Supporting Information

Size-Tunable Synthesis of Monodispersed Thorium Dioxide Nanoparticles and Their Performance on the Adsorption of Dye Molecules

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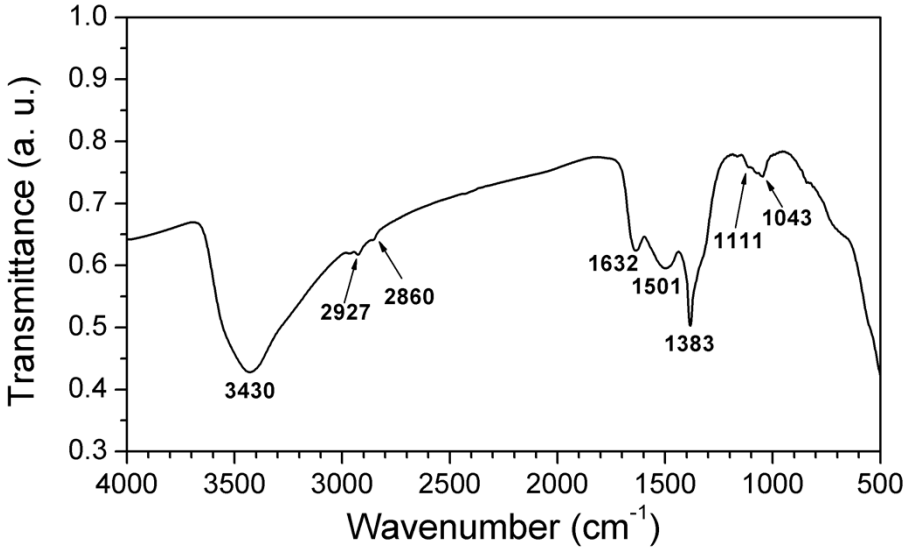

Figure S1. FTIR Spectra of as-prepared precursor nanoparticles of thorium dioxide.

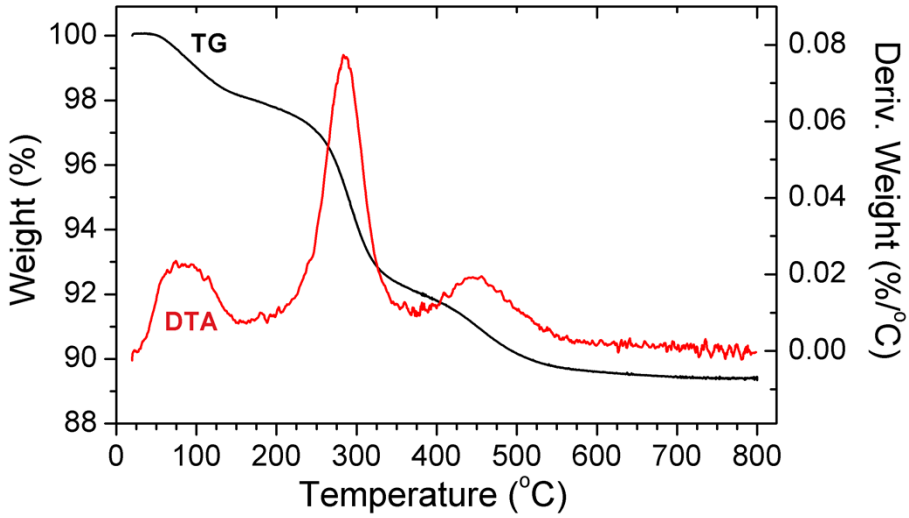

Figure S2. Thermogravimetric weight loss curve (and its derivative) of the precursor nanoparticles, showing three distinguishable weight-loss steps centered at the temperature of 90 ºC, 290 ºC, and 450 ºC, respectively.

