Supplementary Material (ESI) for New Journal chemistry

Developing Electropositive Citric Acid-Polyethylenimine Carbon Quantum Dot for Labeling and Tracing Mesenchymal Stem Cells in vitro and in vivo

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Table. S1. The parameters for calculating the quantum yield of CA-PEI CQD.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Integrated emission intensity (I)</th>
<th>Optical density at 320 nm (Å)</th>
<th>Refractive index of the solvent (n)</th>
<th>Quantum yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinine sulfate</td>
<td>505524.292</td>
<td>0.048</td>
<td>1.33</td>
<td>55.7%</td>
</tr>
<tr>
<td>CA-PEI</td>
<td>90454.111</td>
<td>0.048</td>
<td>1.33</td>
<td>9.966%</td>
</tr>
</tbody>
</table>

Fig. S1. The optimized CA-PEI CQD model, which contains 170 carbon atoms, 8 nitrogen atoms, 28 oxygen atoms and the edges of CA-PEI CQD model were saturated with hydrogen atoms.

Fig. S2. The full XPS spectra of CA-PEI CQD.
Fig. S3. The fluorescence lifetime decay of CA-PEI CQD

Fig. S4. The image of the deionized water (left) and the image of the deionized water under UV light irradiation (360 nm).
Fig S5. Time-lapse photography shows an active absorption process of CQD from the sender MSCs (triangles) pre-labeled with CA-PEI CQD to unlabeled receiver MSCs (stars). Magnification: x200 (a). Expression of EEA1 (green, early endosome marker) detected by immunofluorescence in the MSCs incubated with 200 μg/ml CA-PEI CQD (blue) for 8 hours (b). Nuclei were stained by propidium iodide (PI). Scale bar: 100 μm.