Supplementary Information

Photoluminescent Carbon Quantum Dots Grafted Silica Nanoparticles Directly from Rice Husk Biomass

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1. Additional micrographs of RHA and the as-prepared Silica-C NPs

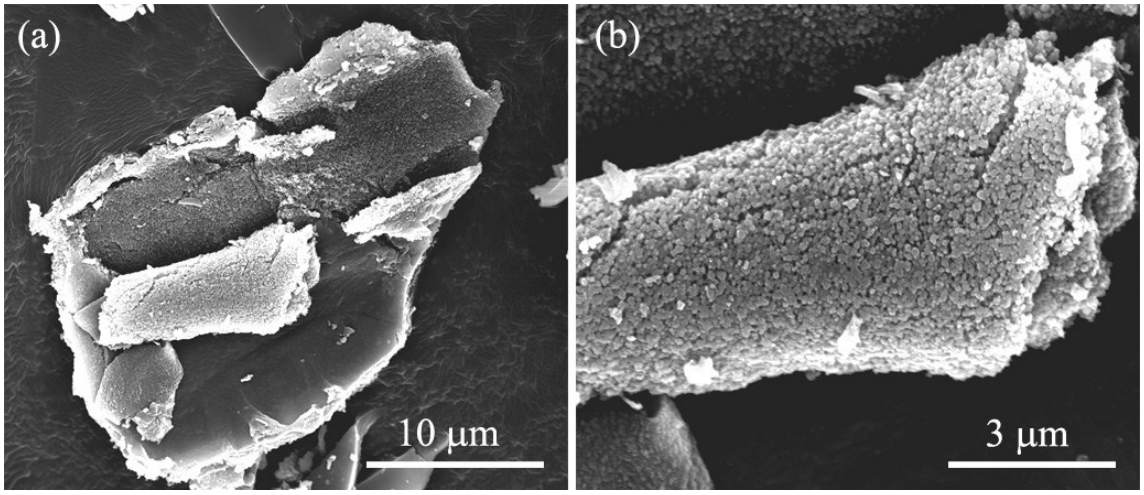

Figure S1. SEM images of RHA in low magnifications.

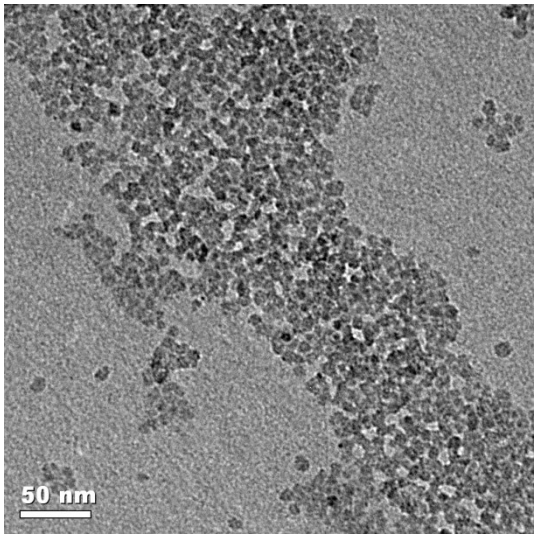

Figure S2. TEM image of the as-obtained Silica-C NPs in a relatively low magnification to verify their uniform morphology.