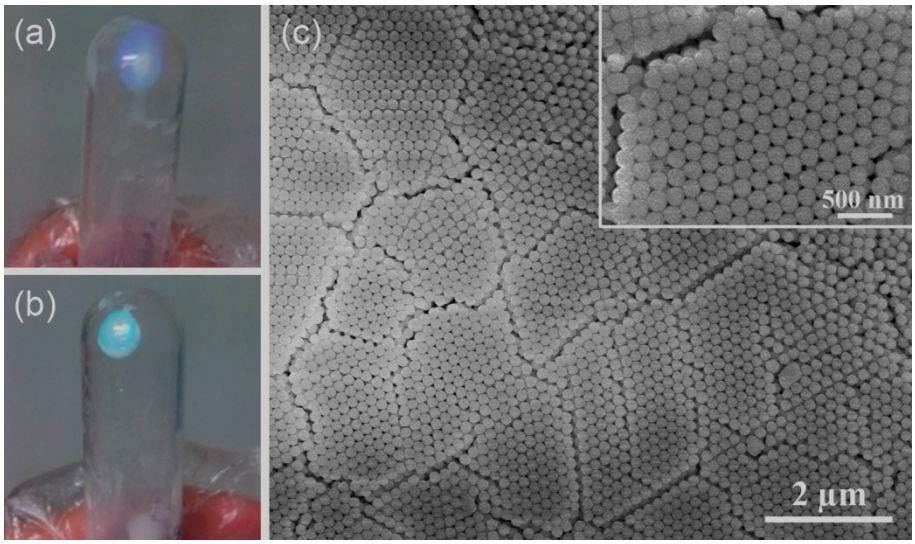

Figure S3. Photo and SEM images of the precursor nanoparticles of thorium dioxide after centrifugation. (a) Precursor nanoparticles with average diameter of 135 nm display a light violet color. (b) Precursor nanoparticles with average diameter of 160 nm have a cyan color. (c) SEM images suggest that the close-packed precursor nanoparticles (diameter ~ 160 nm) have a periodical arrangement structure under the centrifugal force. Inset in (c): high magnification SEM image of close-packed precursor nanoparticles.

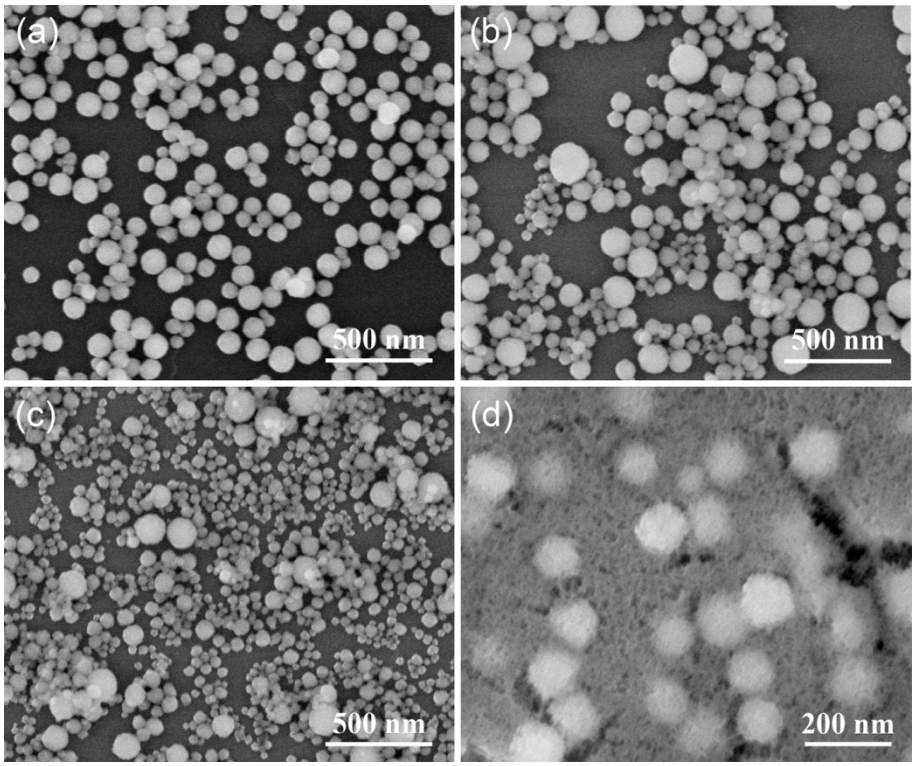

Figure S4. (a) SEM image of precursor nanoparticles if only urea was added to the TNP aqueous solution. (b,c) SEM image of precursor nanoparticles with too much urea, i. e. (b) M_{TNP}/M_{urea} = 1:1.5 and (c) M_{TNP}/M_{urea} = 1:2, when the volume of added glycerol was kept as 200 μL. (d) SEM image of hydrothermal products by using the reaction temperature of 160 ºC. Gel-like byproduct was formed as well as the precursor nanoparticles.

