Supplementary Materials

Substantial Improvement of Color-Rendering Properties of Conventional White LEDs Using Remote-Type Red Quantum-Dot Caps

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Table S1. Simulation parameters of the QD-applied white LED lighting.

	Lighting Frame	Diffuser plate	Quantum dot cap
Diameter (mm)	182	146	Outer wall: 7.4 × 5.3 × 4.2 Attachment side: 5.6 × 3.4 Opening side: 5.6 × 1.7
Thickness (mm)	28 (Height)	2	Attachment side: 1.8 × 0.9 Opening side: 1.8 × 1.2
Material	PMMA ($n = 1.4936$)	Polycarbonate & TiO_2 ($n = 2.4358$)	PDMS& Red quantum dot ($n = 1.43$)
Optical property	Inner side reflectance: 76% Inclination angle of the inner side: 126° PCB board reflectance: 69%	Optical smoothing (Fresnel loss)	Optical smoothing (Fresnel loss)

Table S2. Simulation parameters of white LEDs included in the lighting model.

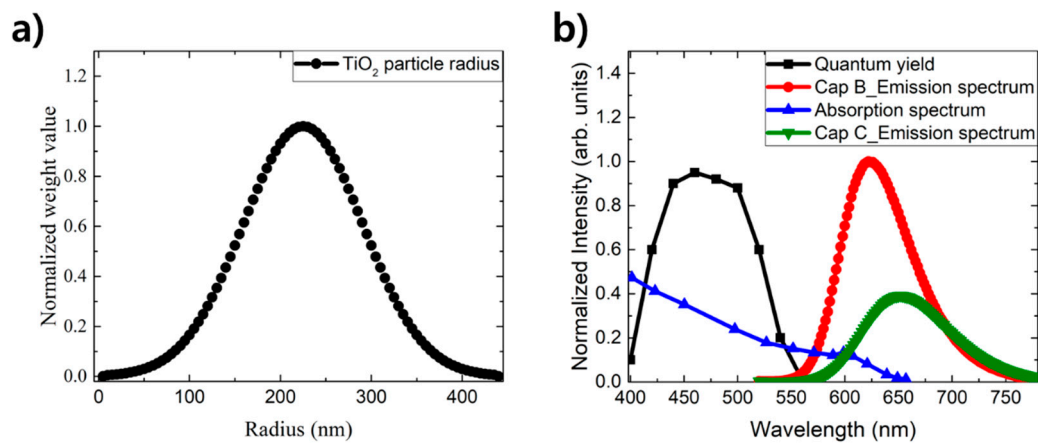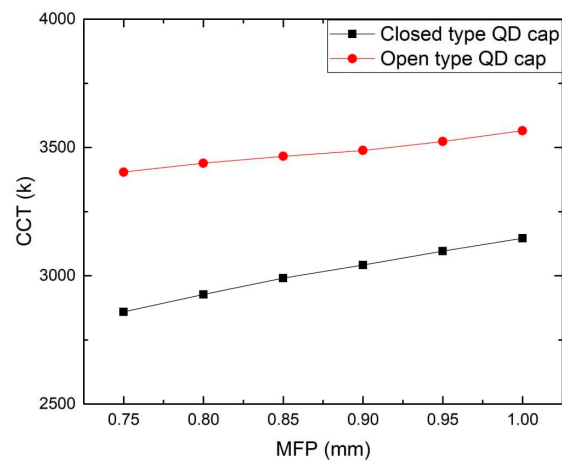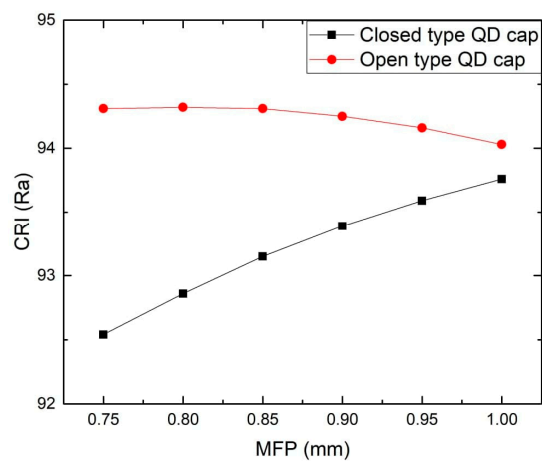|	White LEDs				
Array radius (mm)	10	17.1	24.2	31.3	38.4
Number of LEDs	3	8	12	21	28
Radiant Flux (w) per LED	0.5 (154.25 lm)				
LED dimensions (mm)	2.8 (length) × 3.2 (width) × 0.7(height)				
CRI (Ra)	82.9				
CCT(k)	5382				