2. PL of the RH derived carbon QDs

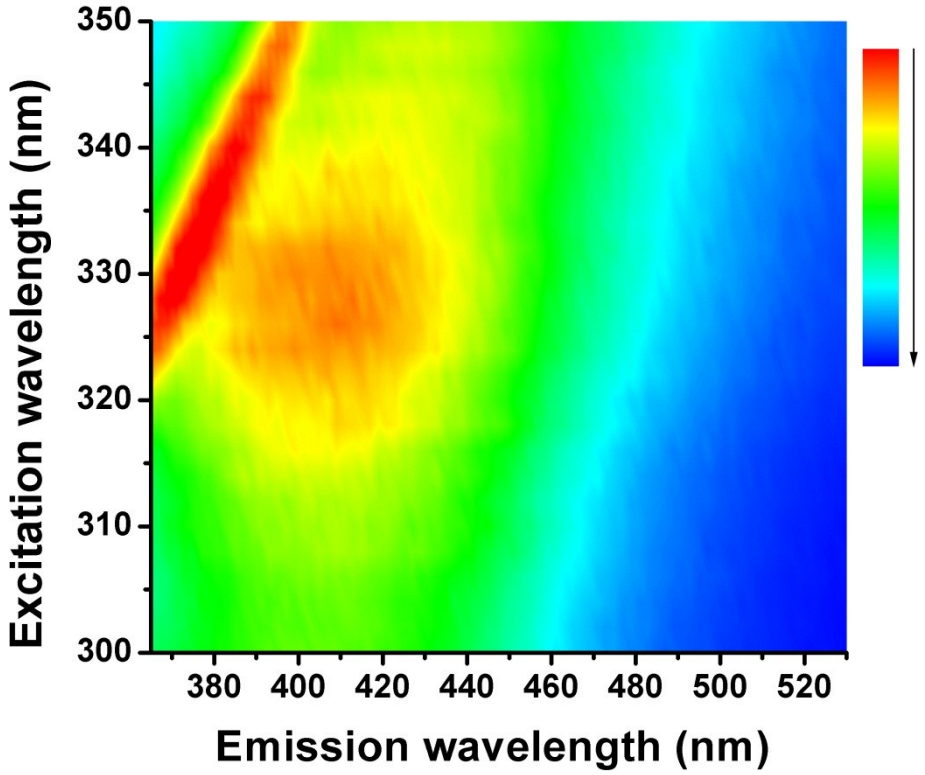

Figure S3. PL mapping image of the RH derived carbon QDs measured at 25 °C. The carbon QDs were prepared under the same experimental conditions as those of Silica-C NPs, except changing the RHA to RH carbon (RHC) extracted from RHs.

3. Tunable emission color of the Silica-C NPs

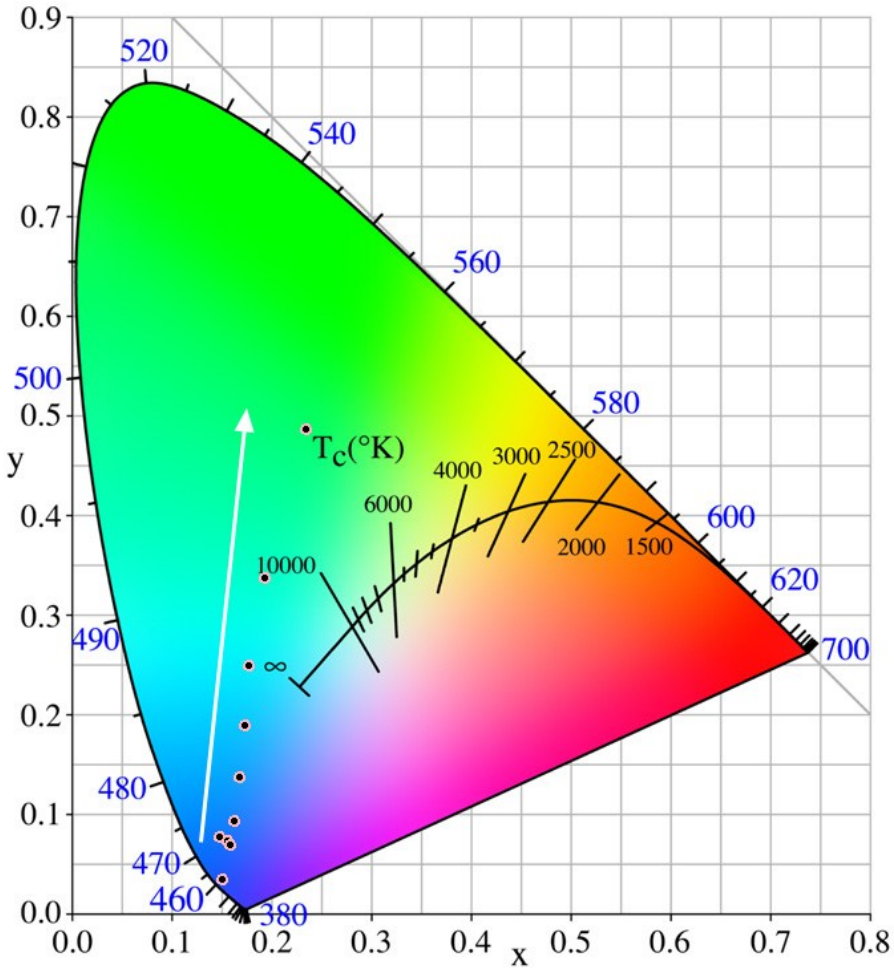

Figure S4. International commission on illumination (CIE) chromaticity diagram for Silica-C NPs with excitations from 260 to 440 nm at 25 ºC. The black dots represent the corresponding color coordinates.