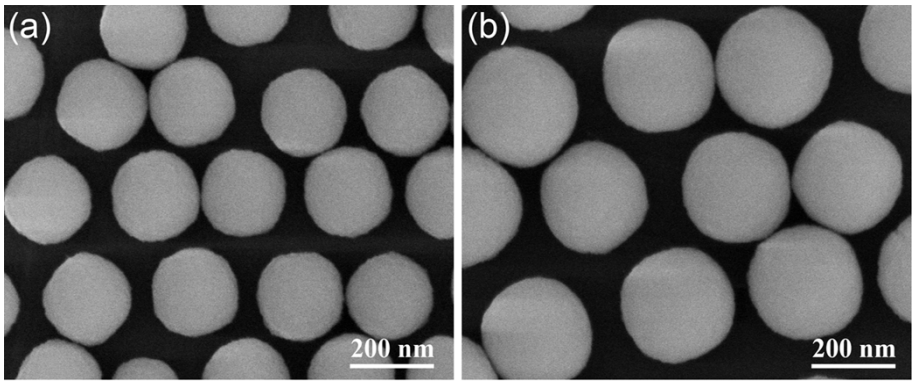

Figure S5. SEM images of precursor nanoparticles when the added urea was slightly decreased from 6 mg to 5.4 mg (a) and 4.8 mg (b), the corresponding diameter of nanoparticles increased to 210 ± 10 nm and 274 ± 20 nm, respectively.

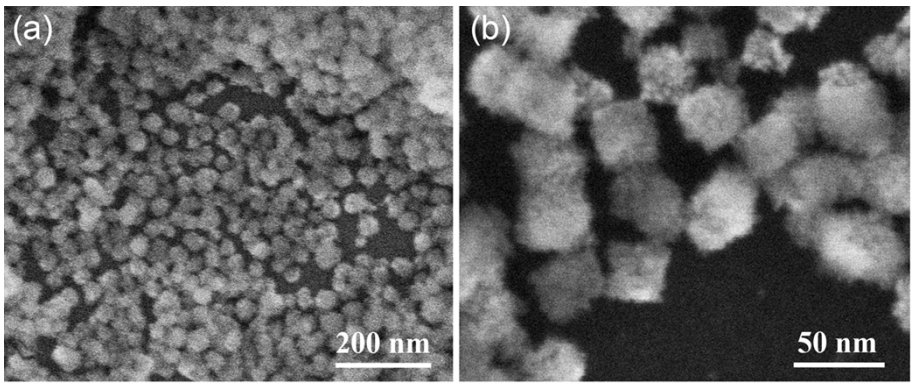

Figure S6. SEM images of monodispersed irregular precursor nanoparticles prepared by controlling M_{TNP}/M_{urea} = 1:2 and $V_{glycerol}$ = 500 μL.