Figure S1. Simulation conditions: (**a**) the size distribution of the TiO$_2$ particles in the diffuser plate, and (**b**) the quantum yield, the absorption spectrum and two emission spectra.
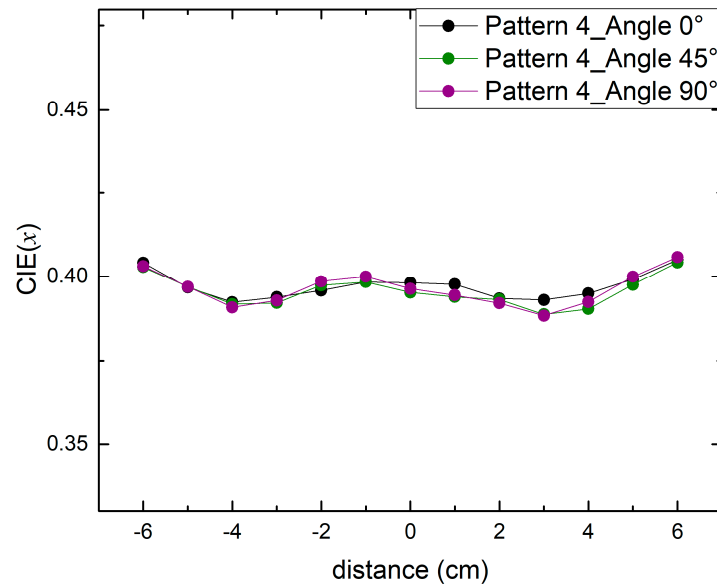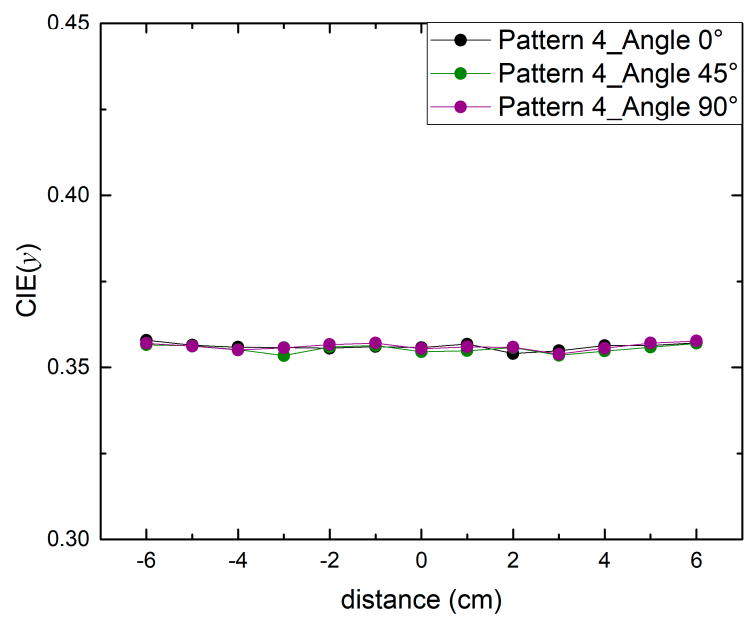

(**a**)

(**b**)