4. Morphology investigation of the HeLa cells treated by Silica-C NPs

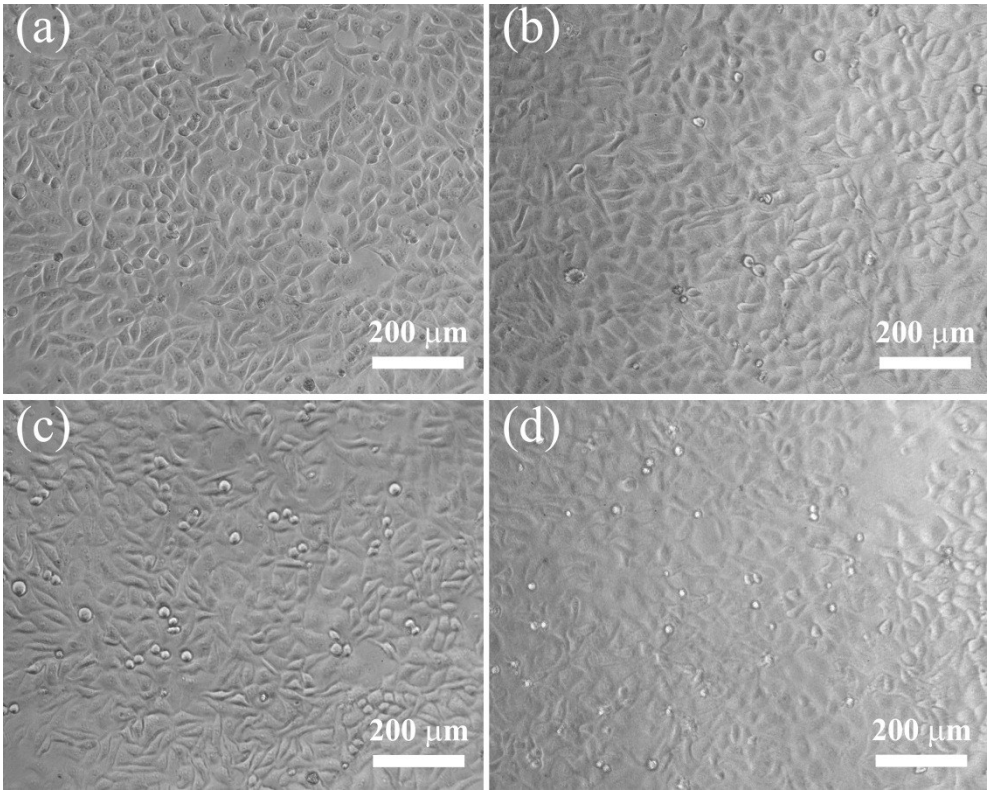

Figure S5. Optical micrographs of Hela cells after being treated with (a) 0, (b) 25, (c) 50, and (d) 100 μg/mL Silica-C NPs for 24 h.

5. Control sample synthesized from carbon black and amorphous silica

Carbon black (99.9+%, Alfa Aesar) and amorphous silica (AEROSIL@380, Evonik) were selected as the raw materials for the control experiment because of their similar structures to those of RHA, as revealed in Figure S6. Different from the Silica-C NPs, the control sample synthesized from the mixture of carbon black and amorphous silica shows gray color, indicating the existence of free carbon. The PL investigation (Figure S7a) clearly shows that the control sample mainly exhibits the characteristic PL of carbon QDs. The TG and DTG thermograms in Figure S7b further show that no chemical combination between carbon and silica was formed since there is no weight loss between 550~650 °C. The control experiment results prove that the unique chemical structure of RHs is the key to ensure the high yield production of Silica-C NPs.