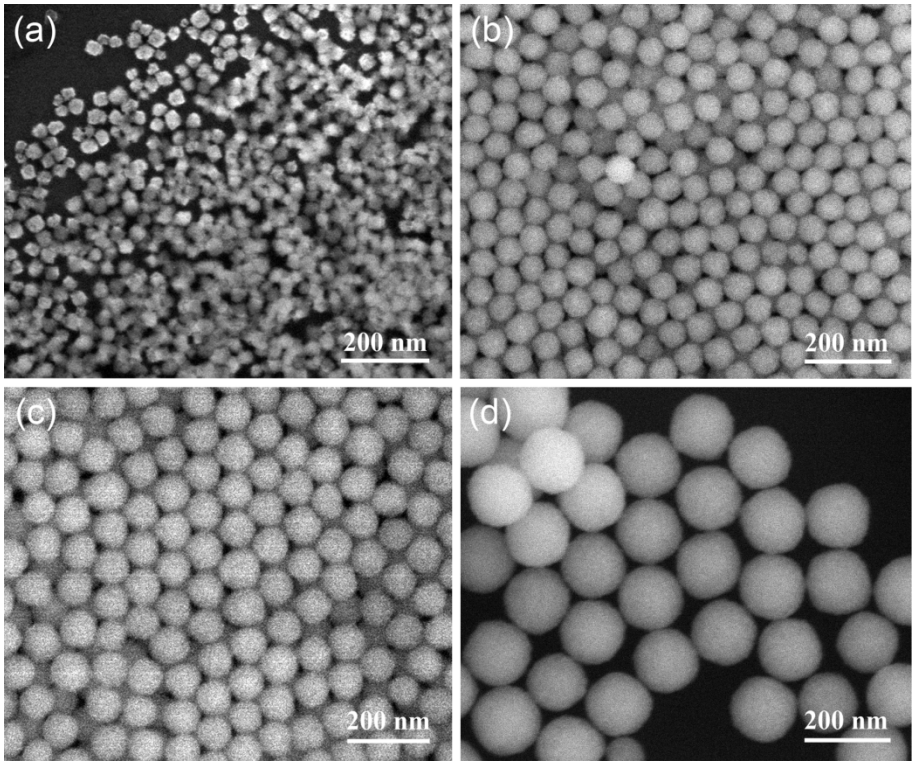

Figure S7. SEM images of as-prepared pure ThO_2 nanoparticles (samples I-IV) which were used in the adsorption performance test for Congo red and the following nitrogen adsorption-desorption measurement. (a) Sample I, monodispersed irregular nanoparticles with average diameter of 30 nm. (b) Sample II, spherical nanoparticles with average diameter of 65 nm. (c) Sample III, spherical nanoparticles with average diameter of 92 nm. (d) Sample IV, spherical nanoparticles with average diameter of 160 nm.

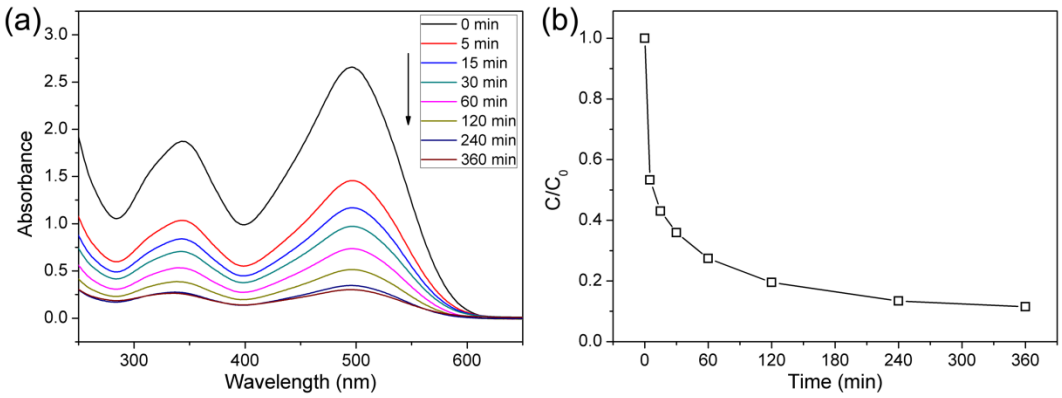

Figure S8. (a) Absorption spectra of a solution of Congo red (100 mg L^{-1}, 20 mL) in the presence of sample I (20 mg) at different time intervals. (b) The corresponding adsorption rate of Congo red on the ThO_2 nanoparticles of sample I.

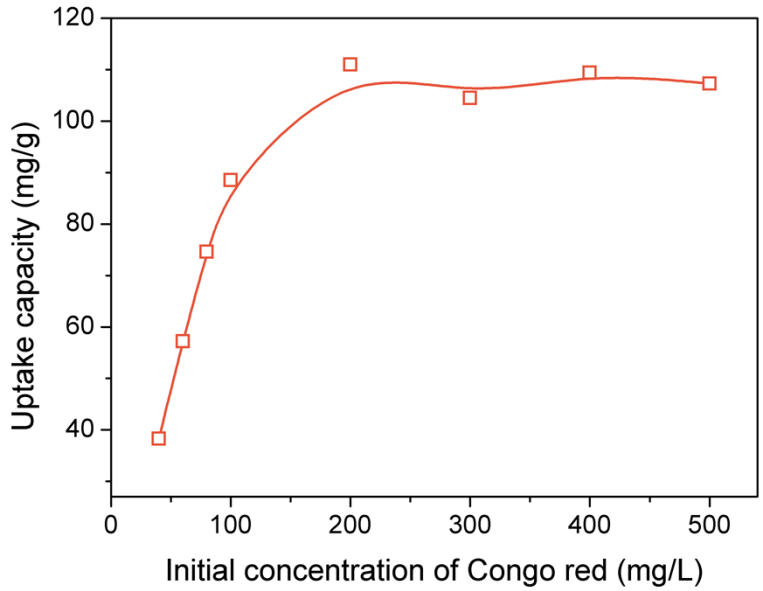

Figure S9. Adsorption isotherm for Congo red on sample I as a function of initial concentration.