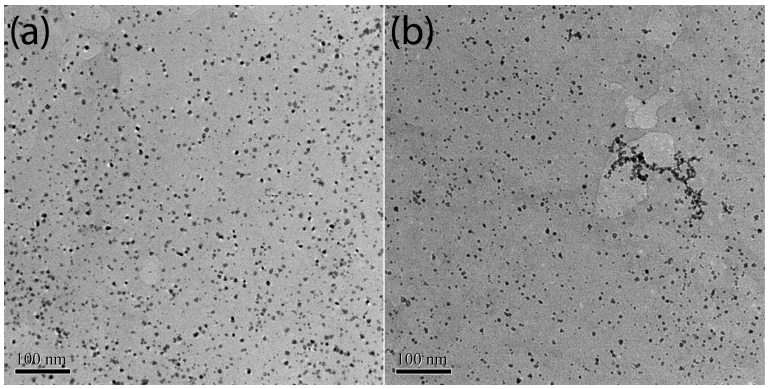

Fig. S9 TEM images of the wood nanomaterials supported cubic Pt NPs catalysts (15.9±2.9 nm) before and after the reduction of *p*-nitrophenol: (a) fresh. (b) after three cycles. The scale bar is 100 nm.

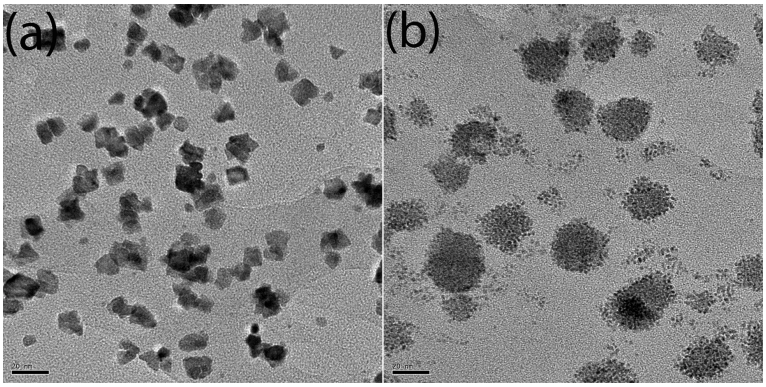

Fig. S10 TEM images of (a) cubic Pt NPs obtained by reduction of 0.4 mM H_2PtCl_6 with cypress nanomaterial (0.1 wt %). (b) spherical Pt nanoclusters obtained by reduction of 0.4 mM H_2PtCl_6 with cypress nanomaterial at pH value of 11.3. Reaction conditions: 16 h at 100 ^oC under atmospheric pressure. The scale bar is 20 nm.

Table S1 Recovery and reuse of wood nanomaterials supported cubic Pt NPs (15.9±2.9 nm) catalyst for the reduction of *p*-nitrophenol.

Conversion (%)	1st	2nd	3rd
60 s	37.8	36.1	34.5
200 s	62.4	58.3	51.2
400 s	87.1	80.5	72.7
600 s	96.0	90.3	78.5