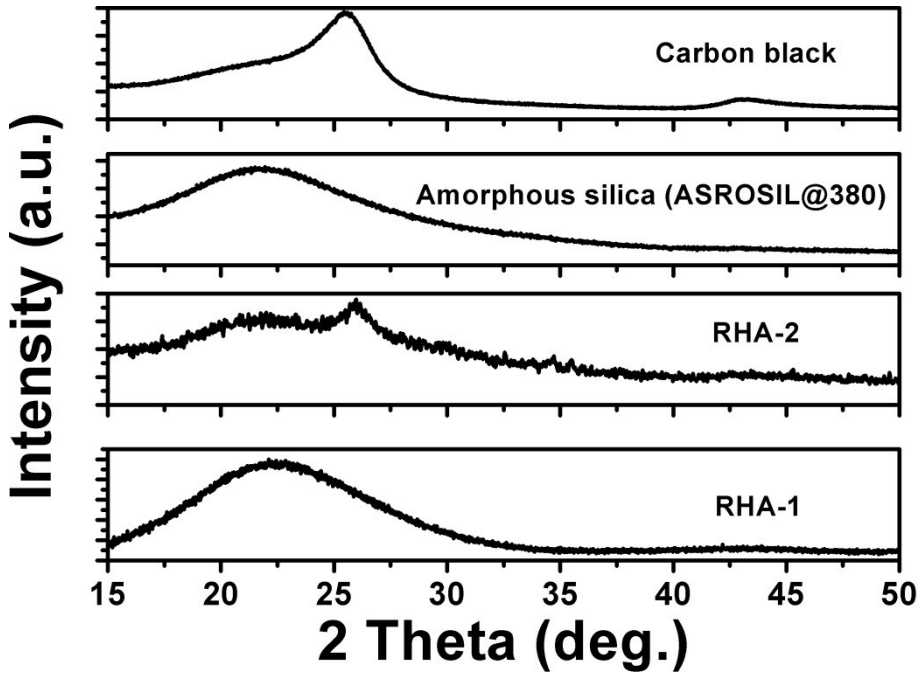

Figure S6. XRD patterns of the carbon black, amorphous silica, and RHA (1: obtained by treating RHs in a mixed gas of air and N_2; 2: obtained by treating RHs in N_2).

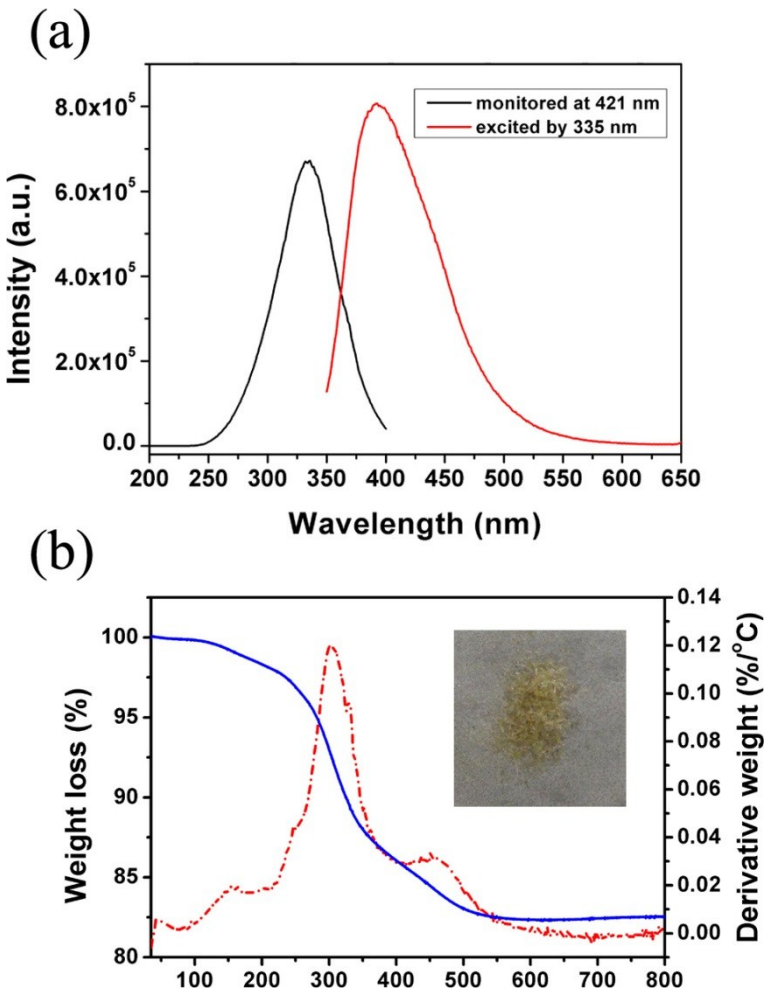

Figure S7. (a) PL excitation spectrum (monitored at 421 nm) and PL emission spectrum (excited by 335 nm) of the carbon black and amorphous silica derived sample; (b) TG and DTG curves of the carbon black and amorphous silica derived sample; the inset of (b) shows the optical photograph of the obtained control sample.