Figure S2. Simulation results for the dependence of (**a**) the CCT and (**b**) the CRI on the MFP of red QDs in the cap.
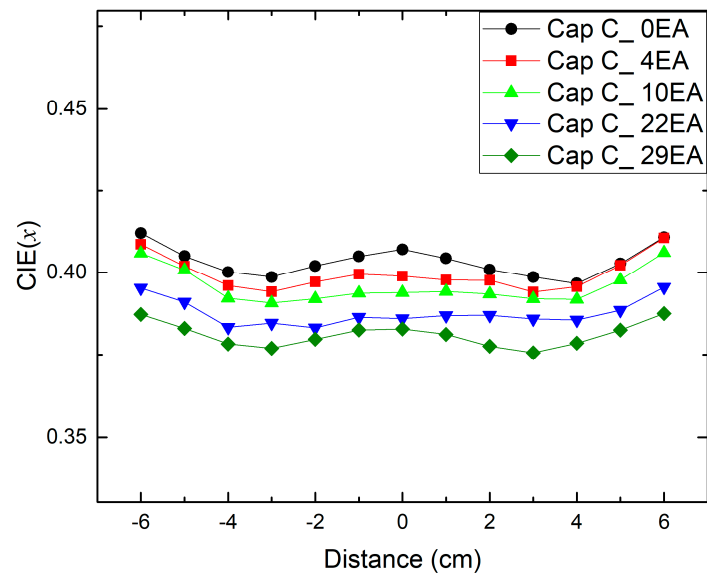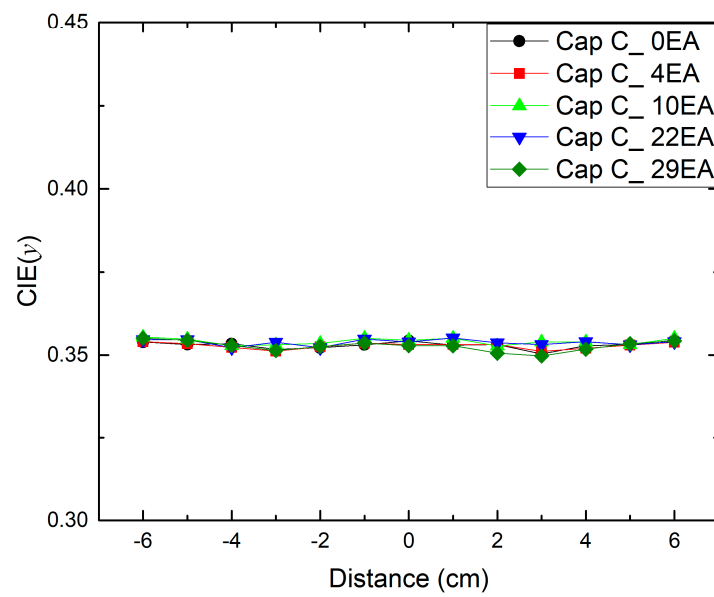
(**a**)

(**b**)

Figure S3. The positional dependence of the color coordinates (*x*, *y*) of the QD lighting adopting the pattern 4 measured along the horizontal (0º), diagonal (45º), and vertical (90º) directions. The subfigures (**a**) and (**b**) are for the color coordinates *x* and *y*, respectively.

(**a**)

(**b**)

Figure S4. The positional dependence of the color coordinates (*x, y*) of the QD lighting for all investigated configurations along the horizontal direction. The subfigures (**a**) and (**b**) are for the color coordinates *x* and *y*, respectively.
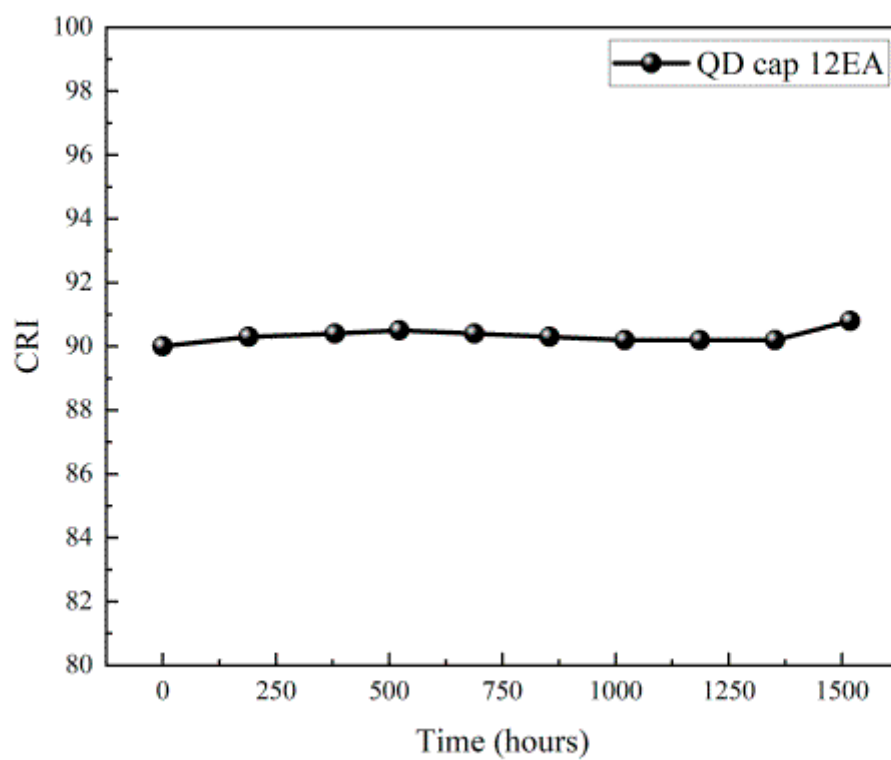
Figure S5. The dependence of CRI on the aging time.